

ICC CRICKET HELMET SAFETY PROJECT

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INTRODUCTION

Cricket is a popular international game whose 105 country member organisation is the International Cricket Council (ICC). The sport is played with a hard ball that is propelled at over 150 km/h by bowlers, fielders, and then struck by batsmen. Consequently, there are a number of potential head impact situations that can result in injury. Most cricket head injuries are relatively mild with, for example, concussed players usually returning without incident following appropriate recovery periods. A tragic exception was the incident that led to the death of Australian batsman Phillip Hughes in 2014 when a ball struck the back of his head causing traumatic basal subarachnoid haemorrhage³.

However, new standard helmets have protected players' heads in situations where they previously failed. Cricket Australia and the England and Wales Cricket Board (ECB) have made it mandatory for their

professional players to wear only compliant helmets, but there is still important work to be done in preventing these potentially career- and life-threatening injuries.

CRICKET AND THE ICC

The International Cricket Council (ICC) is a members' organisation for 105 cricket playing countries. Ten are Full Members (Test playing) and 95 are Associate or Affiliate member countries. The top men's teams play in bilateral cricket across three formats of the game; five-day Tests, 50-over One-Day Internationals and 20-over Twenty20 Internationals, as well as in global events, such as the ICC Cricket World Cup, the ICC Champions Trophy and the ICC World Twenty20.

Although women's tests are only played between England and Australia, the top eight nations now compete in the ICC Women's Championship, which is a qualifying tournament for the ICC Women's

World Cup. In addition to this, there is the biennial ICC Women's World Twenty20, which is contested by the top 10 women's sides.

Most of the Full Member countries also have thriving professional domestic competitions within four-day (first-class), One-Day and Twenty20 competitions, while the ICC organises four-day first-class ICC Intercontinental Cup for the leading eight Associate members.

Cricket, physically and mentally, is a demanding sport. In a test, fast bowlers may be required to run-up 20 to 30 metres, over 120 times a day, to deliver the ball on rock hard pitches. Repeating this kind of workload several times a week makes it no surprise that male fast bowlers have injury rates comparable to players of the football codes, with 15-20 per cent being unavailable due to injury at any given time¹. In contrast, batsmen have lower injury rates but have to contend with a hard ball being



Figure 1: Balls penetrating the visor-to-faceguard gap.

delivered at them at up to 150 km/h, whilst sometimes batting for several hours in very hot conditions.

Some of the most common injuries in cricket include: lower back injury (particularly stress fractures in fast bowlers), hamstring and calf strains, hand fractures in batsmen (even though they are allowed to wear gloves), and injuries in fielders attempting to stop or catch hard struck balls². More research is required, particularly within women's cricket, to identify and address the risk factors associated with the most important injury problems.

HELMET RELATED HEAD INJURY

Whilst not uncommon, overall head injury rates in cricket are considered to be low, especially when compared to contact sports such as rugby, Australian and American football. However, there are a number of potential cricket head impact situations that can result in concussion and other serious head trauma. Along with the

risk of direct batsman impact, the ball can also ricochet off the bat onto the head or body of batsmen, bowlers, wicketkeepers, close fielders and umpires.

Fast moving balls have been known to bounce up into fielders' faces and there was a high profile incident in the English County Championship recently when a ball thrown from the outfield struck another fielder who wasn't watching the return throw, causing concussion. Serious head injuries due to collisions between two fielders trying to catch the same ball have also occurred.

Most cricket head injuries are relatively mild with, for example, concussed players usually returning without incident following a prescribed period of rest, and a supervised, graduated return to play. A tragic exception was the incident that led to the death of Australia batsman Phillip Hughes in 2014 when a ball struck the back of his head causing traumatic basal subarachnoid haemorrhage³. In the same year, England's wicket-keeper batsmen,

Craig Kieswetter and all-rounder Stuart Broad sustained severe injuries when the balls they top-edged penetrated through the gap between their helmet faceguard and visors (Figure 1). Kieswetter's injury was career-ending. Wicket-keepers Mark Boucher from South Africa and India's Saba Karim sustained career-ending injuries when hit in the eye by a ball and ball, respectively⁴.

Often quoted in cricket helmet safety publications is that players' health priorities are illustrated by the fact that groin protectors were first used by 19th century batsmen, whilst widespread helmet use didn't occur until the 1980s. Initial versions, such as those sported by Australia batsman Graham Yallop⁵, and England captain Tony Greig, resembled full face motorcycle helmets and must have been extremely heavy and hot.

Modern cricket helmets consist of a shell that covers the head and a faceguard or visor. The protective element of the shell

is typically made of crushable expandable polystyrene (EPS) foam that is covered in a thin layer of hard plastic formed so that the helmet resembles a cricket cap. Steel or titanium grills form the attached faceguards.

The 2008 ECB Injury Report tabled six case studies of professional cricketers sustaining head injuries despite wearing a helmet. A world-wide audit by the ECB medical staff unearthed many other similar examples. The evidence that cricket helmets were often ineffective was presented to the ICC Medical Committee in 2009 which instigated a helmet safety project. The three aims of the project were to:

1. maintain a database of cricket helmet related injuries,
2. identify vulnerable areas of helmets, and;
3. research and update helmet safety standards in liaison with national cricket boards, standards organisations, helmet manufacturers and player associations.

In an associated project, several problems with existing helmets were identified in a study by the ICC and ECB medical representatives. It documented video analysis of 35 cases of head injuries sustained by professional and international batsmen, all of whom were wearing a protective helmet⁶. Three main mechanisms were identified:

1. The ball penetrating the gap between the helmet faceguard and visor, either

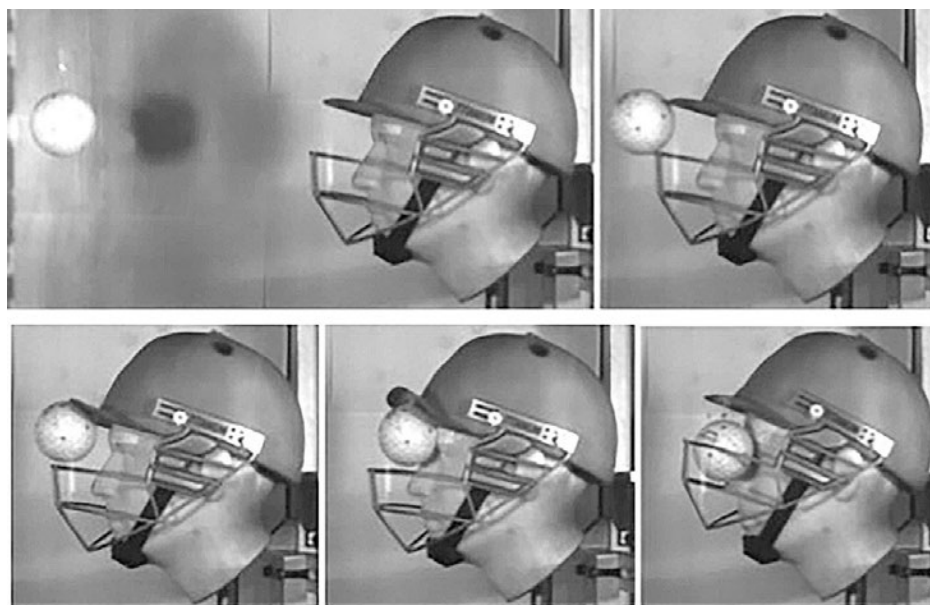


Figure 2: Projectile testing of an old BS7928:1998 standard helmet showing how the ball can penetrate the faceguard to visor gap even if it is narrower than the 73mm ball width (reproduced with the permission of the *British Journal of Sports Medicine*).

because the gap was adjusted to greater than ball width (approximately 73 mm) or, in a number of cases, because the ball was able to force through even if the set gap was considerably narrower than the ball. Nasal and orbital fractures, along with severe ocular injuries, resulted (Figures 1 & 2).

2. The faceguard impacting the face after being struck by the ball causing lacerations, facial fractures and dental damage.
3. Insufficient protection at the back of the head, contributing to several concussions.

The project revealed that there were two cricket helmet safety standards predominantly used by manufacturers: the British Standard (BS7928) published in 1998, and the Australian Standard (AS4499), published in 1997. Despite the most frequent and serious injury mechanisms being due to the ball impacting the face or faceguard, or the back of the head, the only testing element of most commonly obtained British Standard was a drop-test whereby helmet deceleration was measured after dropping the top of the helmet shell, at relatively low velocity onto a stationary hemispherical anvil. The limitations of the testing method

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Figure 3: Example of a BS7928:2013 certified helmet preventing the ball from penetrating the faceguard to visor gap (a), to the relief of the batsman (b).

were detailed in the only study of cricket helmet protective performance which concluded that:

1. a projectile test similar to that utilised in baseball catcher faceguard evaluation would be more appropriate for cricket helmets, and
2. helmets designed to meet existing safety standards performed poorly when struck at more realistic impact speeds.

A New Safety Standard for Cricket Helmets

Subsequent to the ICC project review finding that helmets, and the associated safety standards appeared ineffective, a business case to update BS7928 was accepted by the British Standards Institute (BSI). Throughout 2012 and 2013, a panel of representatives from the ICC, ECB, the Professional Cricketers' Association (PCA) and Federation of International Cricketers' Association (FICA), INSPEC International (a standards testing house), major helmet manufacturers and department of Loughborough Sports Technology was formed to produce the BS728: 2013 'Specification for head protectors for cricketers'⁷.

Published in December 2013, along with the existing drop-test onto the helmet shell, the new standard also included the following key features:

- A projectile test, whereby practice cricket balls are fired at the faceguard to visor gap (Figure 2), and the faceguard

- Failure if there is any contact by the ball, or faceguard, onto a designated 'non-contact' area of the face
- Specific projectile tests at realistic speeds for men's (28 m/s) and junior (23 m/s) helmets
- An additional drop-test site on the back rim of the helmet.

Helmets designed to meet the new standard, with narrower maximum faceguard to visor gaps, stiffer visors and more robust faceguards, came onto the market during 2014 and were available at the time of three of the incidents cited above (Hughes, Kieswetter and Broad). Yet, all three players were injured wearing old standard (BS7928:1998) helmets. In the same year, the ECB began publishing a list of all helmets certified against the new standard within helmet use guidance they issued in conjunction with the PCA⁸.

In 2015, Cricket Australia made it mandatory for all batsmen to wear British standard helmets in domestic and international cricket. For not following its instructions, Cricket Australia reprimanded Sean Marsh when he took to the field in a non-compliant helmet model⁹.

The ECB went a step further when in 2016 it mandated that all batsmen, wicketkeepers and close fielders must wear BS7928:2013 certified helmets in County and international cricket. A high profile challenge to this ruling came about when England captain, Alistair Cook, wanted to continue to wear his old

standard helmet on the basis, somewhat ironically, that he felt his vision might be compromised when wearing a compliant model. He was convinced to adopt a new standard helmet and has continued to perform well since.

The ICC has not yet made it mandatory for the batsmen to wear helmets while batting, taking the stance that in some circumstances the risk of other injury e.g. heat illness, may outweigh the need for head protection. However, following the June 2016 Annual Conference, ICC Chief Executive David Richardson announced plans to ban use of old standard helmets, stating:

"The discretion of wearing a helmet continues to rest with the player, but if a player decides to wear a helmet then it has to be one which complies with the (new) British Standard specifications. This is part of ICC's duty of care to prevent a player from picking up a serious injury as a result of a misperception that the helmet being worn is safe."

The vast majority of professional cricketers now wear helmets certified to BS7928:2013, and in the past few years there have been no recorded incidents where the ball has penetrated the faceguard to visor gap of compliant helmets. In fact, there are several examples where new standard helmets appear to have protected players from types of facial impact injuries that were previously unnecessarily common¹⁰ (Figure 3).

Of concern is that despite recommendations from governing bodies, players' associations, and cricketing administrative and medical staff, some professional and international players, even some who have sustained helmet related injuries, continue to wear unsafe, old design cricket helmets. A stark reminder of the potentially serious consequences of this choice were provided in January 2016 when New Zealand batsman Mitchell McClenaghan suffered a facial fracture when a ball flew through the faceguard of his old standard helmet¹¹, causing an orbital fracture.

New versus Old Standard Helmets

To most people, helmets that meet the new British standard might not look too dissimilar to old models. However, there are a couple of features which make them relatively easy to distinguish.

Firstly, the faceguard to visor gap on compliant helmets is fixed, whereas on most old standard helmets this gap could be adjusted via screw settings where the faceguard attaches to the side of the helmet shell. Secondly, new standard compliant helmets will have a sticker on the inside of the helmet shell indicating they have been certified against BS7928:2013 (Figure 4). Another important aspect to note is the size of ball that has been used during testing. Senior cricket helmets are tested against a full size men's 156 g ball, whilst junior cricketers should choose a helmet that has been tested with the smaller 133 g ball. Women's cricket is played with a 140 g ball and, therefore, it is recommended that women cricketers choose one of the several models of helmet that is certified against both the junior, and senior men's sized cricket balls.

Neck Protectors

Whilst facial protection has been improved, some manufacturers are now also producing separate neck protectors that attach to the back of helmets with the aim of preventing serious or fatal impacts. However, as the Phillip Hughes tragedy occurred after publication of the latest British standard, no tests are currently required for these devices and their effectiveness is unknown.

An update of BS7928 is planned for 2017 and is likely to include methods to evaluated



Figure 4: BS7928:2013 certification sticker on the inside of the helmet shell.

'neck protector' impact attenuation. It is envisaged that this latest version of the British standard will form the basis for a proposed International (ISO) standard that will allow manufacturers and governing bodies to be able to be able to comply with, and refer to, a universal safety standard.

MOVING FORWARD

By and large, helmets worn by fielders and wicketkeepers are the same models as those worn by batsman. Whilst there is still considerable room for improving batting helmets, particularly with regard to reducing their weight and heat retention whilst augmenting protection against concussive impacts, there is also a need to produce helmets that are specific to the protective and ergonomic needs of fielders, wicketkeepers and perhaps even umpires. The challenge for manufacturers is to be able to cost-effectively produce this type of bespoke protective equipment when the top level cricket market is relatively small.

This ongoing project provides several examples of the considerable time and consensus it takes to develop and implement appropriate safety standards within elite sport. The importance of involving all stakeholders, in every aspect, at all stages of injury prevention policy development cannot be understated. Also evident is that even with the implementation of governing body regulation, players will be reluctant to compromise performance. Therefore, it is essential to gain buy-in by providing education, support and in particular for this project, high-quality safety equipment.



The discretion of wearing a helmet continues to rest with the player, but if a player decides to wear a helmet then it has to be one which complies with the (new) British Standard specifications. This is part of ICC's duty of care to prevent a player from picking up a serious injury as a result of a misperception that the helmet being worn is safe.



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