Helmet

Construction helmets are considered essential personal protective equipment for reducing traumatic brain injury risks at work sites. In a study, we proposed a practical finite element modeling approach that would be suitable for engineers to optimize construction helmet design. The finite element model includes all essential anatomical structures of a human head (i.e. skin, scalp, skull, cerebrospinal fluid, brain, medulla, spinal cord, cervical vertebrae, and discs) and all major engineering components of a construction helmet (i.e. shell and suspension system). The head finite element model has been calibrated using the experimental data in the literature. It is technically difficult to precisely account for the effects of the neck and body mass on the dynamic responses, because the finite element model does not include the entire human body. An approximation approach has been developed to account for the effects of the neck and body mass on the dynamic responses of the head-brain. Using the proposed model, we have calculated the responses of the head-brain during a top impact when wearing a construction helmet. The proposed modeling approach would provide a tool to improve the helmet design on a biomechanical basis [1)].

Snow Sport

Neurotrauma from snow-sports related injuries is infrequently documented in the literature. In Australia no collective data has ever been published. The aim of this study is to document the injury pattern of snow sports related neurotrauma admissions to The Canberra Hospital, the regional trauma centre for the Snowy Mountains. A computerised hospital record search conducted between January 1994 and July 2002 revealed 25 head and 66 spinal injury admissions. The incidence of severe injuries requiring referral to tertiary trauma hospital was estimated to be 7.4 per 100,000 skier-days and for head and spinal injury 1.8 per 1,000,000 skier-days and 5.6 per 1,000,000 skier-days, respectively. Collision with a stationary object was disproportionately associated with head injury and falling forward with spinal injury. Snowboarders tended to sustain cervical fractures more often than skiers. The importance of helmet usage in buffering the impact of head-on collision and the proposition of having both feet fastened to a snowboard in leading to cervical injury were highlighted [2)].

Helmets may provide some protection from head injury among skiers and snowboarders involved in falls or collisions [3)].

Similar to bicycle helmet promotion programs, ski and snowboard helmet campaigns should focus on delivering a positive image of helmet use and peer acceptance [4)].

Parent's helmet-wearing behavior was strongly associated with the child/adolescent's helmet-wearing behavior. The results demonstrate the overwhelming influence parental helmet use has on their child/adolescent's decision to wear a helmet [5)].

Skiing

Snowboard

The incidence of possible concussion is high among snowboarding class participants. Emphasis should be given for instituting pre-participation balance training, especially for females to reduce falling in snowboarding. To verify the effects of pre-participation balance training and falling results in a concussion, more research is needed in the future.

Frequently involving occipital impact, could lead to more major head injuries. Measures should be taken to protect the head, especially the occiput, in snowboarding [6].

Not wearing a helmet and riding on icy slopes emerged as a combination of risk factors associated with injury.

Several risk factors and combinations exist, and different risk profiles were identified. Future research should be aimed at more precise identification of groups at risk and developing specific recommendations for each group-for example, a snow-weather conditions index at valley stations [7].

Alpine skiing

The association between helmet use during alpine skiing and incidence and severity of head injury was analyzed. All patients admitted to a Level I Trauma Center for traumatic brain injurys (TBI) sustained due to skiing accidents during the seasons 2000/01-2010/11 were eligible. Primary outcome was the association between helmet use and severity of TBI measured by Glasgow Coma Scale (GCS), CT-results, and necessity of neurosurgical intervention. Of 1362 patients injured during alpine skiing, 245 (18%) sustained TBI and were included. TBI was fatal in 3%. Head injury was minor (GCS 13-15) in 76%, 6% moderate and 14% severe. Number and percentage of TBI patients showed no significant trend over the investigated seasons. Forty-five percent of the 245 patients had pathological CT-findings and 26% of these required neurosurgical intervention. Helmet use increased from 0% in 2000/2001 to 71% in 2010/2011 ($p<0.001$). The main analysis, comparing TBI in patients with or without a helmet, showed an adjusted Odds Ratio (OR) of 1.44 ($p=0.430$) for suffering moderate head injury to severe head injury in helmet users. Analyses comparing off-piste to on-slope skiers revealed a significantly increased OR among off-piste skiers of 7.62 ($p=0.004$) for sustaining a TBI requiring surgical intervention. Despite increases in helmet use Baschera et al., found no decrease in severe TBI among alpine skiers. Logistic regression analysis showed no significant difference in TBI with regard to helmet use, but increased risk for off-piste skiers. The limited protection of helmets and dangers of skiing off-piste should be targeted by prevention programs [8].

Bicycle helmet

Bicycle helmet

Football helmet

Football helmet

Hockey helmet

Hockey helmet

Motorcycle

Motorcycle helmet

Electrically Assisted Pedal Cycles

Electrically Assisted Pedal Cycles (EAPCs) are pedal bikes that are fitted with a motor that travel at higher speeds than conventional bicycles. Recent international data shows that there is an association with increased severity of injury, particularly in paediatric populations. Currently, EAPCs are subject to the same legislation regarding helmet use as pedal bikes in the UK and EU which does not mandate the use of a helmet.

Trichinopoly Krishna et al. examined safety concerns surrounding EAPCs in the context of existing EU and UK legislation to assess whether changes to these should be made by public health bodies to mitigate the increased risk of injury.

A retrospective international literature review looking at electric bicycle-related trauma and legislation was conducted using a systematic search of internet databases. Peer-reviewed articles and online resources were reviewed based on relevance to the above objective.

EAPCS can travel at up to 17.5 mph, resulting in higher speeds of travel and collision. The use of EAPCs has been associated with increased severity of head injury. Bicycle helmets have been shown to reduce the severity of head injury in accidents involving both EAPCs and pedal cycles. Healthcare providers should pay extra attention to the possibility of severe injuries when a patient had a bicycle accident with an EAPC, especially in paediatric populations.

Given that EAPCS have been associated internationally with increased severity of head injuries they propose that existing EU and UK legislation may not be fit for purpose with respects to increased EAPC usage and criteria for impact protection of existing helmets. Further research and audit with more accurate recording of data associated with EAPCs use and associated injuries would inform enhanced regulation regarding EAPC usage in the future [9].

Helmet therapy

Helmet therapy

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