Spinal and Knee Kinematics in Low Back and Lower Limb Injury in Cricket Pace Bowlers

Benita Olivier, Aimee Stewart, Andrew Green, Warrick McKinon
Physiotherapy Department, Faculty of Health Sciences, University of the Witwatersrand, Johannesburg, South Africa.

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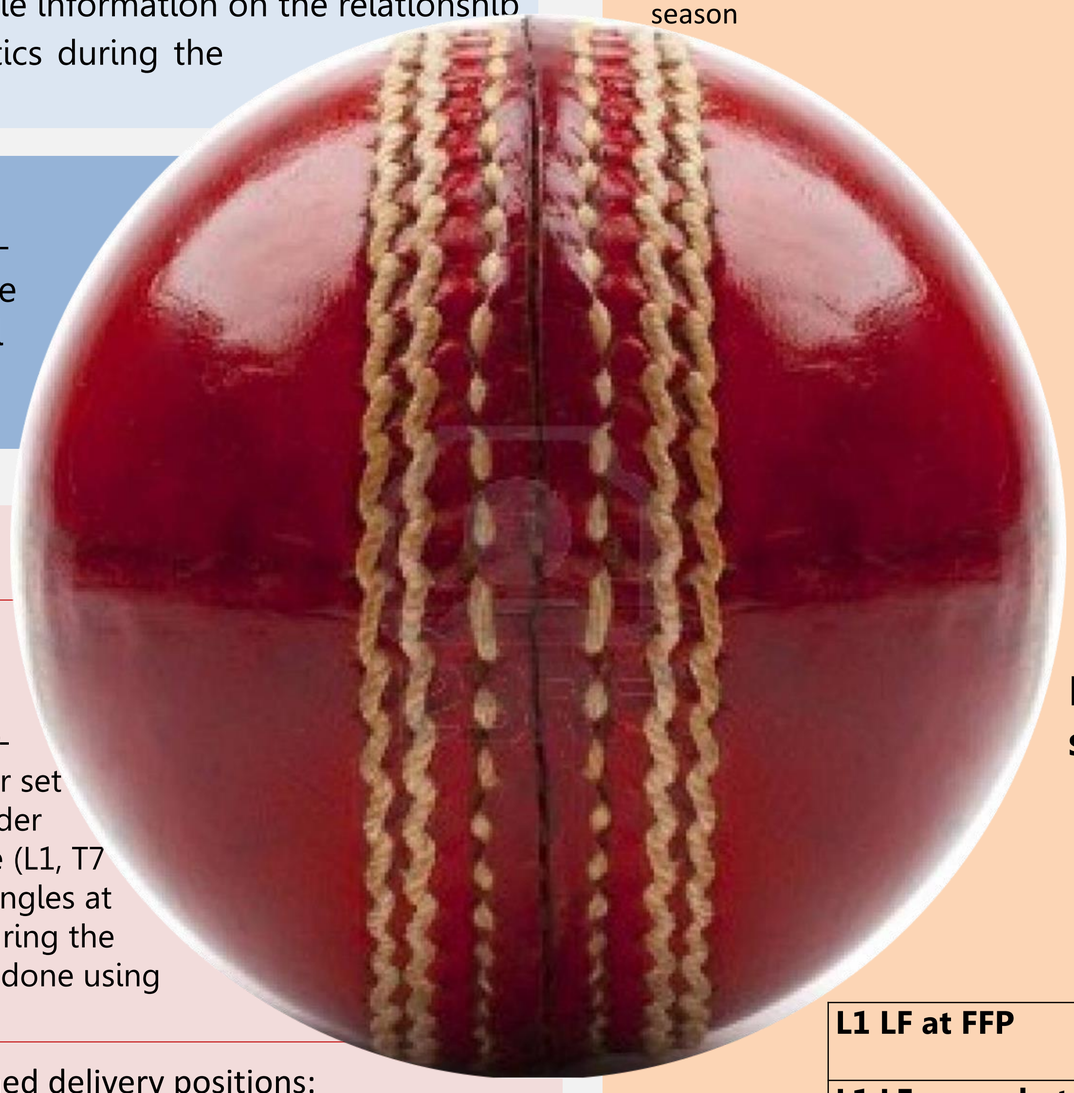
INTRODUCTION

For the cricket pace bowler to bowl an accurate delivery as fast as possible to the opposing batsman, an injury free status is crucial. Although bowling related kinematic studies have focused on the association between spinal and knee kinematics, and low back injury these studies have not investigated injuries sustained in the lower quarter as a whole - lower back injuries in combination with comorbid lower limb injury.[1] Due to the kinetic chain connecting all segments of the lower limb to the spine[2], low back dysfunction appears to be associated with lower limb injury.[1] Since lower quarter injuries are common in pace bowlers,[3] the investigation of all lower quarter injuries may provide useful insights. The comparison of kinematics at the start and at the end of the season and between injured and non-injured players, may give valuable information on the relationship between injury and spinal/knee kinematics during the bowling action.

AIM

The aim of this study is to compare pre-season and post-season spinal and knee Kinematics as well as to compare spinal and knee kinematics between injured and non-injured bowlers.

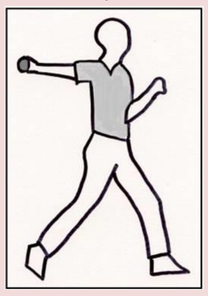


METHODS

31 injury free, premier league (amateur) cricket pace bowlers over the age of 18 years were invited to participate in this study. Five high speed digital cameras (PixeLINK®) recording at 85 Hz, captured a standardised marker set which allowed for the determination of shoulder and pelvic rotation, angles of spinal vertebrae (L1, T7 and T10), as well as shoulder and knee joint angles at both front foot placement and ball release during the delivery stride. All the kinematic analysis was done using Matlab7 (Mathworks, Natick).

Kinematic analysis in two predefined delivery positions:

Front foot placement



Ball release

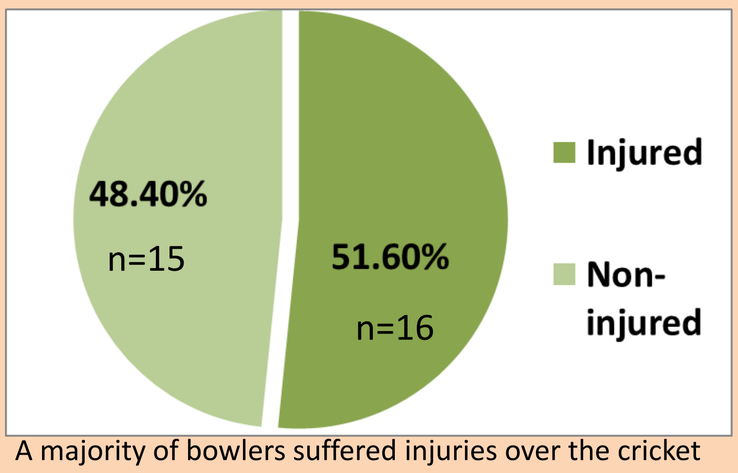
Non-injured*
No lower quarter injuries sustained during the cricket season.

Injured*
One or more lower quarter injuries sustained during the cricket season.

An injury was defined as a "musculoskeletal condition that resulted in loss of at least one day of sporting activity or that occurred during a sporting activity that required medical attention and which forced the bowler to quit the activity".[3] All bowlers were injury free at the start of the season.

An unpaired student's t-test was used to test whether kinematic variables varied between injured and non injured bowlers

RESULTS



A majority of bowlers suffered injuries over the cricket season

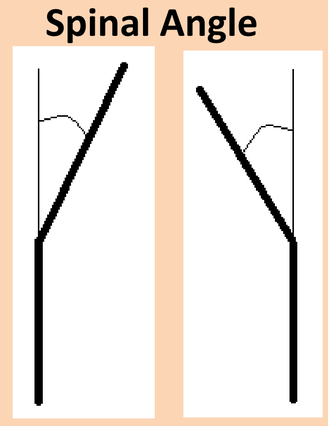
L1 flexion range between BR and FFP at the end of the season was 36.7˚ in non-injured and 15.2˚ injured bowlers (p=0.031).

Knee Angle

Injured: 164.4˚ flexion

Non-injured: 154.7˚flexion p=0.02

Spinal Angle



Injured: 27.2˚ extension p=0.009

Non-injured: 29.2˚ flexion

Differences in Spinal Angles at the start and end of a cricket season

	Injured bowlers		
	Pre-season Mean (SD) (degrees)	**Post-season Mean (SD) (degrees)**	**p-value**
L1 LF at FFP	101.274 (33.340)	74.883 (13.530)	0.021 *
L1 LF range between BR and FFP	36.659 (32.641)	19.571 (21.207)	0.021*
T10 LF at FFP	95.085 (34.413)	72.727 (9.975)	0.047 *
T7 LF at FFP	92.070 (33.590)	70.464 (8.645)	0.047 *

L1-Lumbar vertebra 1; T10-Thoracic vertebra 10; T7-Thoracic vertebra 7

CONCLUSIONS

Differences found between injured and non-injured groups can be explained by three theories. Firstly, the fear-avoidance model states that an individual's fear of movement may lead to avoidance of movements or positions that typically increase pain.[4] Secondly, the pain-adaptation model suggests that pain afferent activity decreases activity in a muscle that is responsible for moving a joint into a pain-provoking position and increases the activity of the muscle antagonists, which leads to a decrease in velocity and limits excursions, and protection against pain.[2] Furthermore, flexion and extension adaptation strategies of the trunk changed the shear forces on the knee.[2] The association between kinematics and lower quarter injuries may reflect an attempt to increase ball release speeds. Low back and knee kinematics, as found in the power phase of the pace bowling action, is associated and may predict lower quarter injuries in cricket pace bowlers.

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