

# Sports Biomechanics: Supporting the Coach's Eye

**Dr Helen Bayne**

**Division of Biokinetics & Sport Science and  
Sport, Exercise Medicine and Lifestyle Institute (SEMLI), University of Pretoria**



18<sup>th</sup> SASMA Congress, Cape Town, 2019

# Sports Biomechanics

“...uses scientific methods of mechanics to study the effects of various forces on the sports performer. It is concerned, in particular, with ways in which sports movements are performed – sports techniques.”

”...the study and analysis of human movement patterns in sport.”

Two key issues:

- 1) why injuries occur
- 2) how performance can be improved

# The Coach's Eye

Coaching inherently involves observation of movement patterns and teaching motor skills

Vast depth and breadth of knowledge from hours of exposure, practice and experimentation



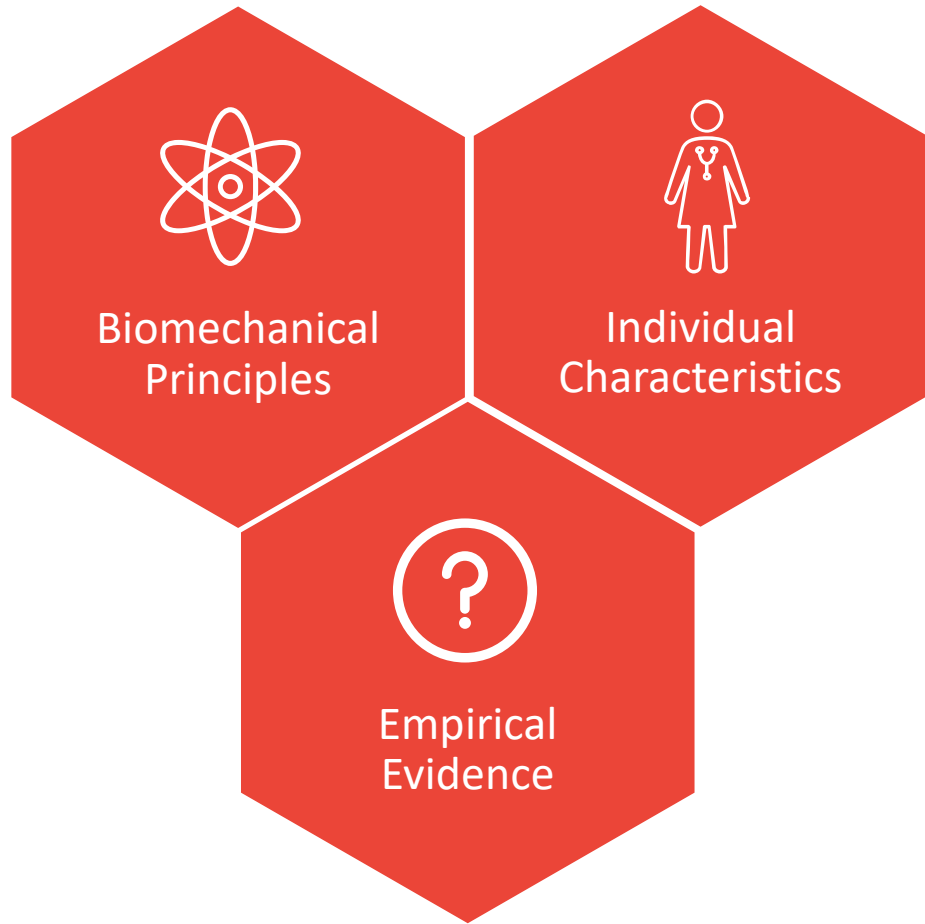
Art or Science?

# Sports Technique





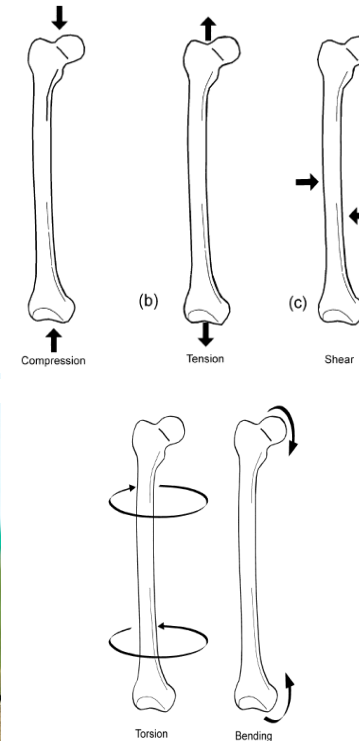
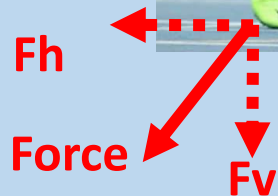
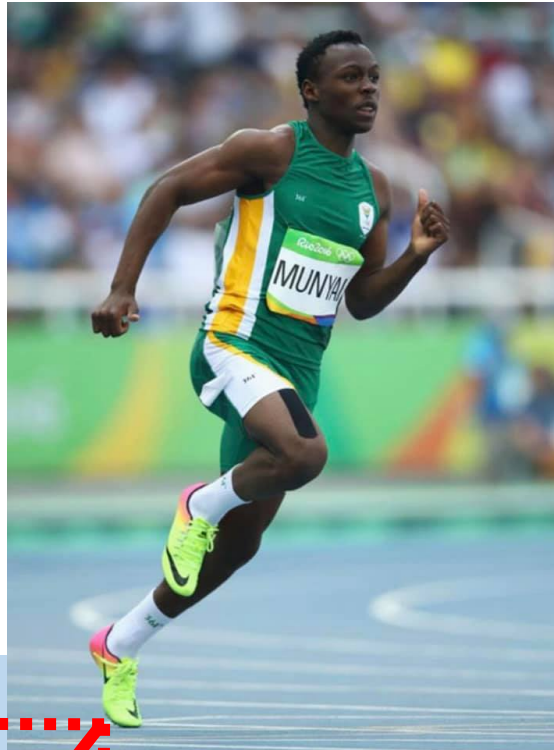
# Sports Technique



# Sports Technique

Biomechanical principles: extension of the laws of motion applied to the human body. **Example: “force-time”**

Improving Performance



Understanding Injury Mechanisms

# Understanding Injury Mechanisms

Stress fracture of the pars interarticularis in the neural arch of the vertebra (spondylolysis)

General population 4-6%

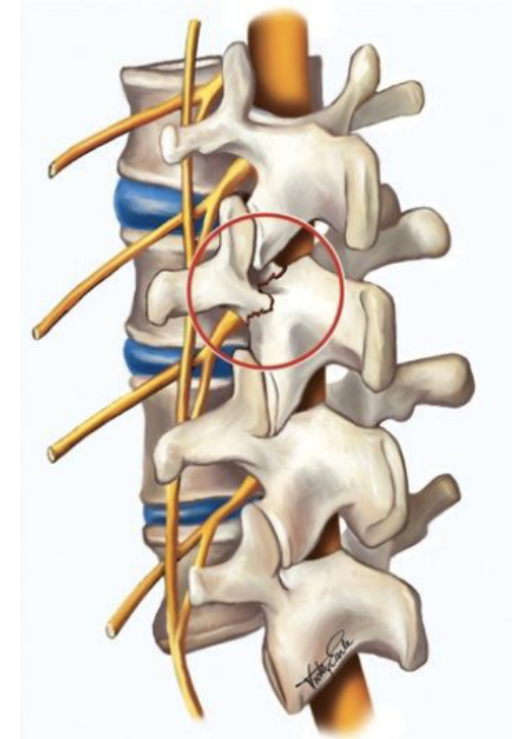
Fast bowlers up to 67%

In fast bowlers, most occur at L5, often unilateral, on the side opposite to the bowling arm

Bowling action:

Simultaneous and rapid extension-flexion, rotation and lateral flexion

GRF of 5-12 x body weight during front foot stance



# Understanding Injury Mechanisms

SIDE-ON



FRONT-ON



MIXED



SHOULDER COUNTER ROTATION

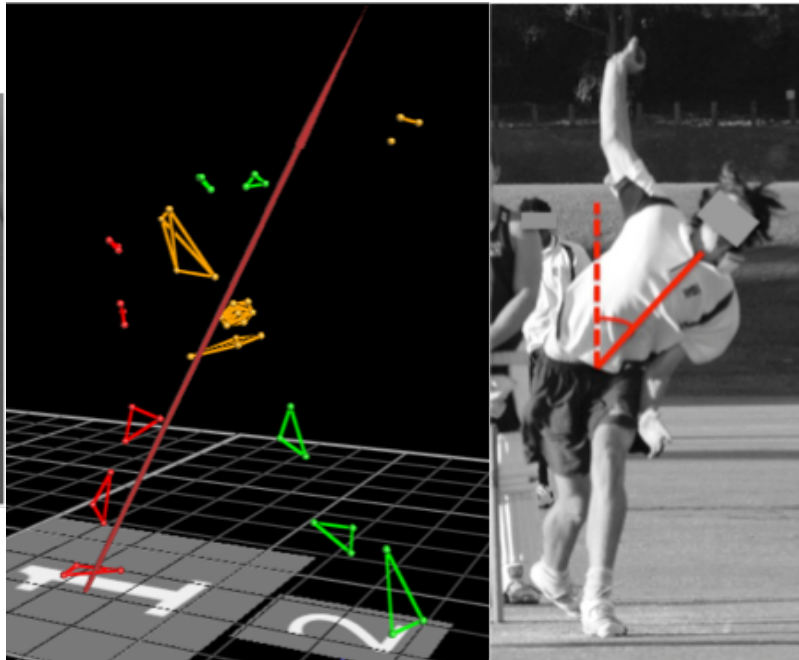
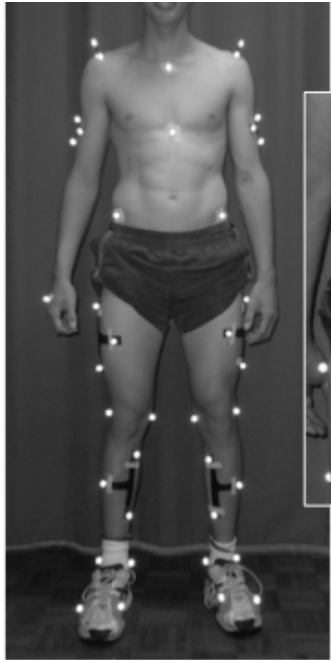


Both occur BEFORE front foot contact, where the highest GRF and lumbar loads are experienced



# Understanding Injury Mechanisms

Prospective study, measurement of lumbar load and technique



Injured bowlers (12/25):

↑ Lateral flexion moment

↑ Trunk lateral flexion and pelvis rotation

Trunk lateral flexion at ball release

- Injured:  $50^\circ \pm 6$
- Uninjured:  $40^\circ \pm 8$

Can be reliably measured using 2D video analysis

# Understanding Injury Mechanisms

Science informs coaching practices

Field-based analyses to support the coach's eye

...



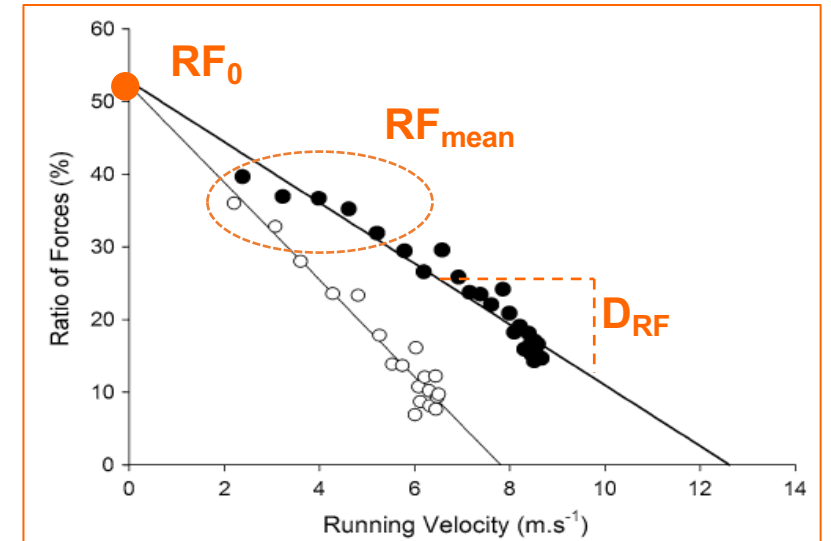
...



# Improving Performance

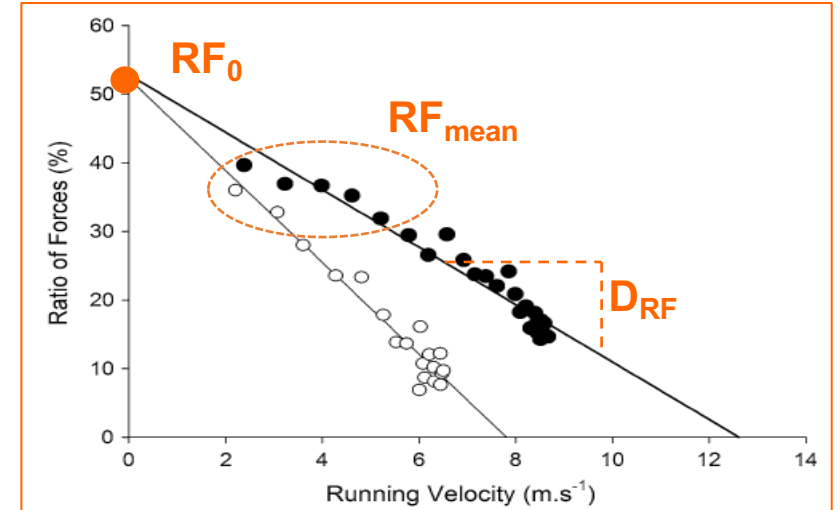
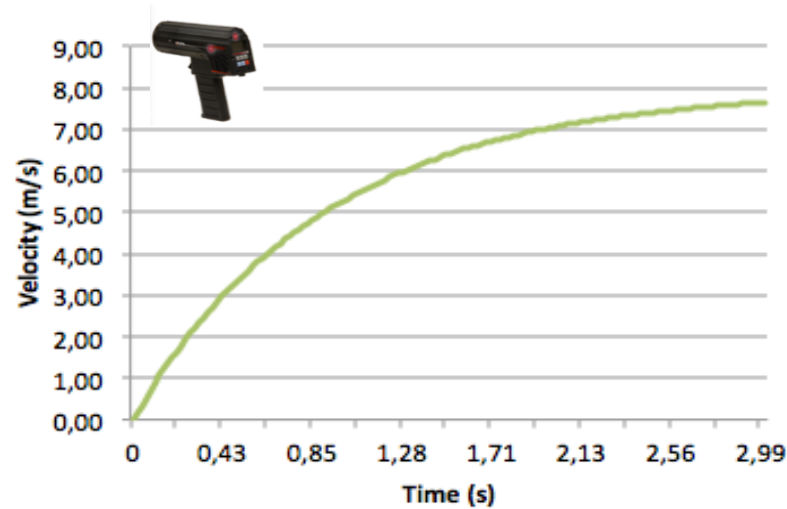
## Mechanical determinants of sprint acceleration

- Ratio of horizontal to total force ( $RF$ )
- Quantifies the direction of force application
- As velocity increases,  $RF$  decreases
- Measures used to quantify technical effectiveness of force application
  - Rate of decline of  $RF$  ( $D_{RF}$ )
  - Theoretical maximum  $RF$  ( $RF_0$ )
  - Mean over first 2s ( $RF_{mean}$ )



# Improving Performance

## Field-based measurement method

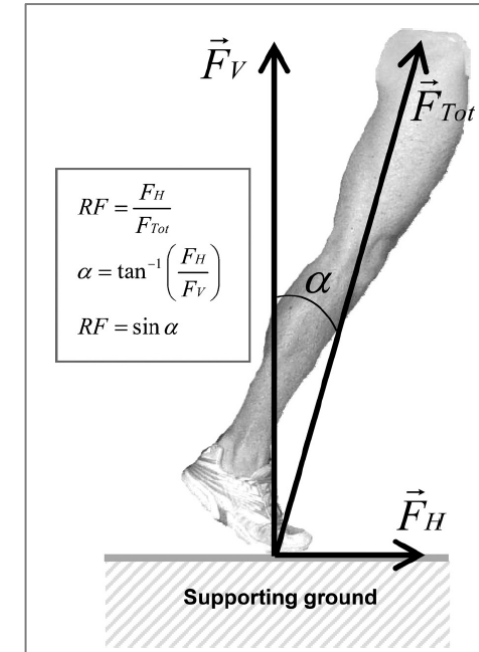
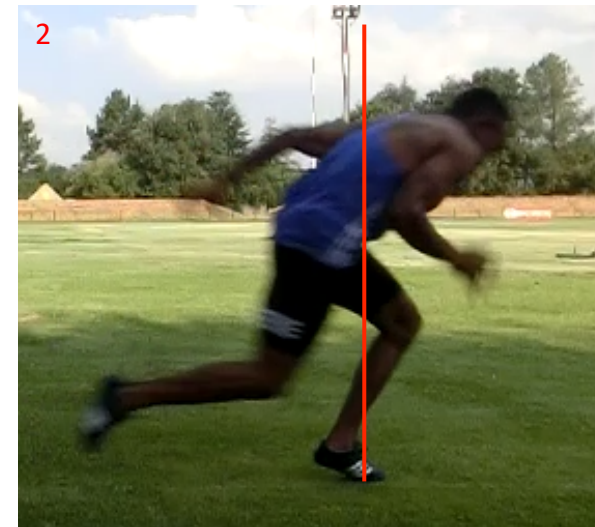


	Your Result	World Class Standard
$RF_0$ (%)	60.2	>55
$D_{RF}$	-8.0	-6.5
$RF_{mean}$ (%)	31.5	



# Improving Performance

Coach's eye?



# Sports Biomechanics: Supporting the Coach's Eye

