LA PATOLOGIA DELL’ANCA NEGLI ATLETI
(Disable hip in throwing)

Analisi ELEMENTARE del LANCIO

Dr. Alberto Costantini
Dr. Giovanni Di Giacomo
Dr. Andrea De Vita
Dr. Nicola de Gasperis

Concordia Hospital Roma, Italy
FOOT Stability
ANKLE Mobility
KNEE Stability
HIP Mobility
Lumbar Spine Stability
Thoracic Spine Mobility
Scapulo Thoracic Stability
Gleno-Humeral Mobility

JOINT — PRIMARY NEED
Ankle — Mobility
Knee — Stability
Hip — Mobility
Lumbar Spine — Stability
Thoracic Spine — Mobility
Scapula — Stability
Gleno-humeral — Mobility
58% all baseball related injuries

75% total time lost from competition

injuries of the upper extremity

"ACUTE" PATHOLOGY
meaning that they just occurred, usually from an outside force or trauma

most are linked and directly related to other issues in the body
### Table 1
Analysis of injury location in tennis players

<table>
<thead>
<tr>
<th>Study type</th>
<th>P Oldenziel and Stam (46)</th>
<th>P Veijgen (60)</th>
<th>P Klünne et al. (38)</th>
<th>P Sallis et al. (56)</th>
<th>P Safran et al. (55)</th>
<th>P Hutchinson et al. (25)</th>
<th>P Winge et al. (62)</th>
<th>R Jayanthi et al. (26)</th>
<th>R Krause and Pöttinger (37)</th>
<th>R Chard and Lachmann (9)</th>
<th>R Reece et al. (48)</th>
<th>R Biener and Caluori (3)</th>
</tr>
</thead>
</table>

### Common Injuries in Tennis Players: Exercises to Address Muscular Imbalances and Reduce Injury Risk

Todd S. Ellenbecker, DPT, MS, CSCS; Babette Pluim, MD, PhD; Stephane Vivier, PT; and Clay Sniteman, PT, ATC

1. Physiotherapy Associates Scottsdale Sports Clinic, Scottsdale, Arizona; 2. KNLTB, The Netherlands; and 3. ATP World Tour

<table>
<thead>
<tr>
<th>Foot/toes</th>
<th>5</th>
<th>2.1</th>
<th>7.2</th>
<th>9.4</th>
<th>13.5</th>
<th>11</th>
<th>8.7</th>
<th>8</th>
<th>4</th>
<th>8</th>
</tr>
</thead>
<tbody>
<tr>
<td>Other</td>
<td>&lt;1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>100</td>
<td>100</td>
<td>99.8</td>
<td>100</td>
<td>100.1</td>
<td>100</td>
<td>100.1</td>
<td>93</td>
<td>99.8</td>
<td>100</td>
</tr>
</tbody>
</table>
Although the shoulder and elbow account for the majority of the overall injuries sustained by baseball players, these injuries often stem from dysfunctions occurring away from the injury site.


CORE MUSCLES

Strong abdominal muscles for good core function, the largest and often the strongest of the core muscles, such as the gluteal muscles, rectus femoris, and hamstrings, are located at the hip and therefore play a key role in core stability.
Baseball (throwing) players spend the time to train shoulder strength and flexibility but not conditioning the hip musculature during the off season. These hip deficiencies of strength and flexibility can be unilateral or bilateral, and can lead to an ineffective transference of potential energy from the lower extremity to the upper extremity during the throwing motion.
This is the separation of the hips and shoulders at front foot strike. This is what builds torque mainly in the core instead of the arm. This component will not only increase velocity but save a pitcher's shoulder.
In assessing the contribution of the hip to this motion, we will examine the biomechanics of the **LEAD LEG** (NON DOMINANT LEG) (the leg on the side opposite the throwing arm) and the **TRAIL LEG** (DOMINANT LEG) (the leg on the same side as the throwing arm) throughout these phases.
five phases consisting of the:

windup, cocking, acceleration, deceleration, follow through

five phases consisting of the:

**WINDUP**, cocking, acceleration, deceleration, follow through

Postural control is required as the player balances on the trail leg as the body begins to rotate away from the intended target in an effort to store potential energy before acceleration, while the lead leg reaches maximum hip flexion.

five phases consisting of the:

**WINDUP**, cocking, acceleration, deceleration, follow through

**ISOMETRIC HIP ABDUCTION STRENGTH**
(gluteus medius of the trail leg)

prevent downward tilt of the contralateral pelvis.

maintain the athlete’s center of gravity over the small base of support available

---

the **gluteus medius muscles** and **hip abductors** of the trail leg are utilized concentrically, to **begin propulsion of the body forward** and to **optimize stride length** as the lead leg is propelled towards the target.

The lower extremity initiates much of the velocity of an overhand throw through the stepping action as the body is driven toward the target, identifying the need for **abduction strength** in the **trail leg** hip.
This leg drive has been shown to be positively associated with arm velocity.

average stride foot placement to be 87% of body height

Stride Angle (the maximum opening between his front and trailing upper leg)

five phases consisting of the:
windup, **COCKING**, acceleration, deceleration, follow through

the hip abductors contribute significantly during pitching, reporting that peak hip abductor activity was 73% of maximal in the trail leg during the pitching motion.

five phases consisting of the: windup, **COCKING**, acceleration, deceleration, follow through

- gluteus medius strength in the **trail leg**

compared to position players

pitchers tend to have more upper extremity injuries than position players

Electromyographic data have shown that a side-lying hip abduction movement produces the most activity in the gluteus medius, potentially leading to the largest gains in strength.

Burkhart et al hypothesized that poor gluteus medius strength can disrupt the kinetic chain during the throwing motion, thereby placing increased stress on the shoulder.
approximately 44% of their patients diagnosed with SLAP (superior labral anterior-posterior) lesions presented with gluteus medius weakness, as found with a positive Trendelenburg test.

Not only is **HIP STRENGTH** a factor during the throwing motion, but proper **HIP FLEXIBILITY** is also critical for optimal kinetic chain synchronicity.
OPTIMAL ORIENTATION OF THE PELVIS at lead foot contact

HIP EXTERNAL ROTATION
ROM of the Lead leg (Non Dominant)

HIP INTERNAL ROTATION
ROM of the Trail leg (Dominant)

is required to position the lead foot in the direction of the intended target.

Internal rotation ROM of the trail hip is necessary to prepare for the proper positioning of the lead leg.

Tippett SR. Lower extremity strength and active range of motion in college baseball pitchers: a comparison between stance leg and kick leg. J Orthop Sports Phys Ther. 1986;8:10-14
The first sequence in this chain is the **trail leg internal rotation**. Proper rotation here not only will place the lead leg in an optimal position to externally rotate towards the target, but this rotation also allows the trunk and subsequently the throwing arm to rotate towards the target.

the lead foot should contact the ground with the toes pointed approximately towards the intended target. For this to occur, both hips must rotate.
Max shoulder anterior force (cocking phase) = 350N
If Lead leg:
- 10 cm toward the open side
- 10° further open

51N (or approximately 15%) increase in shoulder anterior force during the arm cocking phase.
Tippett reported greater hip internal rotation ROM in the trail leg versus the lead leg in baseball pitchers but no bilateral difference in hip external rotation ROM.

*Tippett SR. Lower extremity strength and active range of motion in college baseball pitchers: a comparison between stance leg and kick leg. J Orthop Sports Phys Ther. 1986;8:10-14*

Ellenbecker et al described a greater prevalence of limitation in active hip external rotation (42%) than hip internal rotation (17%) among professional baseball players, which was not statistically significant. This study did not correlate AROM with performance or biomechanical parameters.


Laudner et al described pitchers do have less internal rotation in the trail or dominant leg compared with positional baseball players, but no significant difference was observed within pitchers between hips.

## Descriptive Statistics for Hip Characteristics

<table>
<thead>
<tr>
<th>Measurement</th>
<th>Pitchers</th>
<th>Position Players</th>
<th>Difference</th>
<th>( P )</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Lead IR ROM</strong> (deg)</td>
<td>34.4 ± 6.1</td>
<td>37.0 ± 4.8</td>
<td>2.6</td>
<td>.56</td>
</tr>
<tr>
<td><strong>Trail IR ROM</strong> (deg)</td>
<td>34.6 ± 4.4</td>
<td>37.7 ± 5.8</td>
<td>3.1</td>
<td>.01( b )</td>
</tr>
<tr>
<td><strong>Lead ER ROM</strong> (deg)</td>
<td>40.9 ± 8.1</td>
<td>42.7 ± 6.8</td>
<td>1.8</td>
<td>.69</td>
</tr>
<tr>
<td><strong>Trail ER ROM</strong> (deg)</td>
<td>41.0 ± 6.3</td>
<td>41.9 ± 7.3</td>
<td>0.9</td>
<td>.07</td>
</tr>
<tr>
<td><strong>Lead total arc of motion</strong> (deg)</td>
<td>75.3 ± 7.8</td>
<td>79.7 ± 7.7</td>
<td>4.4</td>
<td>.30</td>
</tr>
<tr>
<td><strong>Trail total arc of motion</strong> (deg)</td>
<td>75.6 ± 5.9</td>
<td>79.6 ± 7.6</td>
<td>4.0</td>
<td>.20</td>
</tr>
<tr>
<td><strong>Lead GM strength</strong> (kg)</td>
<td>41.9 ± 7.2</td>
<td>43.0 ± 7.2</td>
<td>1.1</td>
<td>.39</td>
</tr>
</tbody>
</table>

PROM was significantly less on the nondominant hip (Lead leg-EXTR) compared with the dominant hip (Trail Leg INT).

**TABLE 1**
Paired *t* Test Analysis of Hip Range of Motion (deg) Among Professional Pitchers

<table>
<thead>
<tr>
<th>Range of Motion</th>
<th>Dominant</th>
<th>Nondominant</th>
<th>Level of Significance</th>
</tr>
</thead>
<tbody>
<tr>
<td>External rotation</td>
<td>44.0 ± 9.0</td>
<td>35.6 ± 5.8</td>
<td><em>P</em> &lt; .001</td>
</tr>
<tr>
<td>Internal rotation</td>
<td>50.8 ± 9.2</td>
<td>31.3 ± 6.2</td>
<td><em>P</em> &lt; .001</td>
</tr>
<tr>
<td>Total arc of rotation</td>
<td>94.8 ± 13.3</td>
<td>67.0 ± 7.7</td>
<td><em>P</em> &lt; .001</td>
</tr>
<tr>
<td>ADD</td>
<td>50.8 ± 8.4</td>
<td>31.6 ± 6.2</td>
<td><em>P</em> &lt; .001</td>
</tr>
<tr>
<td>ABD</td>
<td>43.4 ± 12.0</td>
<td>35.7 ± 10.7</td>
<td><em>P</em> = .06</td>
</tr>
<tr>
<td>Total arc of ADD + ABD</td>
<td>94.2 ± 13.9</td>
<td>67.3 ± 12.3</td>
<td><em>P</em> &lt; .001</td>
</tr>
</tbody>
</table>

*ADD, adduction; ABD, abduction.*
This difference would suggest a femoroacetabular rotational deficit, a form of labeling similar to the clinical findings documented with the GIRD of the thrower’s shoulder.
Insufficient hip internal rotation ROM of the trail leg limiting the transfer of energy created in the lower extremity to the arm and placing unnecessary stress on the shoulder.

pelvis and foot are in a more open position, thereby prematurely initiating the arm-cocking phase and resulting in the loss of kinetic energy from the lower extremity.
closed positions at the foot and pelvis occur and the pitcher is forced to pitch across the body, which would limit the kinetic energy transfer from the lower extremity into the arm.
**Significant Correlations with Hip Range of Motion**

<table>
<thead>
<tr>
<th>Passive Hip Range of Motion</th>
<th>Correlated Parameter</th>
<th>Correlation, $r$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Correlations with ball velocity</td>
<td>Ball velocity</td>
<td>.50</td>
</tr>
<tr>
<td>Total arc of rotation of the nondominant hip</td>
<td>Stride length</td>
<td>-.72</td>
</tr>
<tr>
<td>Correlations with biomechanics</td>
<td>Stride length</td>
<td>.70</td>
</tr>
<tr>
<td>Total arc of ADD + ABD, nondominant hip</td>
<td>Trunk separation velocity</td>
<td>.63</td>
</tr>
<tr>
<td>ABD, nondominant hip</td>
<td>Pelvic orientation</td>
<td>-.52</td>
</tr>
<tr>
<td>Abduction, dominant hip</td>
<td>Trunk separation velocity</td>
<td>-.45</td>
</tr>
<tr>
<td>Total arc of ADD + ABD, nondominant hip</td>
<td>Trunk separation velocity</td>
<td>.44</td>
</tr>
<tr>
<td>Total arc of rotation, nondominant hip</td>
<td>Pelvic orientation</td>
<td>-.44</td>
</tr>
<tr>
<td>Total arc of ADD + ABD, dominant hip</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total arc of rotation, dominant hip</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*ADD, adduction; ABD, abduction.*

---

Passive Ranges of Motion of the Hips and Their Relationship With Pitching Biomechanics and Ball Velocity in Professional Baseball Pitchers

Andrew J. Robb, Glenn Fleisig, Kevin Wilk, Leonard Macrina, Becky Bolt and Jason Pajaczkowski

*Am J Sports Med 2010 38: 2487 originally published online August 31, 2010*
Because excessively high and low angles during pitching may be detrimental, both positive and negative correlations between PROM and angles may be undesirable.

Physical therapy and conditioning to regain hip PROM may help the professional pitcher optimize mechanics and ball velocity.

**TABLE 2**

<table>
<thead>
<tr>
<th>Passive Hip Range of Motion</th>
<th>Correlation Parameter</th>
<th>Correlation, r</th>
<th>Significance, P</th>
</tr>
</thead>
<tbody>
<tr>
<td>Correlations with ball velocity</td>
<td>Ball velocity</td>
<td>.50</td>
<td>.04</td>
</tr>
<tr>
<td>Total arc of rotation of the nondominant hip</td>
<td>Stride length</td>
<td>-.72</td>
<td>.002</td>
</tr>
<tr>
<td>Correlations with biomechanics</td>
<td>Stride length</td>
<td>.70</td>
<td>.003</td>
</tr>
<tr>
<td>Total arc of ADD + ABD, nondominant hip</td>
<td>Trunk sagittal velocity</td>
<td>.63</td>
<td>.004</td>
</tr>
<tr>
<td>Abduction, dominant hip</td>
<td>Pelvic orientation</td>
<td>-.52</td>
<td>.04</td>
</tr>
<tr>
<td>Total arc of ADD + ABD, nondominant hip</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Hip IR was different between nonpitchers with and without a history of shoulder injury.
IR of the nondominant hip may be responsible for decelerating the athlete’s body. Thus, it is plausible that a lack of IR in the nondominant hip may transfer some of the demands of decelerating the body from the hip to the shoulder, thereby dissipating less force through the trunk and increasing forces at the shoulder. In turn, the athlete with limited nondominant hip IR may be predisposed to shoulder injury.
Increase in dominant hip EXT was associated with an increase in dominant shoulder ER in pitchers with a history of shoulder injury ($r = 0.62$).

Increase in dominant hip EXT was associated with a decrease in dominant shoulder ER in nonpitchers with a history of shoulder injury ($r = -0.64$).
it is possible that they are attempting to maximize the throwing shoulder’s “whiplike” motion (ie, rapid ER transitioning to rapid IR) through the simultaneous combination of long stride length (ie, dominant hip EXT) and maximal shoulder ER.
it is plausible that the nonpitchers compensate for a lack of dominant hip EXT (ie, small stride length) by increasing dominant shoulder ER to throw long distances or at high speeds. In turn, this increased ER at the shoulder may increase soft tissue forces and predispose the nonpitcher to shoulder injury.
Finding
Associations
history of shoulder injury

training of the throwing shoulder

improved hip flexibility
- dominant hip EXT
- dominant hip flexors
- nondominant hip IR - EXT

improved shoulder flexibility
- posterior capsule
- rotator cuff
- dominant latissimus dorsi
Femoroacetabular impingement and its implications on range of motion: a case report

Peter R Krekel1,2*, Anne JH Vochteloo1, Rolf M Bloem3 and Rob GHH Nelissen1

Krekel et al. Journal of Medical Case Reports 2011, 5:143


Hip Pain and Mobility Deficits – Hip Osteoarthritis:

Clinical Practice Guidelines Linked to the International Classification of Functioning, Disability, and Health from the Orthopaedic Section of the American Physical Therapy Association

*Correspondence: krekel@medisin.uio.no
The Effect of Cam FAI on Hip and Pelvic Motion during Maximum Squat

Mario Lamontagne PhD, Matthew J. Kennedy BSc, Paul E. Beaulé MD, FRCSC


ROM Measurements

- Significant decrease in ROM when injured hip is compared to non-injured hip:
  - **Flexion** (112 degrees), 9 degrees less (p<0.001)
  - **Abduction** (40 degrees), 5 degrees less (p<0.001)
  - **Adduction** (19 degrees), 3 degrees less (p<0.001)
  - **Prone IR** (31 degrees), 5 degrees less (p<0.001)
  - **Prone ER** (38 degrees), 4 degrees less (p<0.001)

Philippon et al. AOSSM 2006
40/40 professional athletes had FAI diagnosed at the time of arthroscopy.

- Cam (25%) N=10
- Pincer (2%) N=1
- MIXED (73%) N=29

Philippon et al. ESSKA 2006
Il conflitto prende il nome di "Pincer FAI", ovvero di conflitto a "tenaglia", quando la causa è un acetabolo troppo coprente, ovvero che avvolge eccessivamente la testa femorale, limitandone il movimento.
Il conflitto viene invece definito “Cam FAI”, ovvero conflitto a "camma", quando la causa è una testa femorale non perfettamente sferica, che provoca una vera e propria abrasione del cotile quando la porzione asferica entra nel gioco articolare.
PINCER TYPE IMPINGEMENT
CONTROLLO - OSTEOPLASTICA

CASO CLINICO
CASO CLINICO

POST - OP
Grazie
Thank you

www.artroscopiaanca.it