



Throwing or bowling?

Biomechanical Analysis of Suspect Actions

Text: Helen Bayne (née Crewe), Head Biomechanist, hpc

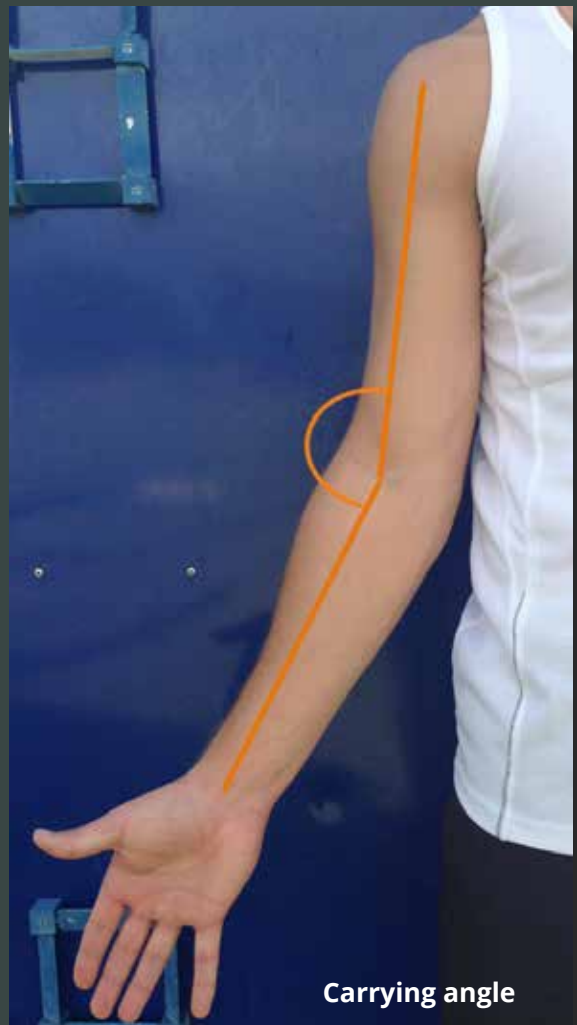
A distinctive feature of cricket is that the bowler is required to deliver the ball with an overarm action

but without throwing. The

Laws of Cricket state that "a ball is fairly delivered in respect of the arm if, once the bowler's arm has reached the level of the shoulder in the delivery swing, the elbow joint is not straightened partially or completely from that point until the ball has left the hand". The implementation of this law has been a controversial and emotive issue ever since the earliest documented reports of umpires calling "no-ball" for throwing in the 1890s and has undoubtedly affected many bowlers' cricket careers. In recent times, modern technology has enabled a more objective procedure for evaluating bowling action legality.

Even in players who bowl with the straightest of arms, the elbow joint is not completely rigid during bowling. So, in 2005, following a review of around 130 spin, medium and fast bowlers who had been examined using field-based and laboratory-based testing methods, the ICC introduced a tolerance threshold of 15 degrees. This refers specifically to straightening of the elbow (extension) between the points where the upper arm reaches horizontal during the delivery stride and when the ball is released.

It is impossible to determine whether a bowler exceeds this 15 degree threshold with the naked eye for a number of reasons. Firstly, the movement happens in less than 1/10th of a second. Secondly,



the bowler's arm and body move through a complex three-dimensional range so that you could never be in a perfect position that would allow you to view the flexion-extension of the elbow. Lastly, anatomical variations can create an illusion that the arm is bending or straightening when in fact it isn't. For example, the actions of bowlers with a large "carrying angle" or a hypermobile elbow often look suspicious even though they are legal.

Currently, the best available method for analysis of



the elbow angle during bowling is through three-dimensional (3D) motion capture. This requires the use of several high-tech infrared cameras, which detect the position of reflective markers placed on specific locations on the bowler's body.

The ICC's team of human movement specialists have developed a 3D motion analysis testing protocol, including a suite of testing equipment and software, that is being used at all accredited testing centres. In December 2014, the University of Pretoria became the fifth accredited testing centre, joining centres in Cardiff, Loughborough, Chennai and Brisbane as testing facilities for players reported in international cricket under the ICC Regulations for the Review of Bowlers reported with Suspected Illegal Bowling Actions. Each of the facilities was assessed against a range of criteria, including having an indoor area large enough to allow a player to bowl off his or her normal full run up, a motion analysis system with a minimum of 12 high speed cameras capable of producing 3D data, suitably qualified personnel who are experienced in using such systems and implementing the ICC testing protocol.

The 3D motion capture system at the University of Pretoria is the most sophisticated of its kind in South Africa. Not only is it being used by hpc biomechanists to assess suspected illegal bowling actions, but also in a number of biomechanical research projects on sports performance and injury.



Three-dimensional motion capture setup in the Cricket South Africa Centre of Excellence at the University of Pretoria