Sports Medicine & Joint Center
Fukuoka Orthopaedic Hospital

New Approaches to Injury; Baseball Injury Prevention from Japan

Hiroyuki Sugaya, MD

Disclosure

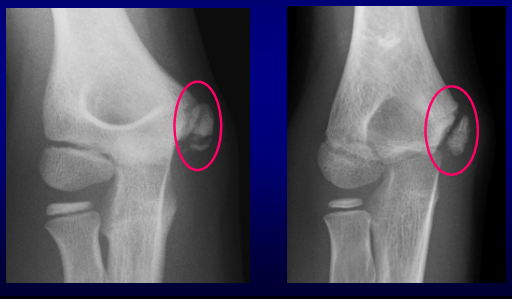
- Speakers bureau/paid presentations
  - *DepuySynthes; Smith&Nephew*
- Unpaid consultant
  - *DepuySynthes; Smith&Nephew ;Biomet*
- Orthopaedic publications editorial
  - *Journal of Shoulder and Elbow Surgery*

Baseball in the World

World Baseball Classic participant countries

Baseball Elbows in Kids

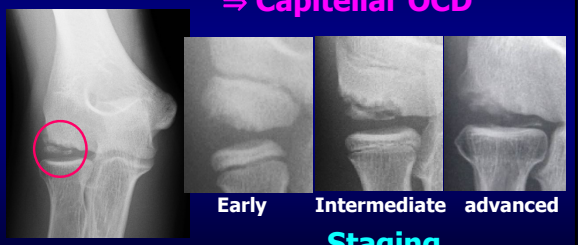
Medial elbow injuries



Baseball Elbows in Kids

Lateral elbow injuries

⇒ Capitellar OCD



Early Intermediate advanced

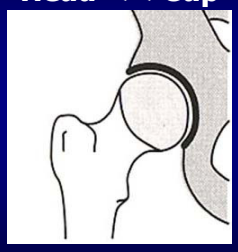
Staging

Shoulder & Elbow

- "Function" is very important!!
  - ➢Scapula, Thorax, Trunk, Lower extremities
- ►Surgical indication: difficult
- ►Physio therapy: important
- ►Arthroscopy: effective

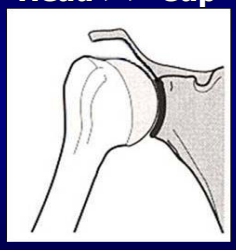
Hip & Shoulder

Head << Cup



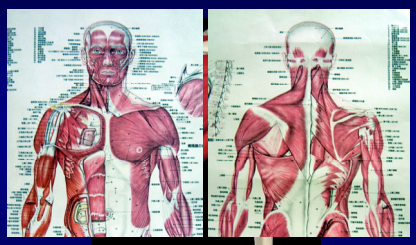
Bone support

Head >> Cup



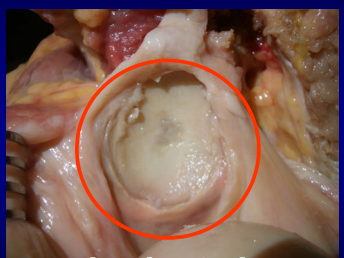
Soft tissue support

Upper Extremities



- Scapula & arm connected to trunk only through the clavicle
- Scapula position & mobility susceptible to posture & muscle function

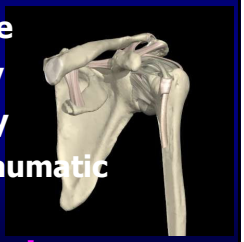
Glenohumeral Joint



HH need to be @ the center of the glenoid

Centralization of the HH

- Static stabilizer @ GHJ
  - ►Negative pressure
  - ►Bony morphology
  - ►Capsular integrity
    - ✓Disrupted in Traumatic Instability
  - ►Requires surgery!

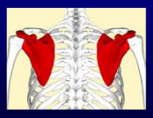


Centralization of the HH

- Dynamic stabilizer @ GHJ
  - ►Rotator cuff
  - ►LHB
    - ►Scapula & thorax
      - ►Trunk
        - ►Lower extremities

Centralization of the HH

- Scapula follows the HH
  - ➢During arm motion, scapula automatically follows the humerus to face the glenoid to the HH



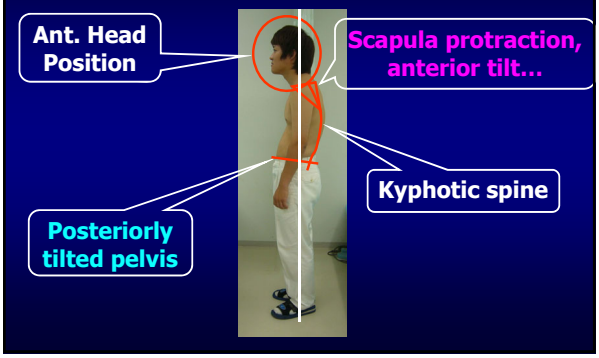
»Yamaguchi & Tsutsui, JJSS, 2009

Scapula as a Follower

- During the arm motion…
  - ►Scapula needs to move freely on the back!

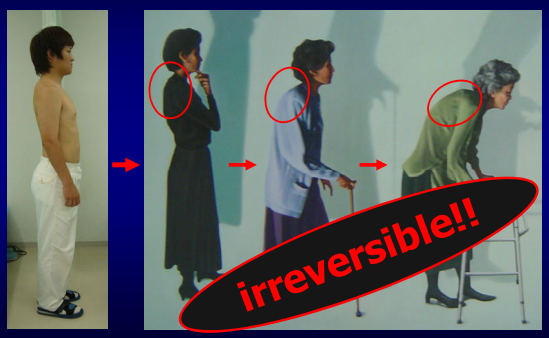
Circumstance is required where scapula can move!

Examples: Bad Posture



Examples: Bad Posture

Examples: the Elderly



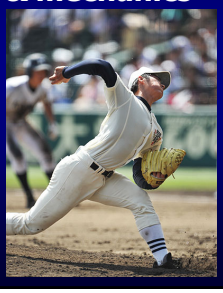
Examples: Baseball Players

Shoulder & Elbow Disorders

- Specific anatomical background
  - ➢Shoulder is non-constrained joint
  - ➢Scapula is floating
  - ➢Function & Physio Tx important
- Shoulder & elbow disorders
  - ➢Anatomical problem associated with functional problem

Shoulder & Elbow Injury in Throwers

- Need to see function & mechanics



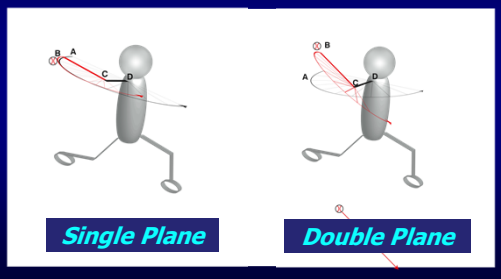
Throwing Mechanics

Optimal Late-cocking

Very small stress to shoulder and elbow

Throwing Plane Concept

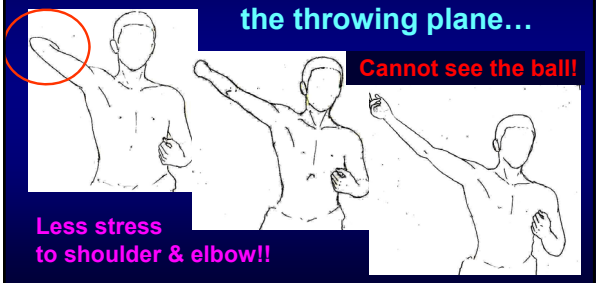
Arm plane & Elbow plane



瀬戸口ら，臨床スポーツ医学 2010

Single Plane Throwing

If the elbow plane parallels to the throwing plane…



Cannot see the ball!

Less stress to shoulder & elbow!!

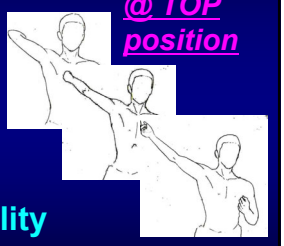
Setoguchi, et al, J Clin Sports Med , 2010; Sugaya, et al, 2011

Single Plane Throwing

Single Plane Throwing

- GHJ
  - External rotation
- Scapula mobility
  - Posterior tilt
  - Upward rotation
- Chest wall flexibility
  - Thoracic spine & rib cage

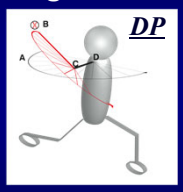
@ TOP position



Setoguchi, et al, J Clin Sports Med , 2010; Sugaya, et al, 2011

Double Plane Throwing

- Need to parallelize during acceleration phase



"Modification"

- Excessive rotation @ GHJ
- Valgus stress overload increases

Scapular Dysfunction

- Static scapular asymmetry
  - Protraction
  - Anterior tilt
  - Depression
  - Downward rotation
  - etc.

- Scapular dyskinesis

Kibler, Journal of AAOS, 2003

Scapular Dysfunction

- External rotation weakness in elevated position

Yamaguchi, et al. JJSS, 2004

If ER in Elevation is OK

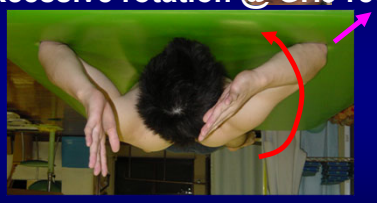
- Elbow extension & trunk rotation

◆Single plane throwing

►Less stress to shoulder & elbow

ER Weakness in Elevation

- Excessive rotation @ GHJ required!



◆Double plane throwing

►Require "modification"

Double Plane Throwing

- "Modification" causes…

◆Acceleration phase

►Hyper horizontal abduction

►Valgus stress overload to the elbow

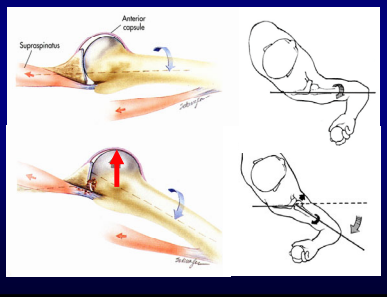
◆Deceleration phase

►Forced E-centric muscle contraction

►Increased stress to the ISP & biceps

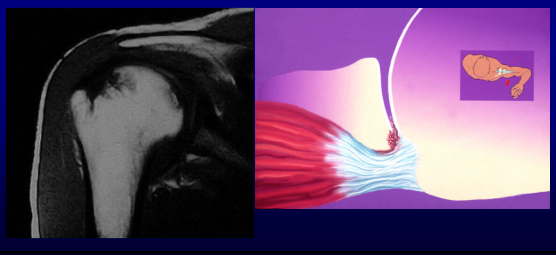
Double Plane Throwing

- "Modification" causes…



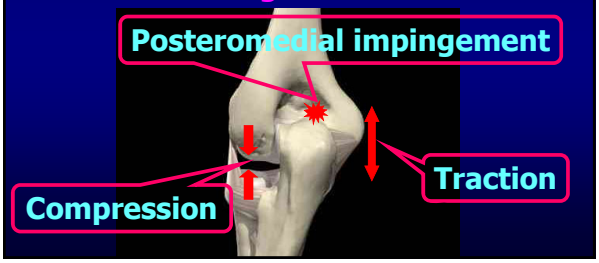
Double Plane Throwing

- "Modification" causes…
  - ►Excessive internal impingement



Double Plane Throwing

- "Modification" causes…
  - ►Excessive valgus stress overload

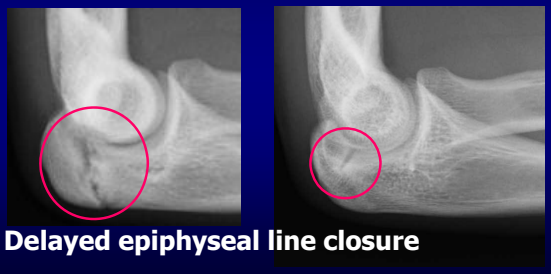


Double Plane Throwing

- "Modification" causes…
  - Glenohumeral joint
    - HH anterior shift due to pull by PMj
    - SSC power output decreases
  - Elbow
    - Internal rotation deficit of humerus
    - Stress to olecranon increases during follow-through

Olecranon Injuries in Adolescent

Olecranon stress fracture



Delayed epiphyseal line closure

Functional Assessment

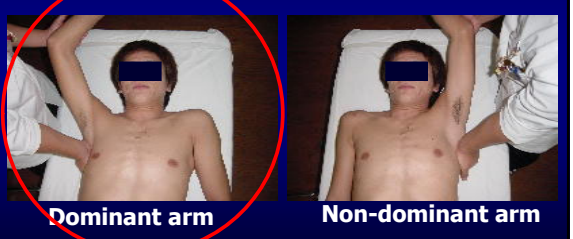
- Important physical function for throwers
  1. Scapulothoracic (ST)
  2. ER in elevation
  3. Hip & trunk
  4. Forearm rotation

ST Dysfunction

- Static scapula alignment

ST Dysfunction

- CAT（Combined Abduction Test)

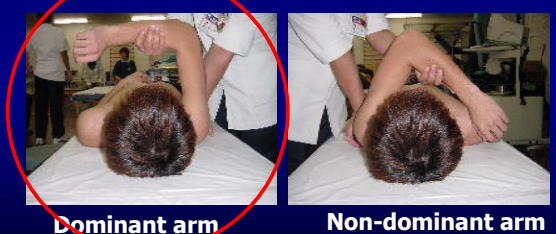


Dominant arm　　Non-dominant arm

Pappas, et al, AJSM, 1985; Hara, et al, Jpn J Clin Sports Med, 1998

ST Dysfunction

- HFT（Horizontal Flexion Test）



Dominant arm　　Non-dominant arm

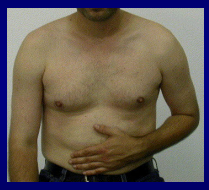
Pappas, et al, AJSM, 1985; Hara, et al, Jpn J Clin Sports Med, 1998

ST Dysfunction

- Positive CAT & HFT means…
  - ►HH anterior shift
  - ►Tight muscles
    - ✓Back: ISP, Tmi, LAT, TMj…
    - ✓Front: Pmi
  - ►Scapula malposition
  - ►Thorax immobility

ST Dysfunction

- Rotator cuff dysfunction
  - ►SSP
  - ►ISP
  - ►Tmi
  - ►SSC



HH need to sit @ center of the glenoid for the cuff muscles to work

ER in Elevation

- External rotation weakness in elevated position

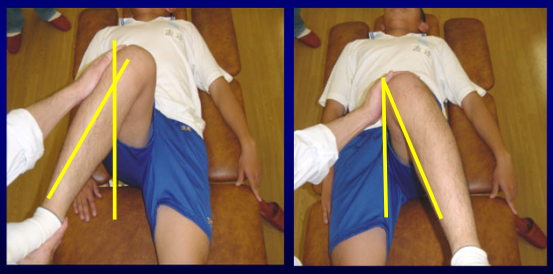
Yamaguchi, et al. JJSS, 2004

Hip

- ROM loss is a concern
  - ➢IR loss
    - ✓Short rotators
    - ✓Gluteus major & minor
  - ➢Flexion loss
  - ➢Adduction loss
    - ✓Spine, Sacroiliac joint

Hip

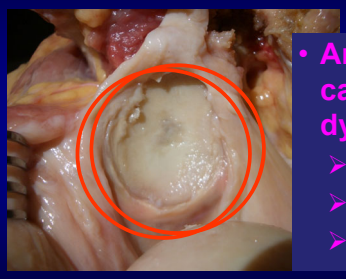
- IR loss



Forearm Rotation

- Pronation/supination motion loss is a concern
  - ➢Tightness of pronator muscles causes pronation loss
  - ➢Compensation by scapula
  - ➢Scapula malposition
    - ➔Scapula dysfunction

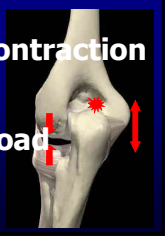
Glenohumeral Joint



- Anterior shift causes RC dysfunction
  - SSP
  - ISP
  - Subscapularis

HH tends to shift anterosuperiorly

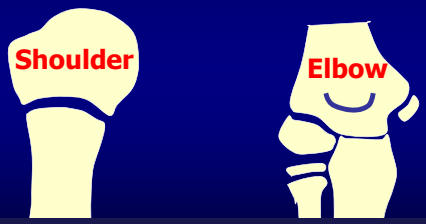
Stress to Shoulder & Elbow



- GHJ
  - Top: internal impingement
  - Acc: excessive rotation
  - Dec: E-centric muscle contraction
- Elbow
  - Acc: valgus stress overload
  - Fth: stress to olecranon

Epiphyseal Line & Bone Age

- Epiphyseal line

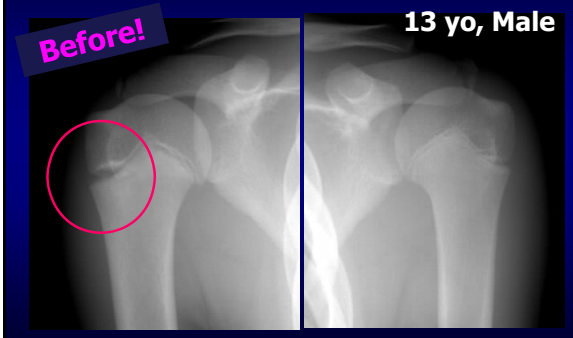


- Closes when 14 to 16Y

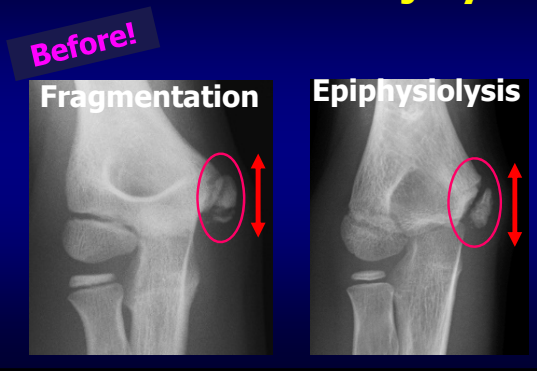
Shoulder & Elbow Injuries in Throwers

- Before closure
  - ►Osteochondral lesion
    - ✓Little leaguers shoulder
    - ✓Little leaguers elbow, OCD
- After closure
  - ➢Shoulder: soft tissue injury
  - ➢Elbow: bone, ligament, nerve

Little Leaguers Shoulder



Medial Elbow Injury



Lateral Elbow Injury

- OCD

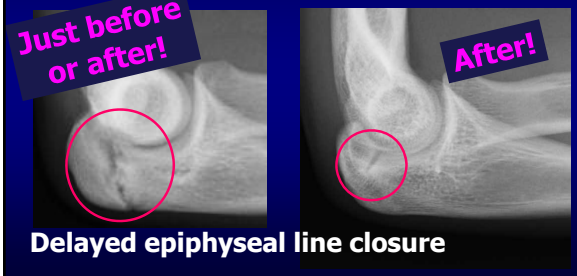
Before!

  - Capitellum, Radial head, Trochlea

Early advanced

Olecranon Injury

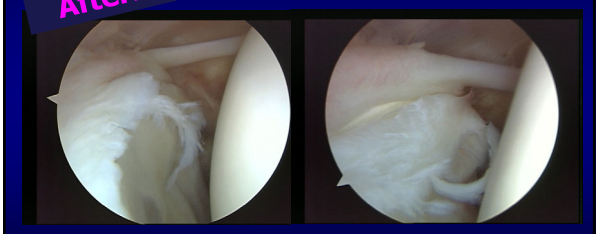
Olecranon stress fracture



Delayed epiphyseal line closure

SLAP

18 yo, Male



PASTA

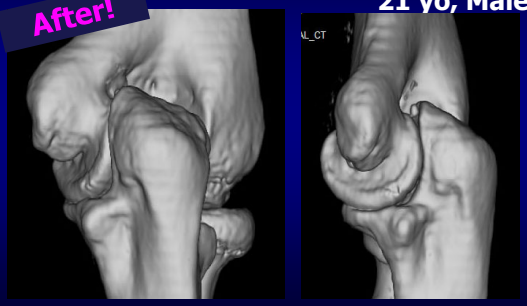
After!

19 yo, Male

Posterior Impingement

After!

21 yo, Male



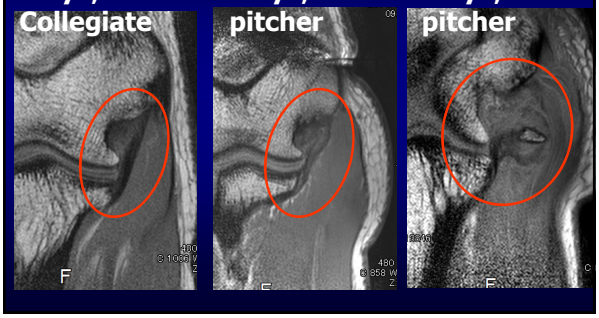
UCL Injury

After!

18 yo, Collegiate

26 yo, MLB pitcher

32 yo, NPB pitcher



My Clinic

Assessment in the Clinic

- Functional problem
  - ➢Scapula
  - ➢Thorax & hip

Positive pain provoking test

►HH does NOT stays @ t
center of the glenoid!

Anatomical? or functional problem?

My Clinic

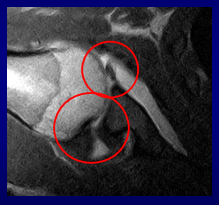
My Clinic

Assessment

- ◆Dysfunction of…
  - ➢Scapulothoracic, hip…
- ◆PPT positive even after reducing HH position
  - ✓Manual reduction, spinal reflex, neuromuscular facilitation
  - ►Anatomical problem
    - ►Imaging

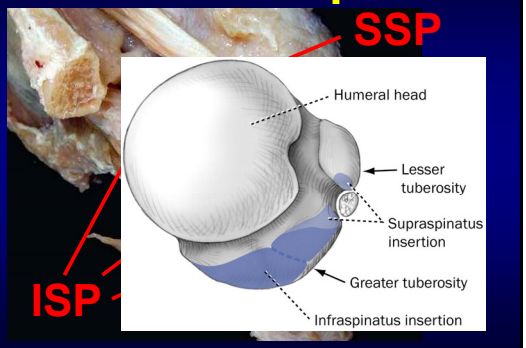
Imaging

- MRA：ABER position



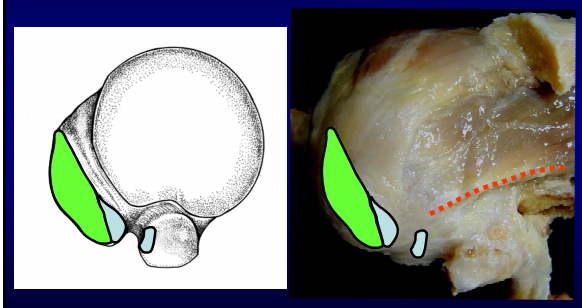
Anatomical problem does NOT necessarily requires surgery!

SSP & ISP Footprint

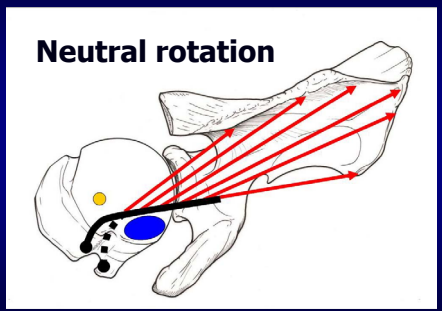


Mochizuki, Sugaya, Akita, et al. JBJS 90A, 2008

SSP & ISP Footprint

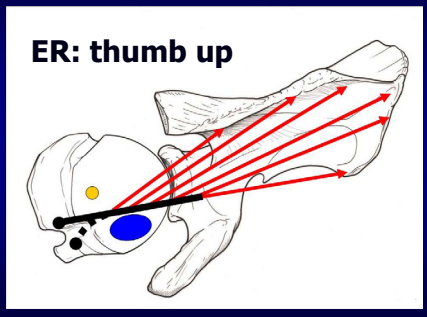


SSP Function



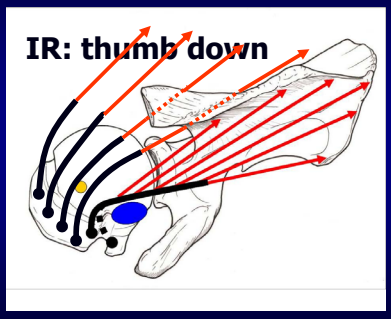
Mochizuki, Sugaya, Akita, et al. JBJS 90A, 2008

SSP as an Abductor



Mochizuki, Sugaya, Akita, et al. JBJS 90A, 2008

ISP as an Abductor



Mochizuki, Sugaya, Akita, et al. JBJS 90A, 2008

My Clinic

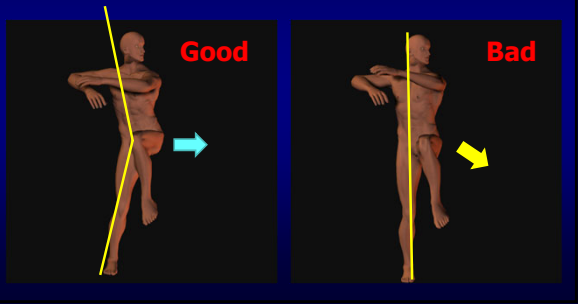
- RC function
  - SSP
  - ISP
  - Tmi
  - SSC

Physio Department

- PT & ATC
  - ➢Functional assessment
  - ➢Resume flexibility
    - ✓Scapula, Thorax, Hip…
  - ➢Resume strength
    - ✓Cuff, scapula stabilizers
    - ✓Core & Lower extremities

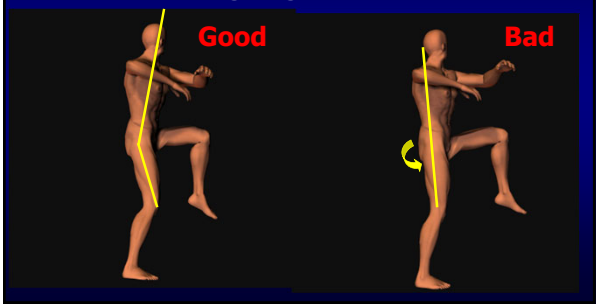
Throwing Mechanics for Kids

1. driving leg & hip position



Throwing Mechanics for Kids

1. driving leg & hip position

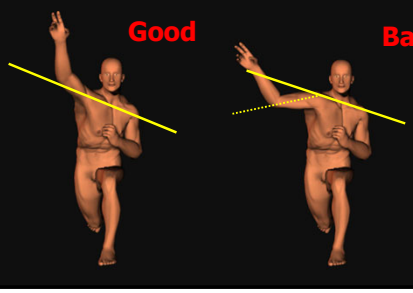


Throwing Mechanics for Kids

2. Arm position @ top

Throwing Mechanics for Kids

3. Shoulder line & elbow

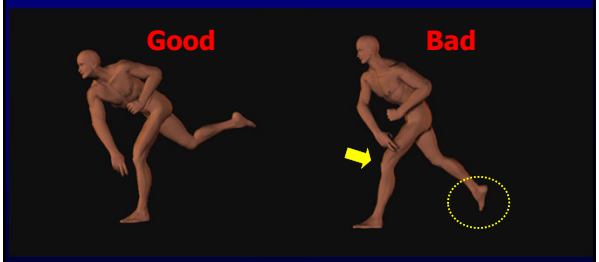


Throwing Mechanics for Kids

4. Non-dominant arm position

Throwing Mechanics for Kids

5. Weight shift during FTH



Pitch Count

- Pitch count does matter especially in adolescent, however…
- If kids has an optimal throwing mechanics, pitch count less likely matters. If otherwise, it DOES matter (personal opinion).
- In Japan, we started limit pitch count for kids baseball.

Injury Prevention

- Volunteered medical check up for kids elbows using US & Seminar

Summary

- Shoulder & elbow injury prevention in adolescent
  - Understand throwing mechanics & function
  - Pitch count limit for for kids pitchers
  - Education to baseball coaches & parents