Br J Sports Med. 2005 Aug;39 Suppl 1:i40-8; discussion i48. Related Articles, Links

Effectiveness of headgear in football.

Withnall C, **Shewchenko N**, **Wonnacott M**, **Dvorak J**.

Biokinetics and Associates Ltd, Ontario, Canada. withnall@biokinetics.com

OBJECTIVES: Commercial headgear is currently being used by football players of all ages and skill levels to provide protection from heading and direct impact. The clinical and biomechanical effectiveness of the headgear in attenuating these types of impact is not well defined or understood. This study was conducted to determine whether football headgear has an effect on head impact responses. METHODS: Controlled laboratory tests were conducted with a human volunteer and surrogate head/neck system. The impact attenuation of three commercial headgears during ball impact speeds of 6-30 m/s and in head to head contact with a closing speed of 2-5 m/s was quantified. The human subject, instrumented to measure linear and angular head accelerations, was exposed to low severity impacts during heading in the unprotected and protected states. High severity heading contact and head to head impacts were studied with a biofidelic surrogate headform instrumented to measure linear and angular head responses. Subject and surrogate responses were compared with published injury assessment functions associated with mild traumatic brain injury (MTBI). RESULTS: For ball impacts, none of the headgear provided attenuation over the full range of impact speeds. Head responses with or without headgear were not significantly different ($p>0.05$) and remained well below levels associated with MTBI. In head to head impact tests the headgear provided an overall 33% reduction in impact response. CONCLUSION: The football headgear models tested did not provide benefit during ball impact. This is probably because of the large amount of ball deformation relative to headband thickness. However, the headgear provided measurable benefit during head to head impacts.

PMID: 16046355 [PubMed - indexed for MEDLINE]

Xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx

1: J Athl Train. 2003 Sep;38(3):220-224. Related Articles, Links

The Efficacy of Soccer Headgear.

Broglio SP, **Ju YY**, **Broglio MD**, **Sell TC**.

University of Pittsburgh, Pittsburgh, PA.

OBJECTIVE: The potential for risks associated with chronic soccer heading has led some soccer leagues to mandate the use of soccer headgear. Although manufacturers have designed and promoted these headbands to decrease the forces associated with heading a soccer ball, their efficacy has not been tested. Therefore, we investigated the efficacy of 3 brands of soccer headgear: Headers, Headblast, and Protector, as compared with a non-headband condition. DESIGN AND SETTING: A force platform was mounted vertically with each headband attached with a length of hook-and-loop tape. A JUGS Soccer Machine projected balls at the platform and headband at 56.45 kph (35 mph). MEASUREMENTS: We measured vertical ground reaction force for 50 trials of each condition and calculated peak force, time to peak force, and impulse. RESULTS: We found a significant reduction in peak force of impact with all 3 headbands. The Protector headband also showed the greatest decrease in time to peak force and impulse, whereas the Headers headband showed a significant increase in impulse. CONCLUSIONS: All 3 headbands were effective at reducing the peak impact force. The Protector headband appeared the most effective at reducing time to peak force and impulse within the design of this study. The clinical effectiveness of these products remains to be seen.

PMID: 14608431 [PubMed - as supplied by publisher]

Xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx

1: Acad Emerg Med. 2003 Jan;10(1):85-90. Related Articles, Links

Does soccer headgear attenuate the impact when heading a soccer ball?

Naunheim RS, **Ryden A**, **Standeven J**, **Genin G**, **Lewis L**, **Thompson P**, **Bayly P**.

Department of Emergency Medicine, Washington University, St. Louis, MO 63110, USA. naunheir@msnotes.wustl.edu

There is increasing concern that repetitive blows to the head, such as those from heading a soccer ball, can cause measurable cognitive impairment. Reducing acceleration of impact could reduce neurologic sequelae. OBJECTIVE: To measure the effectiveness of four different types of soccer headgear in reducing the acceleration of impact. METHODS: A standard magnesium headform was instrumented with a triaxial accelerometer. A soccer ball was propelled at the headform at three different speeds known to occur in soccer play: 9, 12, and 15 m/sec (20, 26, and 34 mph). The main outcome was the peak acceleration of the

headform associated with these impacts with and without protective headgear. RESULTS: Peak accelerations were found in a range from 144 m/s(2) to 289 m/s(2) (14.67-29.5 G, G = 9.81 m/s(2)). Using multivariate analysis of variance (MANOVA) methods to compare the headbands and controls, there was no significant difference in the measured accelerations at the center of gravity with or without headgear (p = 0.50). However, the interaction term of headbands, pressure, and speed was significant at F = 5.51 and p = 0.00001. Using contrasts within conditions, some headbands were found to cause a decrease in peak acceleration at the highest speed and pressure. CONCLUSIONS: Currently available headgear for soccer heading shows little ability to attenuate impact during simulated soccer heading. However, statistically significant decreases are present at the highest speeds and pressures tested, suggesting the headbands may play a role in decreasing impact for more forceful blows.

PMID: 12511322 [PubMed - indexed for MEDLINE]

Xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx

1: Acad Emerg Med. 2001 Jun;8(6):604-9. Related Articles, Links

Do football helmets reduce acceleration of impact in blunt head injuries?

Lewis LM, **Naunheim R**, **Standeven J**, **Lauryssen C**, **Richter C**, **Jeffords B**.

Emergency Medicine Division, Washington University School of Medicine, St. Louis, MO, USA. lewisl@msnotes.wustl.edu

Several recent studies suggest that acceleration of the head at impact during sporting activities may have a detrimental effect on cognitive function. Reducing acceleration of impact in these sports could reduce neurologic sequelae. OBJECTIVE: To measure the effectiveness of a regulation football helmet to reduce acceleration of impact for both low- and moderate-force impacts. METHODS: An experimental paired study design was used. Male volunteers between 16 and 30 years of age headed soccer balls traveling approximately 35 miles per hour bareheaded and with a helmet. An intraoral accelerometer worn inside a plastic mouthpiece measured acceleration of the head. The helmet also had an accelerometer placed inside the padding. For more forceful impacts, cadaver heads, both with and without helmets, were instrumented with intraoral (IO) and intracranial (IC) accelerometers and struck with a pendulum device. Simultaneous IO and IC accelerations were measured and compared between helmeted and unhelmeted cadaver heads. The main outcome was mean peak acceleration of the head and/or brain associated with low- and moderate-force impacts with and without protective headgear. RESULTS: Mean peak Gs, measured by the mouthpiece accelerometer, were significantly reduced when the participants heading soccer balls were wearing a helmet (7.7 Gs with vs 19.2 Gs

without, p = 0.01). Wearing a helmet also significantly lowered the peak Gs measured intraorally and intracranially in cadavers subjected to moderate-force pendulum impacts: 28.7 Gs with vs 62.6 Gs without, p < 0.001; and 56.4 Gs with vs 81.6 Gs without, p < 0.001, respectively. CONCLUSIONS: A regulation football helmet substantially reduced the peak Gs associated with "heading" a soccer ball traveling at moderately high velocities. A helmet was also effective in reducing the peak acceleration both intraorally and intracranially for impacts significantly more forceful than heading a soccer ball.

PMID: 11388933 [PubMed - indexed for MEDLINE]

Xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx