The Fast-Medium Bowler

Sports Biomechanics and Technical Analysis Model

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Aim:

- **To inform young cricketers, parents and coaches on the role and importance of sports biomechanics and technical analysis in maximising performance and prevention of injury both in training and competition.**
- **To develop a coherent technical model of sports biomechanics and technical analysis for all fast-medium bowlers for the England and Wales Cricket Board.**

During the summer of 2001, sixty fast-medium bowlers playing England age groups U13, U14, U15, U17 and U19 were filmed and analysed during competitive play. Each bowler was filmed from three angles, side-on, front-on and back view. Technical and biomechanical analysis were made for each bowler using the following phases, Pre Delivery Stride (gather), Mid bound, Back Foot Contact, Mid position / Front foot contact, Release and Follow Through.

Throughout the bowling action the following key biomechanical parameters formed the bases of the study: ***approach speed, angle of run-up, feet position during the delivery phase, hip-to-shoulder separation angle, upper torso & arm position, release height, front knee angle during front foot contact, delivery stride length and follow through*.** As a result of this investigation, this study highlights the most commonly found biomechanical and technical problems associated with fast-medium bowling. The seven most common technical problems are reported below. The percentage figure represents the number of bowlers associated with that particular technical problem. The technical problems presented in this document are, in the opinion of the authors, the priority sequence that a coach should use as a template, when working with young fast bowlers**:** All the following descriptions assume a right-handed bowler bowling to a right-handed batsman.

Coaches Analysing Sequence

1) Approach Speed: (Too FAST for optimum efficiency! 85%)
In most cases all the sixty bowlers analysed had a athletic run-up, however in a number of cases the basic gait (running style) would need to be corrected. Approach velocity is a key component in the production of force. The quicker a bowler runs into the wicket, the greater the forces exhibited during both back foot and front foot contacts. The faster the bowler runs into the wicket, the greater their physical conditioning needs to be to withstand the ground reaction forces (GRFs), in particularly at front foot contact. This can be between five to ten times the body weight (BW) of the bowler for each delivery. Over half the bowlers analysed had an approach velocity that we would consider too fast for them to deliver the cricket ball. There is an optimum approach speed for each bowler that enables him or her to deliver the ball in a controlled and efficient manner. It was noted that none of the bowlers ran in too slowly!

2) Long Arms prior to delivery: (Momentum directed upwards and not towards the target! 40%)

For a number of bowlers analysed the following symptom was very common: ***"What goes up must come down!"*** The higher the bound, the greater the force that is exerted on the body during landing. This can lead to a number of problems. Momentum is lost due to

(1) the bowling hand and ball starting in front of the body.
(2) the bowling arm begins to rise high above the bowler's head
(3) The ball and arm are moving backwards whilst the body moves forwards.

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As a result the torso leans too far backwards and the bowling action becomes long and slow. At pre delivery-take-off, the ball is still behind the bowler. This causes the momentum of the bowler to go upwards and not towards the wicket and target. There is a loss in horizontal speed in the run-up at this point. Side-on bowlers are more prone to this problem, since they need sufficient time in the pre-delivery stride to attain their side-on position. The unnecessary height of the bound coupled with the loss in horizontal momentum often creates a pre delivery stride that is too long. In some cases bowlers were covering over 3 meters in distance with their pre-delivery stride. This creates undue stress on the body during back foot landing. If this is happening to the legs, the arms must be correspondingly long and slow. An example of this is given (see Figure 1) As a coach this is an important consideration, as if you modify the leg action you MUST modify the arm movement. Ideally the arms in this phase should be compact and held close to the body. They should only begin to open once the back foot has made contact with the ground.

Figure 1

3) Back Foot Collapse: (Unstable base! – Absorbs Momentum! 25%)

There are two main reasons for the back foot collapsing prior to the delivery stride.

(1) The pre delivery stride is too long or too high. If it is exaggerated it may not only be inefficient and a waste of effort, but will heighten the risk of injury as the GRFs at back and front foot contact will be increased. Back foot forces are in the region of 2-3BW, similar to the GRFs which occurs during the run-up phase. There are different requirements for side-on and front-on bowlers. The height of the bound during the pre-delivery stride for a front-on bowler will not be as high as for a side-on bowler, who needs more time to rotate into position.

(2) The angle of run up – several bowlers momentum was directed towards fine leg. At the moment of BFC the bowler then has to redirect his momentum towards the target. This takes time and effort! The more time spent on the back foot, the more energy is expended and the more momentum is lost through the crease. This also creates unnecessary stress on the hip and knee joint of the back leg. See figure 2 for examples. The cause and effort result of a collapsing back leg is a long, slow and high movement of the front leg (See point 5 for details). Ideally, you would want to get off the back foot as quickly as possible!

Figure 2

4) Blocking and Opening of the front foot: (Good foot alignment reduces the chance of injury! 65%)
One reason for bowlers blocking off the body with the front foot is the angle of run up. If this is combined with the collapsing back leg the bowler has a major problem. With this angled approach the bowler's momentum is still directed towards fine leg. At the moment of BFC the bowler is unable to redirect his momentum towards the target and the front leg ends up going across body. This creates a tremendous amount of additional stress throughout the lower back. As a result the torso starts to fall away in order to allow the bowling arm to be redirected towards the target. In some cases a bowler started with their front leg aiming towards fine leg, however it is then realigned prior to front foot contact (FFC) more towards the direction of 1st 0r 2nd slip. This can lead to an excessive amount of lateral flexion – "falling away of the torso" prior to the release of the ball. (See point 6 for details)

Figure 3 below gives an indication of the good and poor alignment. The red arrow represents a straight line from the bowler's middle stump to the target (batmen's middle stump). The yellow line is a vertical line drawing. The black arrow indicates the direction of the feet at FFC. This example highlights the problems of blocking off the front foot during the delivery phase. It is very inefficient, plus it increases the amount of force around the lower back were injuries could occur very quickly. Figure 3a shows the black arrow pointing towards fine leg, where as in Figure 3b the black arrow is pointing directly towards off stump.

Figure 3a

Figure 3b

5) Long Delivery Stride: (Collapsing of the Front Leg 75%)

There are three major reasons for the front foot collapsing prior to the delivery stage.
(1) Back leg collapsing on BFC, the more the back foot collapses the higher the front leg tends to become, the higher it gets, the longer the delivery stride will be. The longer the delivery stride becomes, the harder it is for the bowler to bowl over a solid, braced front leg. As a general rule of thumb, the back foot should land close to the popping crease and the front foot landing on the batting crease. This is achievable by all bowlers!
(2) Approach velocity (see point 1)
(3) Physical fitness and strength. On many occasions fast bowlers had a front knee angle that "collapses" during the delivery stride. Ideally the bowler should have a technique that enables him / her to maintain a constant front knee angle during the release of the cricket ball.

Figure 4

Figure 4 is very inefficient, plus the bowler has lost a tremendous amount of height. All the bowler's momentum is absorbed by the front leg, instead of bowling up and over a braced front leg. On many occasions the angle of the front leg reduced even further after the ball was released. Ideally, the front knee angle should be constant at the point of release.

6) Excessive Lateral Flexion (Bending sideways creates injury 57%)

The majority of the sixty bowlers analysed, exhibited an excessive lateral flexion of the torso at release. The main reason for bowlers falling away and creating unnecessary forces through their lower back was due to the upper body being out off alignment with the lower body. Incorrect feet positioning or hip and shoulder alignment can cause this. The way to look for a potential problem is to draw a line through the shoulders at the moment of release and measure the angle created with the vertical. A number of bowlers exhibited angles of 10-20° (see figure 5). It is preferable to have an angle much closer to the horizontal: approximately 45°. It is very important to note by how much the shoulder angle changes from FFC to RELEASE. It is also important to measure the angle of the pelvis (hip joint at the moment of release) to the shoulder angle. The greater this angle than the more stress is place on the lower back, even if the hip-to-shoulder angle is low. Strength in the lumbar region is vital in order to prevent injuries in this area. It is also important to note the position of the head in both images; every effort must be made with bowlers to keep the head more upright throughout the delivery phase. In order to try and minimise these forces it is a good practical principal to try and get the bowler to release the ball directly above their front foot. Figure 5a shows the ball being released directly over the front foot. Figure 5b however shows that at the point of release the ball is outside the front foot (see vertical yellow line). The red line indicates the amount of lateral flexion is occurring in the spine.

Figure 5

Figure 6

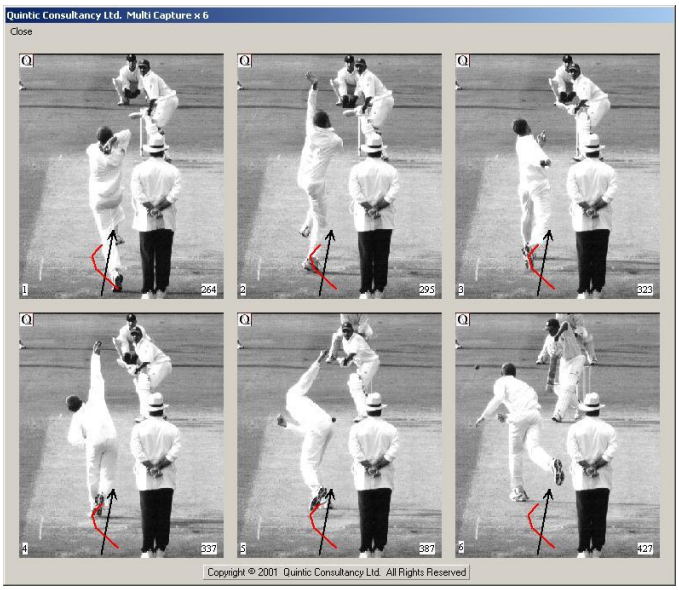
All coaches should be fully familiar with the phrases Side-on, Front-on, Midway and Mixed Techniques. The hip-to-shoulder separation angle is used for the classification of ***MIXED ACTIONS***… It is preferable to view bowlers at both BFC and FFC for hip-to-shoulder separation angles in order to obtain a more detailed analysis of the bowling action. However it is during FFC that the loading and hence the forces through the body are at their maximum.

Figure 6 highlights even though the hip-to-shoulder separation angle may be very small, there can still be a large degree of lateral flexion in the spine. This over time will create problems around the lumbar region (lower back) along with rib injuries. Physical conditioning of this area is vital for the fast bowler.

7) General Alignment (Maintain momentum in one direction! 83%)
(Pre-Delivery, Back Foot Contact, Front Foot Contact, First Stride in the Follow Through)

Very few bowlers demonstrated good alignment. In an ideal technique the pre-delivery stride, BFC, FFC and the first stride in the follow through should be in a straight line, ***AIMING TOWARDS THE TARGET***. This should maximise the efficiency of the action; the top half and lower halves of the body will not be fighting each other. It is a simple procedure for all coaches to check and should do so on a regular basis.
The image sequence below shows an example of a bowler jumping outwards towards 2nd slip. The red line follows the path of the feet during the action. The black arrow shows the target line. The two are totally different. Every effort should be made to get the run-up on a straight line and thus allow good alignment to happen naturally. The pre-delivery stride, BFC, FFC and the first stride in the follow through should be in a straight line, ***AIMING TOWARDS THE TARGET*** – follow the black arrow!

Figure 7



Conclusion

This study investigated the bowling action of sixty fast-medium bowlers playing England age groups U13, U14, U15, U17 and U19. The most common biomechanical and technical faults were identified. This data was used to develop a technical model of sports biomechanics and analysis for all fast-medium bowlers. The authors suggest that if the seven most common technical faults can be eradicated then the young fast-medium bowler would reduce the risk of injury and fully maximise his / her potential.

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