



Biomechanical perspective of underhand pitching in elite female softball players.

Softball Australia National Coaching Conference and Olympic Solidarity Softball Course.
May 2005



Confidentiality

- Apply appropriate ethical and professional care to all discussion today!
- Data is confidential it belongs to the individual athlete and the AIS.



Overview

- Aim of the next 40 minutes.
- What would you like to get out of this session?
- Review of some recent and not so recent research.
- Discussion on some common faults.



Who or what is a biomechanist?

- Where does biomechanics fit into pitching?
- How can biomechanics assist me as a coach?
- Can I pick up a biomechanist at Coles?



BIOMECHANICS

- Subdiscipline of biophysics
- Studies structures and functions of movements of biological systems
- Methods and laws of mechanics
- Practical approach in during work, daily life and sport

Sports Biomechanics

...is concerned with the human body in connection with the sport during movement where description and explanations of mechanics are used.



SPORTS BIOMECHANICS

- ★ objective quantitative and qualitative analysis
- ★ applies concepts of mechanics to the body

Qualitative Analysis

Photo
Filming (Video analysis)

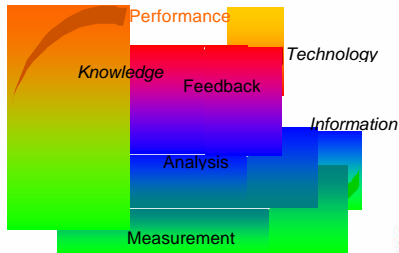
Quantitative Analysis

Kinematics - describes the motion of nature (Time, Distance, Velocity, Acceleration)

Dynamics - explains the causes of the motion (Mass, Force, Work, Power, Energy)



What Biomechanics can do to improve technique



Pitching Fundamentals

- Simple process.
- Three primary aims:
 - Maximise velocity.
 - Maximise accuracy.
 - Maximise movement.
- Underarm pitching is not a natural activity.
- Shoulder pathology is not designed for the external loads.

Too many experts!



Science

- Can only provide part of the picture.
- Assists in determining appropriate models.
- Stops the reliance of past performances - champions.
- Coach needs to synthesis and utilise relevant information.

Technique & Style

Technique is a...

- specific sequence of movements depends on sport situation
- standard and development depend on biological factors, physical laws, technological progress, as well as socio-cultural standards and developments
- different type of meaning for different types of sports

Style versus Technique

- Individual.
- Can add to performance.
- Can detract from performance.
- Essential – robotic.
- Essential elements.



Aim of the Pitching Biomechanics Program

- Improve performance.
 - Increase speed.
 - Increase accuracy.
- Reduce risk of injury
 - Repetitive activity.
 - Dynamic by nature.
 - Substantial force(s) on the body.



Elements that may lead to injury

- Two primary forces acting on the body:
 - External
 - Internal
- Repetitive nature of the activity:
 - Game may be 50 – 200 pitches.
 - Multiple games in a day.



Biomechanical Analysis

- Not over critical.
- Look for primary fault – which may lead to a sequence of events.



Biomechanical Framework

- Pitching action broken into 4 phases:
 - Preparation
 - Stride
 - Delivery
 - Follow through – includes fielding position



Preparation Phase

- This phase commences from when the athlete assumes the 'ready to pitch' position on the pitching plate up to and including the leg drive off the pitching plate.





Preparation Phase

- Stance on the plate (wide versus narrow)
- Position on the plate (centred, outer edge)
Body mass centred over both feet.
- Balanced stable position.
- Weight transfer from back foot to front foot
- Dynamic drive off the plate into the stride.
- Lifting of the front knee.
- Glove position?



Common Faults – 1



- Increased flexion at the hips.
- Hamstrings “pulling” at lower back.
- Most athletes will then ‘stand-up’ from this position prior to driving forward.



Stride phase

- This phase includes the stride from the pitching plate to the front foot contacting the ground.



Stride phase

- The following being the key points:
 - Opening of hips and shoulders (right handed pitcher left hip and shoulder directed towards batter).
 - Stride directed towards batter.
 - Pitching arm long (small amount of flexion at the elbow).
 - Glove arm active and directed towards batter.



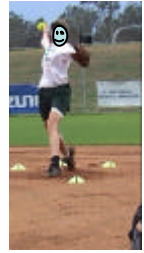
Stride phase

- Pitching arm at approximately '11 o'clock' at front foot contact.
- Front foot located between '11 and 1 o'clock'.
- Front foot orientated with toes pointing towards '12 and 1 o'clock'.

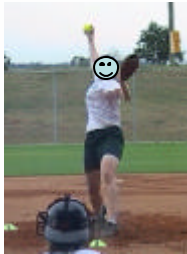


Common Faults - 2

- Left glove arm away from body.
- Both hips and shoulders closing early.
- Pitching arm may be a fraction low.



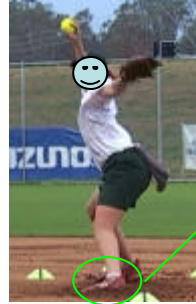
Common Faults - 3



- Front foot not stepping across body – resulting in premature closing of hips.
- Backward lean of the body, placing the body in an unbalanced position.



Common Faults 4



- Foot orientation approximately between 1 and 2 on the clock face.
- The foot in this position (nearer to 3) places extra stress on the knee and difficult to continue the momentum of the body forward.



Landing Impact

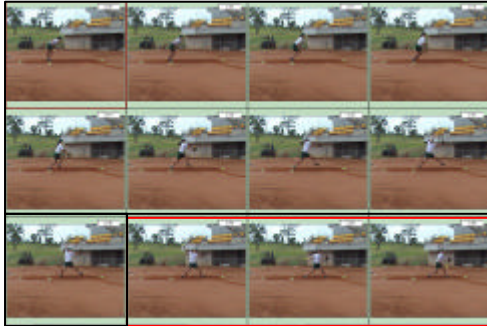
- Heel versus Toes
- Toes:
 - Ankle joint acts as a shock absorber.
- Heel:
 - All force transmitted to knee joint.



Delivery Phase

- This phase includes from front foot contact to release of the ball.





Delivery Phase

- Closing of hips and shoulders.
- Pitching arm coming through slightly in front of closing hips.
- Correct sequencing of closing hips and shoulders.

Delivery Phase

- Glove hand dynamically moves back towards the body to assist with rotation of hips and shoulders.

Common Faults - 5

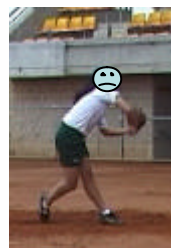


- Poor trunk strength/stability.

Follow through phase

- This phase includes from ball release to the fielding position.
- Pitching arm continues forward after release.
- Moving into balanced fielding position.

Knee Extension - blocking



- Over extension of the knee places loads on the bones.
- Surrounding musculature is no longer able to be supportive.

Ground versus the athlete



- Load is not high but, repetitive nature (50 – 150).
- Ankle, knee, lower back problems.

Internal Forces – shoulder distraction



- Hips close to early.
- Shoulders close prior to the hips.
- Pitching arm is too low at 'toe' contact.

Internal Forces – shoulder distraction

- To reduce the risk of injury:
 - Proper pitching mechanics.
 - Strengthen shoulder and rotator cuff musculature.
 - Develop shoulder and scapula stability and control.

Internal Forces – elbow distraction

- Upper arm is halted by the body.
- Early closure of the hip.
- Can lead to an Ulna nerve neuritis.



Implications - 1

- Forces in underhand throwing can be defined as moderate.
- Pitching is normally a repetitive movement/event, both in training and competition.
- With developing athletes consider limiting the repetition.

Spinal Compression and Rotation



- Hyperextended position -compression between intervertebral discs.
- Rotation causes friction between vertebrae and discs.



Implications - 2

- Whilst the spine is a robust structure it is simply not designed for certain movements:
 - ✓ Flexion, extension or rotation in isolation is fine.
 - ✗ Any of the above may lead to an eventual problem.

