

Cricket injuries: a longitudinal study of the nature of injuries to South African cricketers

R A Stretch

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Objective: To determine the incidence and nature of injuries sustained by elite cricketers during a three season period in order to identify possible injury patterns.

Methods: Thirty six physiotherapists and 13 doctors working with 11 provincial and the South African national teams completed a questionnaire for each cricketer who presented with an injury during each season to determine anatomical site of injury, month of injury during the season, diagnosis, mechanism of injury, whether it was a recurrence of a previous injury, whether the injury had recurred again during the season, and biographical data.

Results: A total of 436 cricketers sustained 812 injuries. Bowling (41.3%), fielding and wicketkeeping (28.6%), and batting (17.1%) accounted for most of the injuries. The lower limbs (49.8%), upper limbs (23.3%), and back and trunk (22.8%) were most commonly injured. The injuries occurred primarily during first class matches (27.0%), limited overs matches (26.9%), and practices (26.8%) during the early part of the season. Acute injuries made up 64.8% of the injuries. The younger players (up to 24 years) sustained 57% of the first time injuries, and the players over 24 years of age sustained 58.7% of the injuries that recurred from a previous season. The injuries were mainly soft tissue injuries predominantly to muscle (41.0%), joint (22.2%), tendon (13.2%), and ligament (6.2%). The primary mechanism of injury was the delivery and follow through of the fast bowler (25.6%), overuse (18.3%), and fielding (21.4%).

Conclusion: The results indicate a pattern of cause of injury, with the young fast bowler most likely to sustain an acute injury to the soft tissues of the lower limb while participating in matches and practices during the early part of the season.

Correspondence to:
Dr Stretch, Sport Bureau,
University of Port Elizabeth,
PO Box 1600, Port
Elizabeth 6000, South
Africa; sparas@upe.ac.za

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Today elite sportspeople are expected to train longer, harder, and earlier in life to excel in their chosen sport. The modern cricketer is no exception. The demands placed on the cricketer are further increased because of the repetitive nature of the game, often for long periods of time. Thus the demands of cricket, which in the 1970s was regarded as a sport of "moderate injury risk",¹ have changed, and players are susceptible to a wide variety of injuries at vital stages of the season. Studies of cricket injuries show an increasing incidence, varying from 2.6 to 333/10 000 athlete hours played,²⁻⁴ with 28.4–71.6% of cricketers⁵ sustaining between 1.61 and 1.91 injuries per season.⁶

The anatomical sites of injuries in cricket have been reported in a number of studies. Injuries to the lower limbs varied from 22.8% to 50.0%.¹⁻⁵⁻⁹ Upper limb injuries accounted for 19.8–34.1% of total injuries,¹⁻⁵⁻⁹ with the fingers found to be the most vulnerable site.^{1,6,7} Back and trunk injuries accounted for about 18% and 33.3% respectively of the injuries.⁵⁻⁹ The incidence of injury to the head, neck, and face varied from 5.4% to 25%.⁵⁻⁹ These injuries consisted primarily of concussions, contusions, and lacerations.

Bowling has been found to be the major cause of cricket injuries, with between 38%¹⁰ and 47.4%⁸ of schoolboy bowlers sustaining back injuries, compared with 33.0–65.7% in provincial bowlers.⁶ Spondylolysis is often encountered in Australian fast bowlers playing first class cricket,¹⁰ and stress fractures at other sites are common in fast bowlers and occur primarily in the metatarsal bones, the fibula, and the tibia.² The high incidence of back injuries in young bowlers is the result of a combination of factors. These include inadequate physical and physiological preparation, postural defects, high physical demands, biomechanical aspects of the bowling technique, escalation in training frequency, duration of bowling

spells in matches, and repetitive movements.¹¹⁻¹⁴ Muscle strains and impact injuries are the most common batting injuries.⁷

Younger players tend to be at greatest risk of injury,⁵⁻⁸ with bowlers (mean age 16.8 years) showing increased vulnerability to injury because their growth process is not complete.¹⁰

A study of recovery time from injury showed that 47.8% of the players were able to return to practices or matches within seven days of sustaining the injury, and 28.4% returned within 8–21 days. However, 23.8% of the injuries were severe enough to prevent return to play for more than 21 days.⁵

Injuries tend to occur during specific stages of the season, with the many preseason matches and the concentration of matches toward the end of the season tending to result in an increase in injuries at those times.⁵⁻⁸

Touring constitutes a large part of an international cricketer's programme. On two international tours, lasting eight days¹⁵ and two months,¹⁶ 14 and 71 injuries were sustained respectively. On the shorter tour, eight players sustained injuries, broken down into injuries to the head and neck (14%), upper limbs (14%), trunk and back (7%), and lower limbs (64%). The bone and joint structures of the lower limbs accounted for 50% of the injuries sustained on the tour. On the longer tour, all 16 players received treatment for at least two injuries each, with one player receiving treatment for six different injuries and four players receiving treatment for five injuries each. The injuries were to the head and neck (7.0%), upper limbs (26.8%), trunk and back (19.7%), and lower limbs (46.5%).

In a retrospective study using files from 54 players from one English county, an acute injury rate of 57.4 per 1000 days of cricket played was found, with the regional distribution to the head and neck (6%), upper limb (29%), trunk (20%), and lower limb (45%).¹⁷

Table 1 Number of players and injuries sustained during the three season period

	S ₁	S ₂	S ₃	Total
Players	88	160	188	436
Injuries	163	258	391	812
Mean	1.9	1.6	2.1	1.9

S₁, S₂, S₃, Seasons 1, 2, and 3.

Although there have been a number of investigations into the incidence and nature of injuries sustained by cricketers, the literature reviewed shows that no long term investigation has been carried out to determine if any injury patterns could be identified. Thus the aim of this study was to investigate the nature of injuries sustained by elite cricketers during a three season period (1998–1999 (S₁), 1999–2000 (S₂), and 2000–2001 (S₃)).

METHODS

The doctors and physiotherapists working with the South African team and the 11 provincial teams were required to complete a questionnaire for all cricketers that presented with an injury. It was designed to obtain the following information: anatomical site of injury; month of injury during the season; the diagnosis; mechanism of injury; whether it was a recurrence of a previous injury; whether the injury had recurred again during the season; biographical data.

An injury was defined as any pain that prevented the player from completing that particular match, practice, or training session and caused the player to seek medical attention. Acute injuries were those of rapid onset, chronic injuries were of longer duration involving very slow changes, and acute on chronic injuries were of longer duration and involved gradual changes, but were brought about by movements causing rapid onset.¹⁸ The severity of the injury was related to the length of time the player was not able to participate in practice sessions or matches.

For the purpose of this survey the incidence of injury was expressed as a percentage of the total number of injuries recorded. Injuries were grouped according to anatomical region as follows: the head, neck, and face region; the upper limbs; the back and trunk; the lower limbs. Injuries were also classified according to whether they were sustained during batting, bowling, or fielding. To allow comparisons between phases of play, the number of injuries in each phase was expressed as a percentage of the total. The time in the season when the injury occurred was also recorded. The off season was defined as the period when no specific cricket practice or training was performed. The preseason was defined as the two months preceding the start of matches when specific cricket practice and training was undertaken. The season was when matches were played and included international tours.

The BMDP Statistical Software Package (BMDP, 1993; BMDP Statistical Software Inc, Los Angeles, California, USA) was used to compute univariate statistics.

RESULTS

During the period under review, the physiotherapists and doctors working with the 11 provincial teams and the national team recorded 812 injuries sustained by 436 cricketers, with an average of 1.9 injuries per player (table 1) and a range of 1–27 injuries (table 2). The 36 physiotherapists recorded 691 (85.1%) injuries, and the 13 doctors recorded 121 (14.9%) injuries. The injuries were mainly to the soft tissues, predominantly muscle (41.0%), joint (22.2%), tendon (13.2%), and ligament (6.2%).

Table 2 Number of players sustaining single or multiple injuries per season for the three season period

Number of injuries	Number of injured players				%
	S ₁	S ₂	S ₃	Total	
1	54	106	117	180	57.0
2	15	33	25	45	14.2
3	8	11	21	33	10.4
4	4	4	10	15	4.7
5	1	3	1	10	3.2
6	3	1	3	9	2.8
7	1	–	4	5	1.6
8	–	2	2	3	0.9
9	–	–	–	3	0.9
10	–	–	3	2	0.6
11	–	–	–	2	0.9
12	–	–	2	1	0.3
13	–	–	–	1	0.3
14	–	–	–	1	0.3
15	–	–	–	2	0.6
16	–	–	–	1	0.3
17	–	–	–	1	0.3
22	–	–	–	1	0.3
27	–	–	–	1	0.3

S₁, S₂, S₃, Seasons 1, 2, and 3.

Table 3 Age and role of the players sustaining injuries during the three season period

	S ₁	S ₂	S ₃	Total
Age				
12–18 years	0.7	9.9	4.9	4.9
19–24 years	45.2	47.1	49.0	47.7
25–29 years	28.1	24.8	22.6	24.3
29 years >	38.0	18.2	23.5	23.1
Role				
All rounder	34.3	25.6	30.8	29.9
Batsman	27.6	21.3	24.6	24.2
Fast bowler	27.1	34.8	34.7	33.2
Spin bowler	1.8	10.9	7.6	7.4
Wicketkeeper	9.2	7.4	2.3	5.3

Values are percentages.
S₁, S₂, S₃, Seasons 1, 2, and 3.

Table 3 gives the age and role of the injured players. The younger players (up to 24 years) sustained more overuse (59.3%) and bowling (56.9%) injuries than the older players. All 14 of the stress fractures sustained occurred to the younger players, with 13 as a result of bowling.

The injuries occurred predominantly when practising or playing for provincial (36.7%), provincial B (24.1%), and international (16.0%) teams. When representing club and school teams, 9.1% and 7.2% of the injuries occurred respectively. Players attending the various provincial and national cricket academies suffered 6.8% of the total injuries.

The injuries occurred equally during first class (27.0%) and limited overs (26.9%) matches and during practices and training (26.8%). The gradual onset of the injury, caused as a result of a combination of training, practising, and playing matches, over a period of time, accounted for 19.3% of the injuries.

Table 4 shows the chronicity and occurrence of injuries. The majority (64.5%) of the injuries were first time injuries, and the younger players (up to 24 years) sustained 57% of these injuries. Of the new or first time injuries, 123 (23.5%) occurred during fielding. Recurrent injuries from the previous season made up 22.8% of the injuries, and players over 24 years of age sustained 58.7% of these injuries. A similar injury rate for injuries sustained during the season and recurring during the

Table 4 Chronicity and occurrence of injuries for the three season period

	S ₁	S ₂	S ₃	Total
Chronicity of injury				
Acute	62.6	58.9	69.9	64.8
Chronic	14.7	17.8	7.5	22.5
Acute on chronic	22.7	23.3	12.4	22.8
First time injuries	63.6	59.3	68.5	64.5
Recurrent injuries				
Previous season	28.4	16.7	24.5	22.8
Same season	8.0	24.0	6.9	12.7

Values are percentages.
S₁, S₂, S₃, Seasons 1, 2, and 3.

Table 5 Regional distribution of the injuries sustained in the three season period

	S ₁	S ₂	S ₃	Total
Head, neck, and face (n=33)				
Total injuries (%)	4.3	5.4	3.1	4.1
Cervical vertebrae (No)	4	7	10	21
Upper limbs (n=189)				
Total injuries (%)	21.5	19.8	26.3	23.3
Metacarpal/phalanges (No)	16	18	33	67
Glenohumeral joint (No)	6	13	22	41
Elbow joint (No)	–	2	14	16
Back and trunk (n=185)				
Total injuries (%)	24.5	24.8	20.7	22.8
Thoracic spine (No)	2	8	7	17
Lumbar spine (No)	17	30	41	88
Ribs (No)	8	5	6	19
Soft tissue (No)	7	13	15	35
Lower limbs (n=405)				
Total injuries (%)	49.7	50.0	49.9	49.8
Groin (No)	7	10	15	32
Hamstring (No)	20	25	27	72
Quadriceps (No)	5	12	24	41
Knee (No)	9	13	33	55
Ankle (No)	8	20	15	43

S₁, S₂, S₃, Seasons 1, 2, and 3.

same season was found for the players up to 24 years (49.2%) and over 24 years (50.8%).

Table 5 presents the regional distribution of the injuries. Lower limb injuries accounted for nearly half of the injuries (49.8%), and injuries to the hamstring (17.8%) and quadriceps (10.1%) muscles, patella and knee (18.5%), and ankle (10.6%) comprised the majority of the 405 lower limb injuries. The hamstring injuries were mainly muscle strains (49) and tears (16), and injuries to the quadriceps were mainly muscle strains (28). These injuries were primarily caused by bowling (hamstring, 21; quadriceps, 19) and fielding (hamstring, 9; quadriceps, 8).

The 189 upper limb injuries were predominantly to the phalanges (24.3%), glenohumeral joint (21.7%), and metacarpals (11.1%). Injuries to the phalanges and metacarpals were primarily caused by impact from the ball while batting (25) and fielding (32), mainly resulting in fractures (19) and joint (14) injuries. The glenohumeral injuries were predominantly muscle (14), tendon (10), and joint (10) injuries caused by fielding, including throwing (22), overuse (5), and bowling (4).

Injuries to the lumbar spine (47.6%), abdominal muscles (18.9%), and ribs (10.3%) made up the majority of the 185 back and trunk injuries. The 88 lumbar spine injuries were made up mainly of joint (40) and muscle (20) injuries, and

Table 6 Role when injuries were sustained during the three season period

	S ₁	S ₂	S ₃	Total
Bowling	40.5	40.3	42.2	41.3
Batting	21.5	14.3	17.1	17.1
Fielding	25.7	27.5	31.0	28.6
Warming up	4.9	7.8	4.5	5.8
Other	7.4	10.1	5.2	7.2

Values are percentages. S₁, S₂, S₃, Seasons 1, 2, and 3.

stress fractures (13) and were caused by overuse (31), bowling (25), fielding (12), and batting (7).

Of the 33 injuries to the head, neck, and face, 21 (63.6%) were cervical spine injuries, with 13 being muscle spasms or muscle strains. Of these, nine were the result of batting for long periods at a time.

Bowling (41.3%) and fielding, including wicketkeeping (28.6%), accounted for most of the injuries, with batting accounting for 17.1% (table 6). Of the bowling injuries, 53.4% were lower limb injuries and 32.6% were back and trunk injuries. Of these, 58.0% were acute injuries, 16.6% chronic injuries, and 25.4% acute on chronic injuries. Batting injuries were primarily lower limb injuries (54.4%) and impact injuries to the upper limbs (23.5%). The fielding, including wicketkeeping, injuries were predominantly to the upper (40.6%) and lower (42.9%) limbs.

The injuries occurred during the preseason (9.4%) (September), the early part of the season (32.3%) (October and November), midseason (21.7%) (December and January), the latter part of the season (12.5%) (February and March), and the "off season" (24.2%) (April to August).

The severity of the injuries varied, with 36.4% of the injuries only preventing the player from completing the training or practice session or the match that they were involved in when the injury occurred. The more severe injuries resulted in 12.3%, 13.7%, and 11.5% of the players not being able to practice or play matches for one to three days, four to seven days, and 8–21 days respectively, with a further 26.1% of the injured players not being able to practise or play matches for more than 21 days.

The primary mechanism of injury was the delivery and follow through of the fast bowler (25.6%), overuse (18.3%), running, diving, catching, and throwing the ball when fielding (21.4%), and being struck while batting (7.0%). Of the 149 overuse injuries, 82 (55.0%) were first time injuries, and 41 (27.5%) and 26 (17.5%) were recurrent injuries from the previous or the same season respectively.

DISCUSSION

The results indicate a pattern of cause and risk of injury. The principal finding is that young fast bowlers are at the greatest risk of sustaining an acute injury to the soft tissues of the lower limb during matches and practices during the early part of the season.

As the nature of cricket has developed in recent times, the cricketer has become more at risk of injuries associated with field sports. The results show a slight variation in the mean seasonal risk of injury, with acute injuries being the most common. Acute injuries, particularly to the soft tissue of the lower limbs, were primarily sustained during bowling, running between the wickets while batting, and running to field the ball. More than half of the first time injuries were acute, with many sustained while fielding.

Fast bowlers are at the greatest risk of injury for a variety of reasons, including the demands that fast bowling places on the musculoskeletal system, incorrect technique, poor preparation and training, and overuse.^{11–14} Of greatest concern is the

Take home message

Fast bowlers are the most likely to be injured, and there is evidence of an increase in overuse injuries. Players and coaches need to be aware of the increase in these injuries, which are often first time injuries, which are likely to recur if not fully rehabilitated.

fact that overuse was the major contributing factor to the injuries sustained by the younger players. Most of their injuries were the result of overuse, with 13 of the 14 stress fractures in the lumbar spine resulting from bowling. A lot of this bowling seems to be due to the need for early specialisation in order to excel, more players participating for their school team as well as for a club team, and young players bowling at provincial practices to allow the batsmen extended batting practice, while the provincial bowlers rest.

Injuries occurred most often during limited overs and first class matches and practices, particularly during the early part of the season. Muscle injuries were the most likely to recur during the season, and the primary mechanism of injury was bowling and overuse. More than half of the overuse injuries were new injuries.

As limited overs matches are often decided by a few runs, fielders are regularly required to dive full length to stop a ball, resulting in injury. This has, in particular, resulted in an increase in injuries to the cervical vertebra caused by "whiplash" when diving to stop the ball, trying to regain a balanced standing or kneeling position, and then attempting a quick return throw in order to secure a run out. Players and coaches need to be aware of the increase in these injuries as many of them are first time injuries and are likely to recur if not fully rehabilitated. Training sessions should therefore include focusing on the correct techniques of diving and returning to a balanced position to throw the ball. It may be necessary to have specialist coaches and use training equipment, such as soft mats, to learn and practise the correct techniques.

The younger players suffered most of the first time injuries, and they also sustained slightly more injuries than the older players. Previous injury is a strong predictor of current injury in a fast bowler,¹⁹—that is, once a player sustains an injury, it is likely to recur. Thus players, coaches, trainers, medical personnel, and administrators should aim to keep players injury free for as long as possible.

The severity of the injuries has decreased over the past decade, with nearly two thirds of injured players returning to cricket in the first week after injury compared with less than half in the previous study.³ The reasons are probably various, but one of the main ones may be that there is a better understanding of the scientific and medical aspects of the sport, allowing better management of the injured players.

Cricket today demands greater physical effort from players at vital stages during their careers. It is the duty of the players, coaches, medical support team, and administrators to put in place measures to ensure that unnecessary injuries do not prevent players from reaching their full potential. To understand further the incidence and nature of injuries, it is recommended that research is carried out to assess the number of injuries sustained in relation to the exposure time to training, practices, and matches for junior, provincial, and international players.

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COMMENTARY

South African studies coordinated by Richard Stretch have been the most published of the early cricket epidemiological studies, and this paper represents the largest of these series to date. The processes are now obviously in place for recording injuries to elite cricketers in South Africa. The next challenge for this study as it evolves is to define a specific cohort of players and exposure time in order to report actual incidence and prevalence of injury.

Australia now also has a system for monitoring injuries to elite cricketers.¹ England apparently has a similar process underway. Although New Zealand does not yet have a specific elite cricket injury survey, they are perhaps the country best placed to monitor cricket injuries at the amateur level because of the existence of a specific body—the Accident Compensation Corporation (ACC)—which is responsible for all sports injuries in New Zealand.²

This South African study and the recently published Australian study¹ show very similar injury profiles, but no injury rates can be directly compared because of differing methodologies. This is a familiar tale to anyone who has tried to compare injury rates between football studies from different countries. Cricket authorities have an obligation to try to promote research into the causes of cricket injuries. The most coordinated approach would be for the International Cricket Council to fund a cricket injury surveillance project (with a universal injury definition) in all Test playing countries.

J Orchard

South Sydney Sports Medicine, 111 Anzac Parade,
Kensington, NSW 2033, Australia;
johnorchard@msn.com.au

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