

The Athlete's shoulder - My structured approach for diagnostic and treatment

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Why is there a problem
in the thrower's shoulder ?



Thanks to Sven Reuther

Two critical moments in the throwing motion

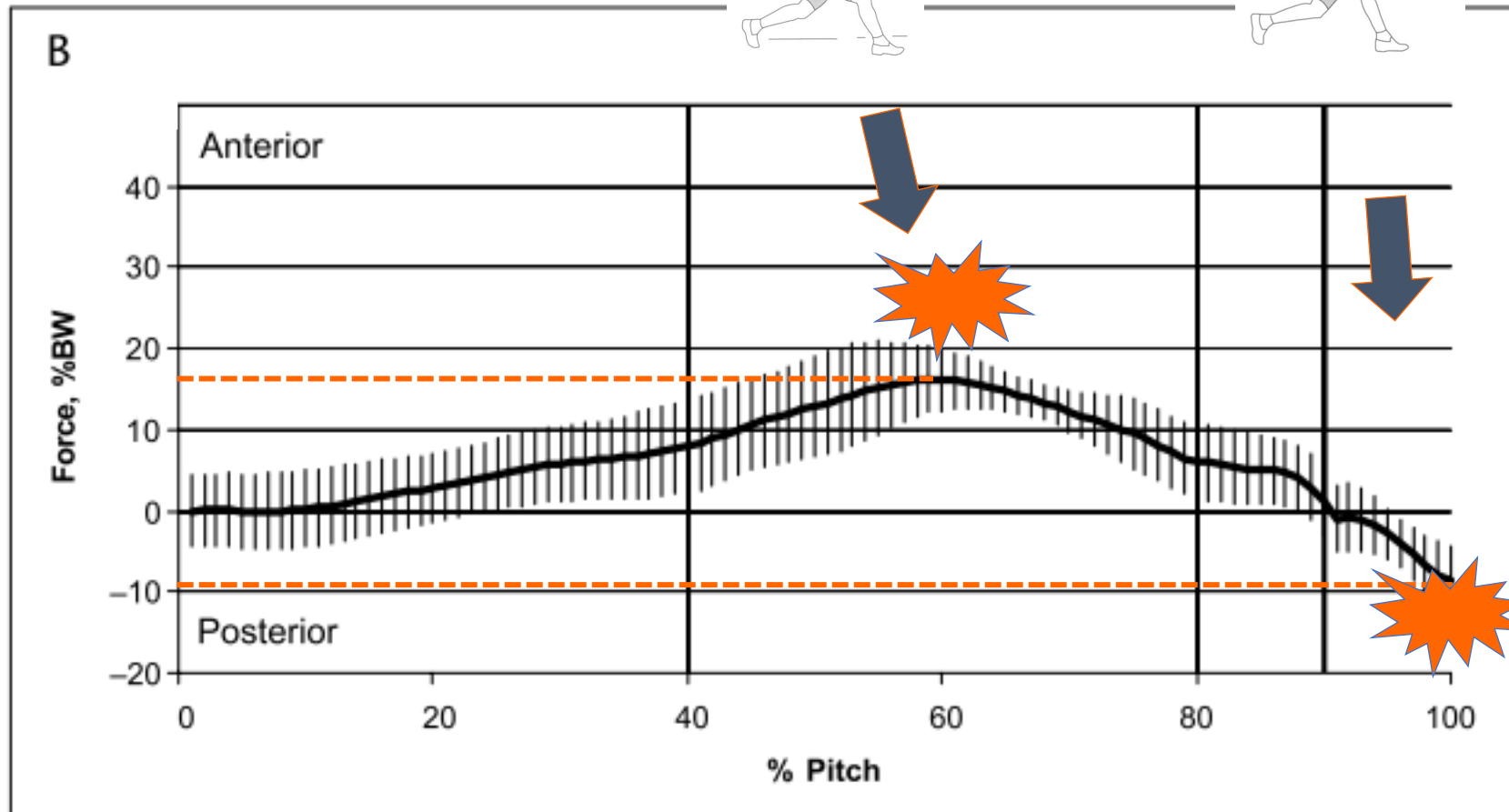


Late Cocking



Release

Two critical moments in the throwing motion



Peak angular velocity of $6940^{\circ}/\text{second}$ ($\pm 1080^{\circ}/\text{second}$)

Keeley et al., J Pediatr Orthop, 2008

Fleising et al., AJSM, 1995

Leonhard & Hutchinson, Br J Sports Med, 2010

But wait.. Why do monkeys not have shoulder pain ?



3 millions years of evolution



... and we only lost fur

But.. Why do monkeys not have shoulder pain ?



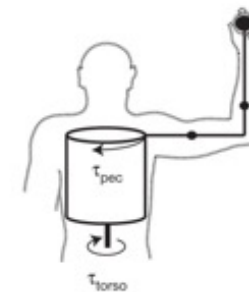
Kinetic Chain results in high loads on shoulder

- Humans throw projectiles **by storing and releasing energy in the tendons and ligaments** crossing the shoulder
- **3 critical changes** during evolution:
 1. The expansion of the waist (twisting core)
 2. Lower positioning of the shoulders on the Torso / Glenoid Position
 3. Twisting of the humerus

Chimpanzees
(20 mph)

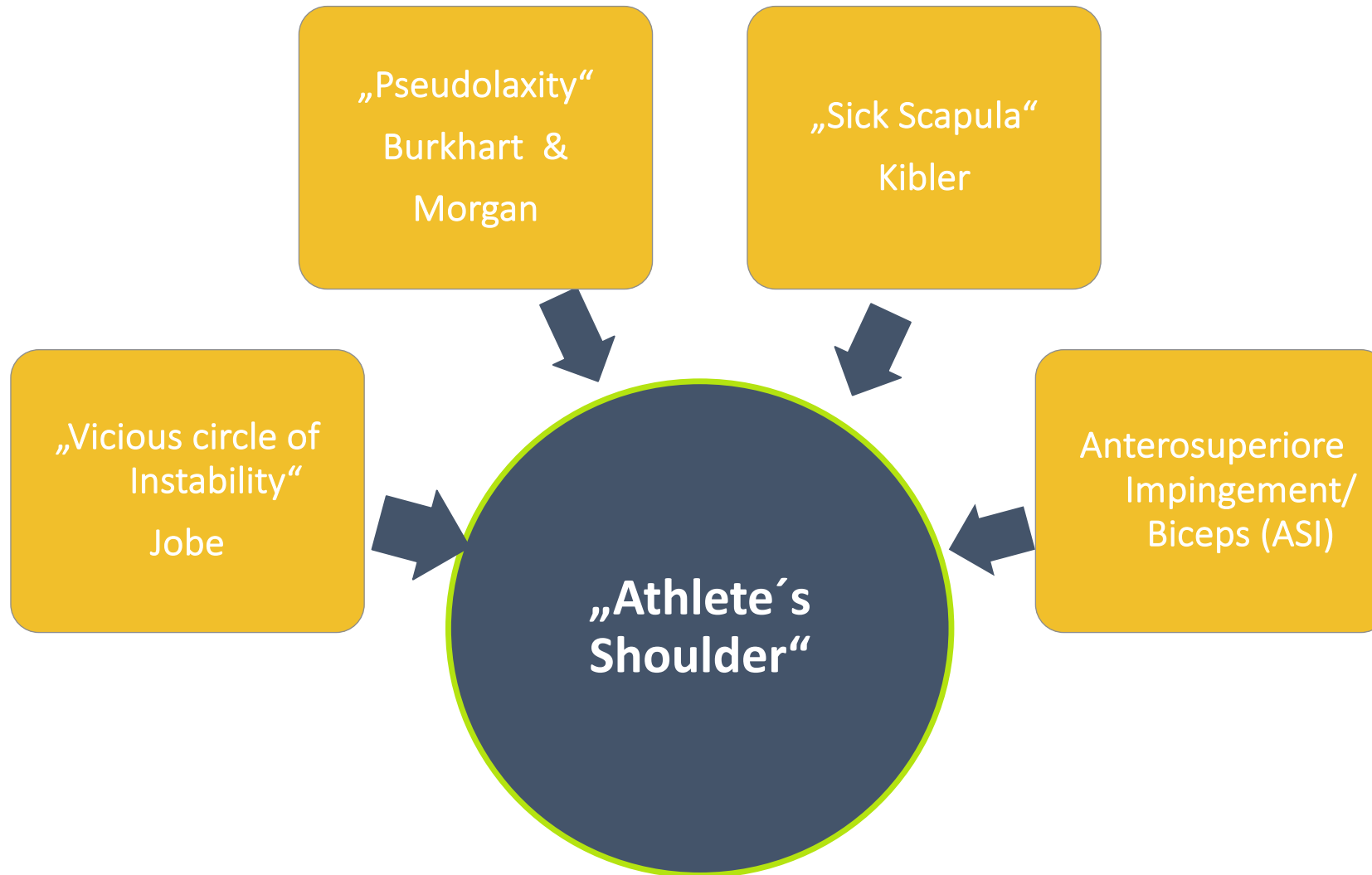


Humans
(90 mph)



Roach et al., Nature, 2013

Multiple theoretical concepts exist to explain this problem..



Trauma vs. Overloading

Trauma

Overloading

ATTENTION

ATTENTION

ATTENTION

ATTENTION

There are different types of „Athlete’s shoulders“!



Type 1: Throwers etc.

- PSI, posterior Impingementpain, GIRD, PASTA



Type 2: Handball etc.

- Anteroinferior Microinstability / -Instability, anterior Pain, Labrum lesion, SLAP, PASTA



Type 3: Swimmers etc.

- Hyperlaxity, Sulcus sign, „Dead Arm“, non-specific RAPS



(Type 4): Crossfit etc.

- Posterior Labrum / cartilage Lesion, Pulley, OA



Beitzel, et al., OBEX, 2022

Gelber, et al. JAAOS, 2018

Beitzel K¹, Reuter S¹, Imhoff AB¹, Braun S¹

Die Sportlerschulter: Der 5-Punkte-Check zum Therapieerfolg

Athlete's Shoulder: 5 Point Check for Therapeutig Success

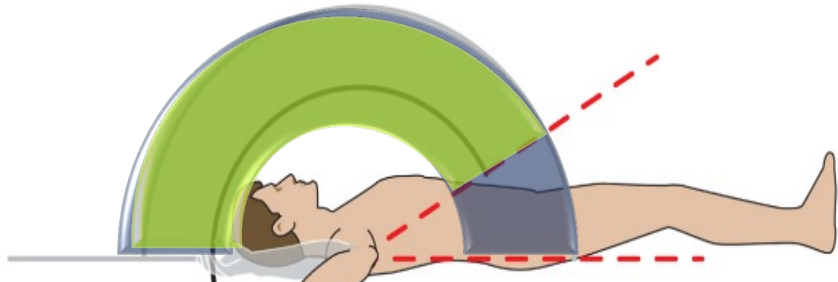
My „5 Keys“

- Capsule (GIRD)
- Scapula
- Stability
- Rotator Cuff
- Biceps & SLAP

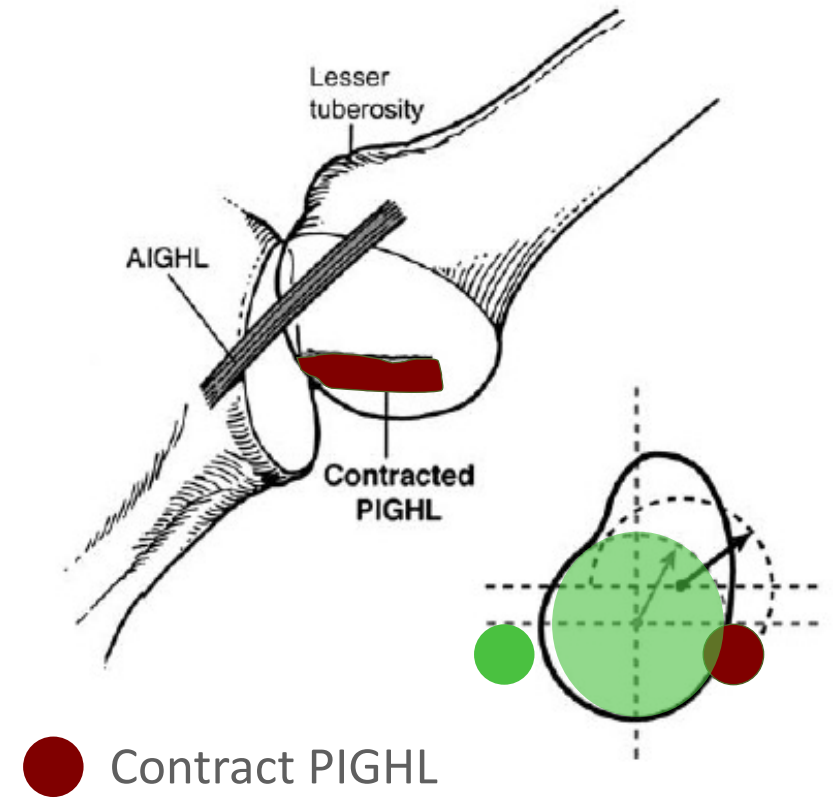
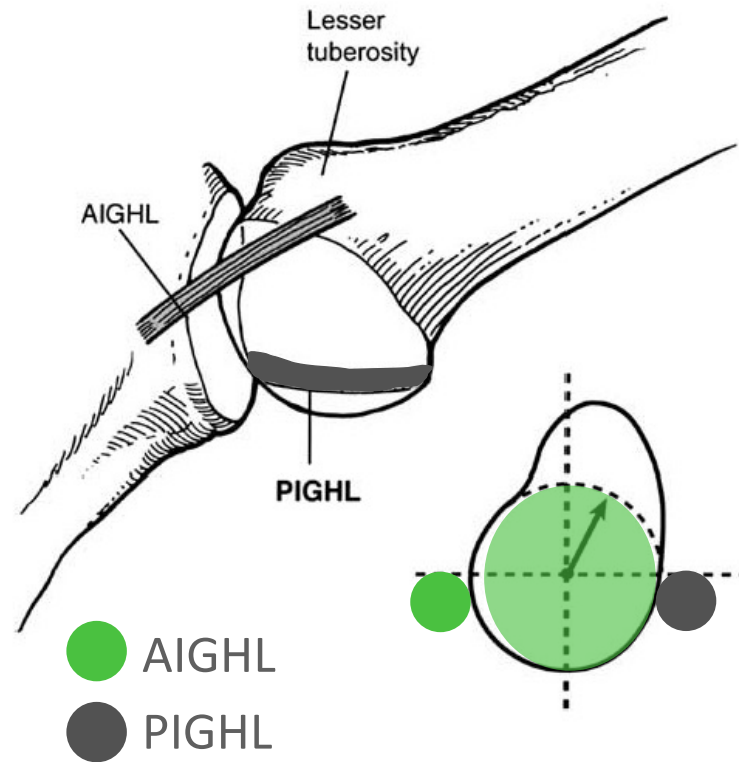
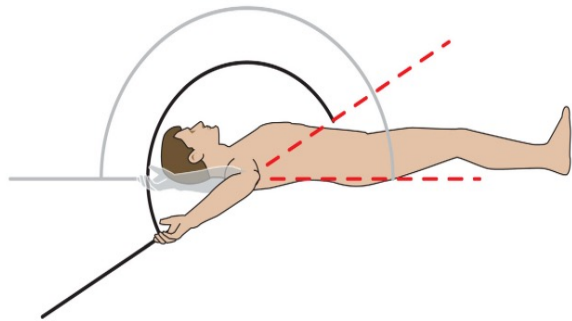


Beitzel, Braun et al., DZSM , 2016

„Glenohumeral Internal Rotation Deficit“ (GIRD)

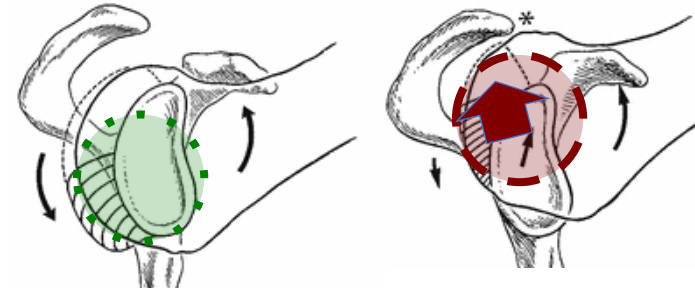


„Glenohumeral Internal Rotation Deficit“ (GIRD)

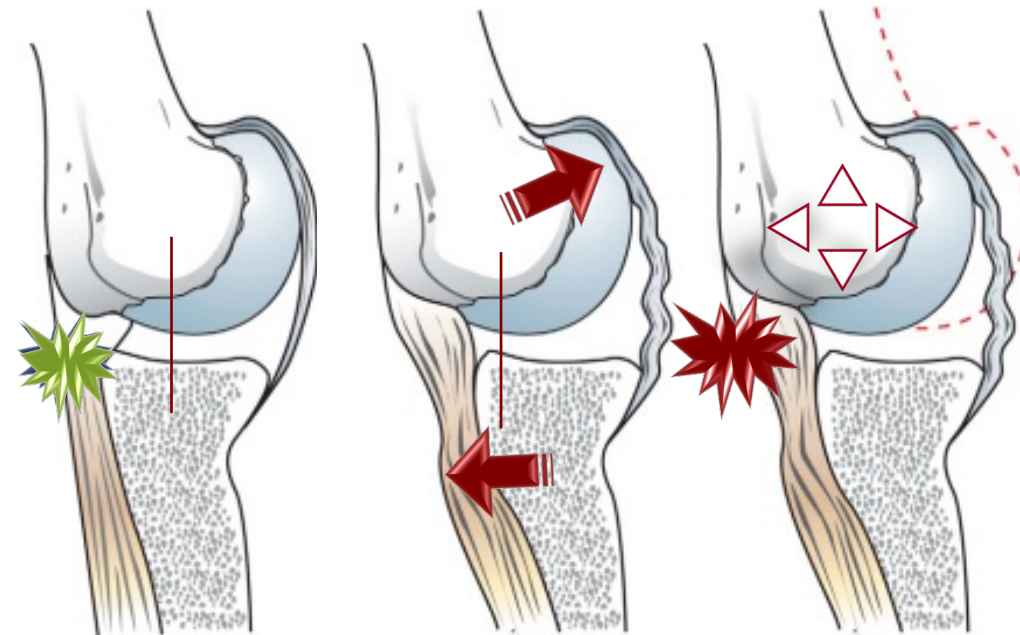


The basic principle of the „Posterior-Superioren-Impingement“ (PSI)

„Physiologic“



- GIRD (IR-Deficit)
- CAM-Effect
- Pseudo-Laxity
- „Pathologic“ PSI
- SLAP
- RC-Lesion



„Pathologic“

irt et al., Arthroscopy, 2003
Braun et al., JBJS am, 2009

Glenohumeral Internal Rotation Deficit and Risk of Upper Extremity Injury in Overhead Athletes: A Meta-Analysis and Systematic Review

Robert A. Keller, MD,^{*†} Anthony F. De Giacomo, MD,[‡] Julie A. Neumann, MD,[‡]
Orr Limpisvasti, MD,[‡] and James E. Tibone, MD[‡]



- Female, 30 years; Volleyball

„GIRD“ seems to be a risk factor

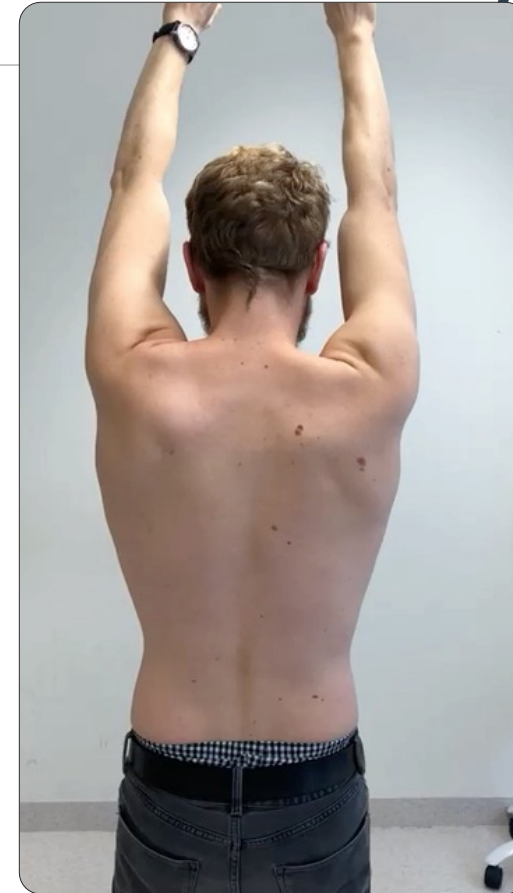
- The pooled results did not reach statistical significance for any shoulder motion measurement
- Results, though not reaching significance, favored injury in overhead athletes with GIRD as well as rotational loss and external rotational gain.

Keller et al., Sports Health, 2018

Scapular dyskinesis increases the risk of future shoulder pain by 43% in asymptomatic athletes: a systematic review and meta-analysis

Darren Hickey, Veronica Solvig, Vinicius Cavalheri, Meg Harrold, Leanda Mckenna

The Scapula is important !



Athletes with scapular dyskinesis have **43% greater risk of developing shoulder pain** than those without scapular dyskinesis.

Hickey D, et al. Br J Sports Med 2017

Resilience of the Cuff -> never work the Cuff until failure !

Journal of Athletic Training 2011;46(4):349-357
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www.nata.org/jat

original research

Shoulder External Rotation Fatigue and Scapular Muscle Activation and Kinematics in Overhead Athletes

Mithun Joshi, PT, ATC†; Charles A. Thigpen, PhD, PT, ATC*; Kevin Bunn, MD, ATC‡; Spero G. Karas, MD§; Darin A. Padua, PhD, ATC¶

†University of Sydney, Australia; *Proaxis Therapy, Greenville, SC; ‡University of North Carolina, Chapel Hill; §Emory University, Atlanta, GA; ¶Department of Exercise & Sport Science, University of North Carolina, Chapel Hill

Journal of Athletic Training 2008;43(4):352-358
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www.nata.org/jat

original research

Rotator Cuff Fatigue and Glenohumeral Kinematics in Participants Without Shoulder Dysfunction

Deydre S. Teyhen, PhD, PT, OCS*; Joseph M. Miller, MPT, PT†; Tansy R. Middag, DPT‡; Edward J. Kane, PhD, PT, ECS, ATC§

*US Army-Baylor University, Fort Sam Houston, TX; †Landstuhl Regional Medical Center, Landstuhl, Germany; ‡Brooke Army Medical Center, Fort Sam Houston, TX; §University of St Augustine, San Diego, CA



Oslo Sports Trauma
RESEARCH CENTER

Key Factors:

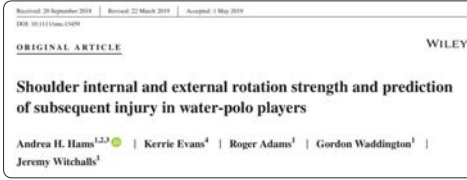
- Superior migration of the humeral head **increases with rotator cuff fatigue** in healthy individuals.
- External rotator fatigue leads to **loss of scapular control**
- Latissimus activity reduced by 4%; ISP & Scapula upward rotation activity increased by 3°.

Teyhen et al., JAT, 2008

Hickey D, et al. Br J Sports Med 2017



ER-Strength correlates with Risk for injury



The neutral and 90-90 test position showed a significant difference ($P = 0.01$) in **absolute preseason IR and ER mean strength** between prospectively injured and non-injured players.

Hams et al., Scan Sci Sports, 2019

Preseason Shoulder Strength Measurements in Professional Baseball Pitchers

Identifying Players at Risk for Injury

Ian R. Byram,^{1*} MD, Brandon D. Bushnell,¹ MD, Keith Dugger,² ATC, Kevin Chamon,¹ MD, Frank E. Hanel Jr.,³ PhD, and Thomas J. Noonan,^{4*} MD
From the ¹Department of Orthopaedic Surgery, Vanderbilt University, Nashville, Tennessee, ²Harden Clinic Orthopaedics and Sports Medicine, Rome Braves Baseball Club, Rome, Georgia, ³Colorado Rockies Baseball Club, Denver, Colorado, ⁴Carrollton Orthopaedic Clinic, Carrollton, Georgia, the ⁵Department of Biostatistics, Vanderbilt University, Nashville, Tennessee, and ⁶Steadman-Hawkins Clinic, Denver, Greenwood Village, Colorado

Preseason weakness of **external rotation and SS strength** is associated with in-season throwing-related injury resulting in surgical intervention in professional baseball pitchers

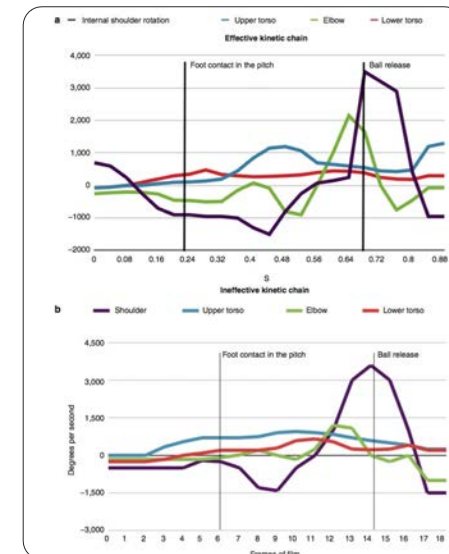
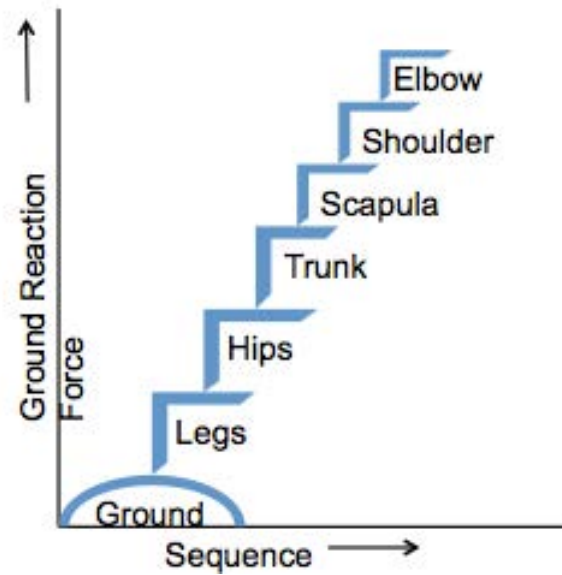
Byram et al., AJSM, 2020

The „Kinetic Chain“

**Improper Trunk Rotation Sequence
Is Associated With Increased Maximal
Shoulder External Rotation Angle
and Shoulder Joint Force in High School
Baseball Pitchers**

Sakiko Oyama,^{1,2} PhD, ATC, Bing Yu,³ PhD, J. Troy Blackburn,¹ PhD, ATC,
Darin A. Padua,¹ PhD, ATC, Li Li,¹ PhD, and Joseph B. Myers,¹ PhD, ATC
Investigation performed at the University of North Carolina at Chapel Hill,
Chapel Hill, North Carolina, USA

- Ineffektive Rumpfrotation zeigte einen größeren maximalen **Schulteraußenrotationswinkel** und eine **größere resultierende Schulterbelastung**

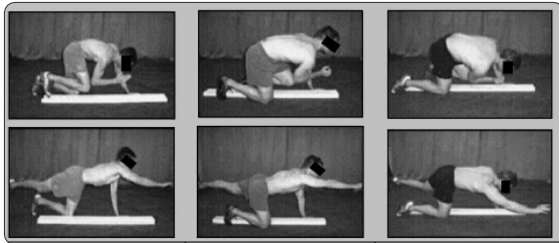


Oyama et al., AJSM, 2014
Provencher et al., Bain, Springer, 2015

Core Stability is important !



*Test for Core Stability:
e.g. Single Leg Squad*



*Test for Core (Endurance & Strength)
of touches in 15 Seconds (>25 Tipps)*



Maske, Reiman, Sports Health, 2013
Reuter, Beitzel et al., JoSMaPF, 2017

Early Changes found in athletes

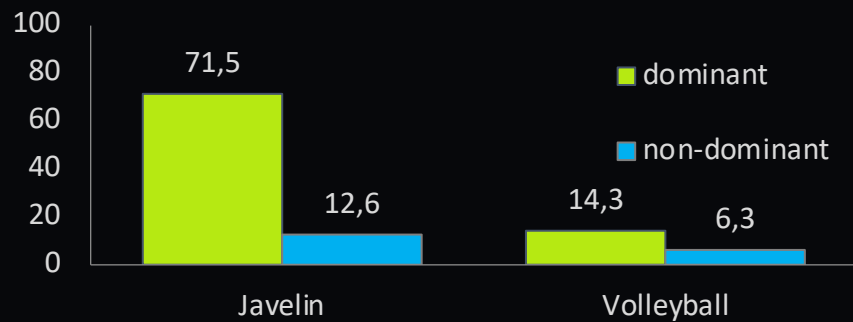
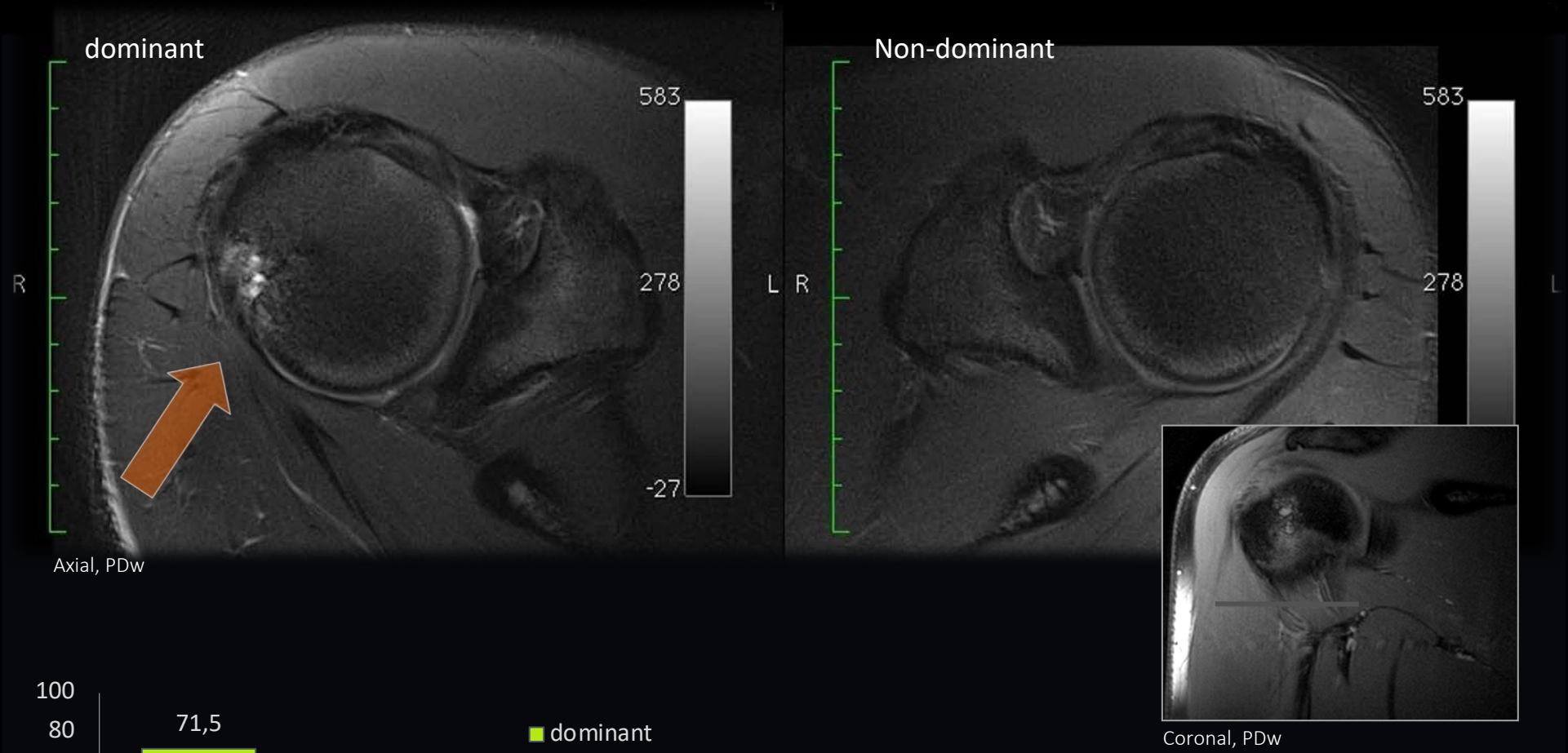


German Junior National Team Javelin



Sports specific Boarding School VCO
Kempfenhausen

More zystic lesions in Athletes



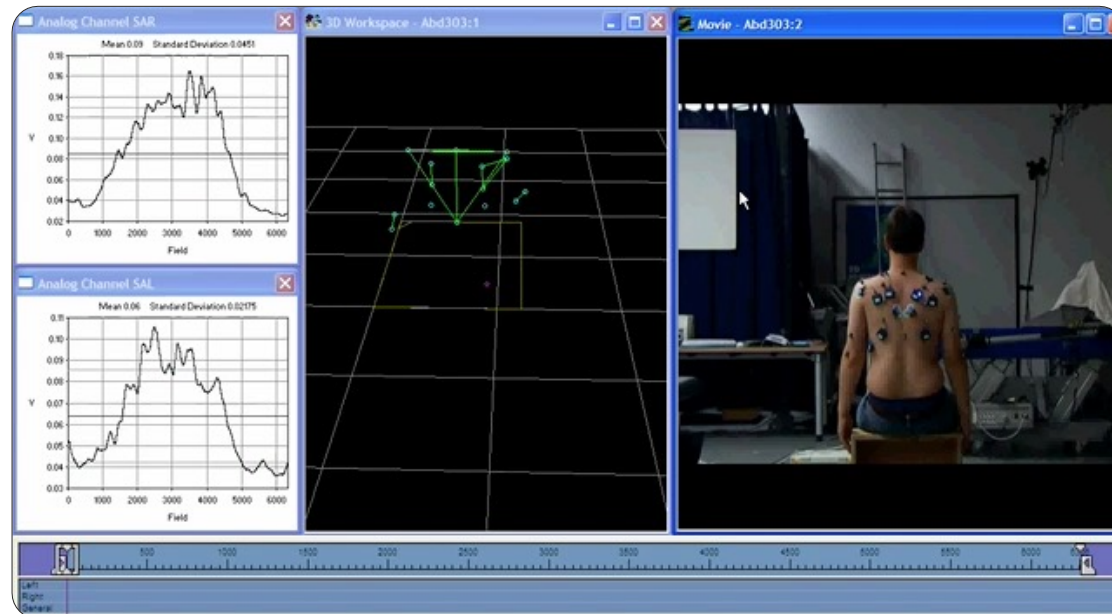
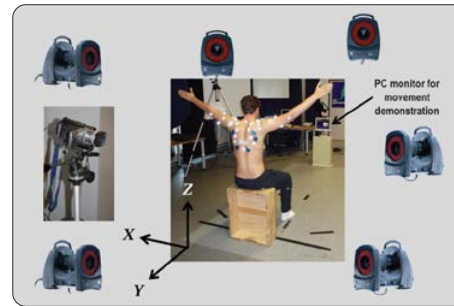
Are there morphologic changes even in the young and asymptomatic athlete?

Knee Surg Sports Traumatol Arthrosc
DOI 10.1007/s00167-014-3223-y

SHOULDER

Structural and biomechanical changes in shoulders of junior javelin throwers: a comprehensive evaluation as a proof of concept for a preventive exercise protocol

Knut Beitzel · Julia F. Zandt · Stefan Buchmann ·
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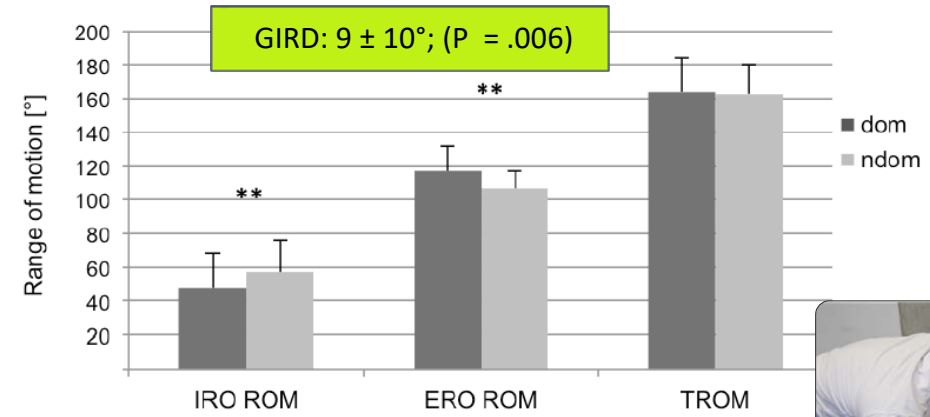


Knee Surg Sports Traumatol Arthrosc
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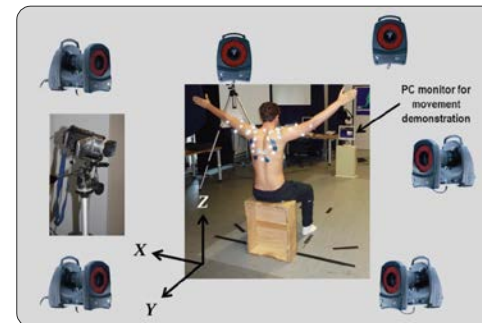
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Static Scapular Resting Position and Orientation (Mean ± SE [°])					
	Upward Rotation	Anterior Tilt	Internal Rotation	Elevation	Retraction
Dominant	2.0 ± 1.5	18.9 ± 1.3	29.6 ± 1.4	7.2 ± 0.6	18.1 ± 1.1
Non-dominant	1.5 ± 1.0	14.6 ± 1.0	32.2 ± 1.6	7.0 ± 1.0	15.7 ± 1.7
Bilateral difference	-0.6 ± 1.4	-4.2 ± 1.4	2.6 ± 1.3	-0.2 ± 0.7	-2.4 ± 1.0
ANOVA P-value	.699	.010	.058	.835	.038



Our concept of treatment / Prevention

EXTREMITY AND JOINT CONDITIONS

Current Concepts: Rotator Cuff Pathology in Athletes — A Source of Pain or Adaptive Pathology?

John E. Kuhn, MS, MD



The essential treatment

- Core stability
- Glenohumeral internal rotation
- Scapular dyskinesis

The throwing athlete can be considered „on the edge of a cliff“.
->
The treatment should put him back „on the edge of the cliff“
and not restore his shoulder to „normal“.

Kuhn, Current Sports Medicine Reports, 2013

Preventive exercise protocol based on the 5 keys

Knee Surg Sports Traumatol Arthrosc
DOI 10.1007/s00167-014-3223-y

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Structural and biomechanical changes in shoulders of junior javelin throwers: a comprehensive evaluation as a proof of concept for a preventive exercise protocol

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Main goals:

- Restoration of ideal **upper body posture and passive mobility** of the shoulder girdle
- Normalization of **local muscular imbalances** within the rotator cuff and scapular stabilizers
- Optimization of **scapulothoracic movement**
- Enhancement of **local eccentric stress resilience** of the rotator cuff
- Athlete's **education**



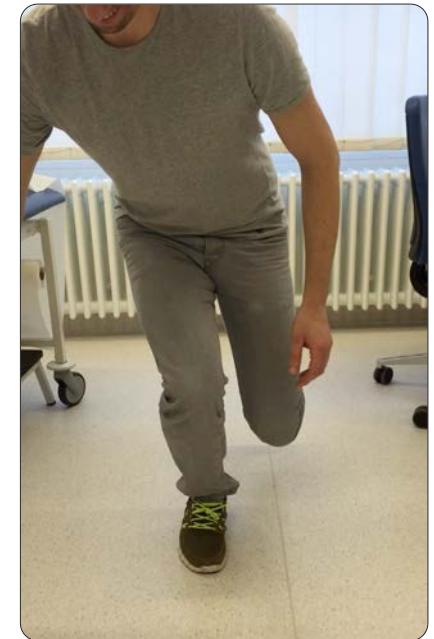
Beitzel et al., KSSTA, 2014



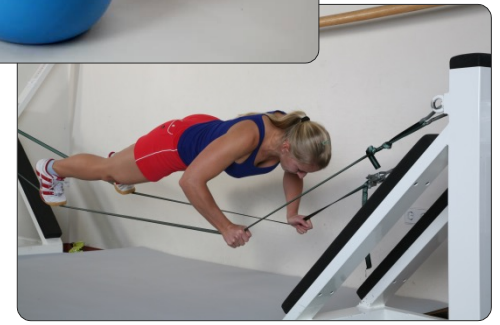
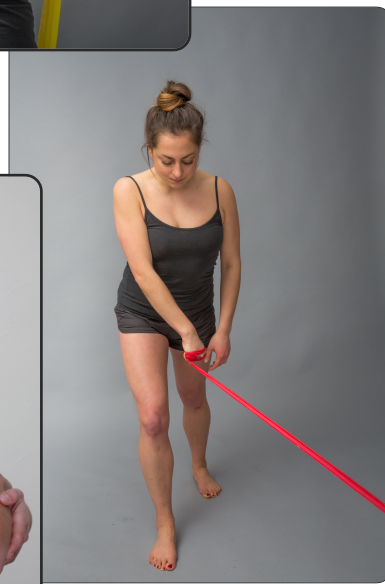
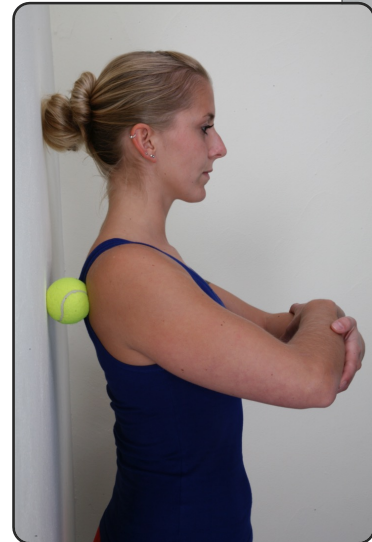
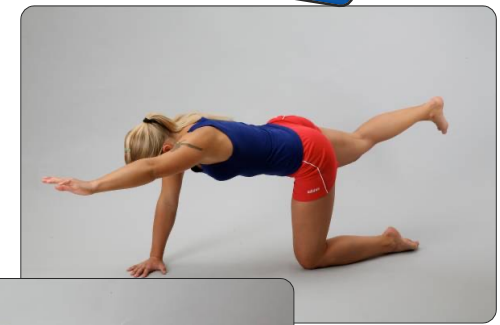
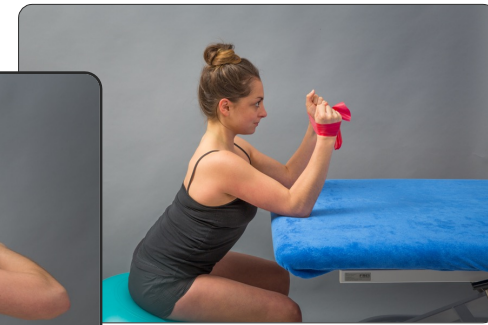
SHOULDER
The shoulder needs to have strength
extreme mobility at the same time.



Male, 36years Pitcher



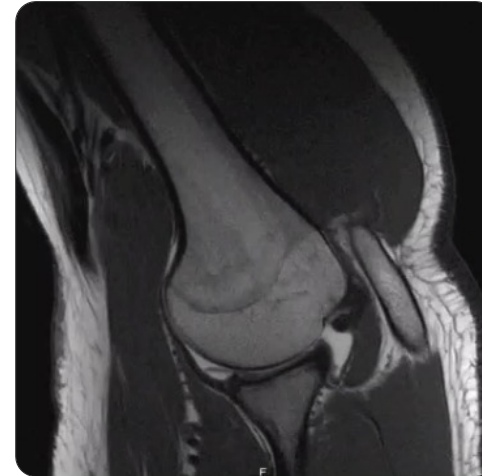
5 Keys as basis of Training / Prevention / Therapy



The 5 Keys for treatment - Stability & Biceps

Male, 22 y

- Pain when playing Volleybal
- Trauma Skiing 6 months ago



Arthroscopic Stabilization & LHB-TD (subpec)

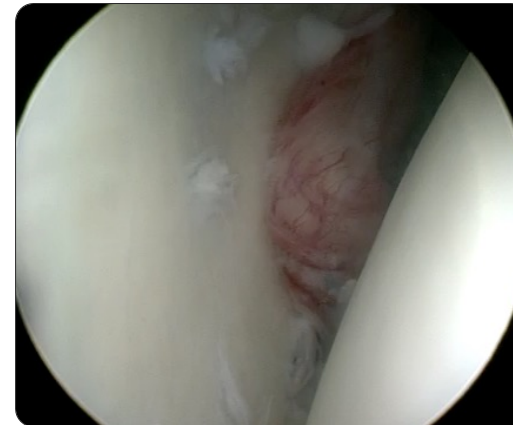
SLAP Repair



LHB TD subpec



Ant.-inf. Stabilization



Observational data of our clinic:

Operative Techniken

Oper Orthop Traumatol 2016 · 28:418–429
DOI 10.1007/s00064-016-0463-7
Eingegangen: 17. Februar 2016
Überarbeitet: 14. März 2016
Angenommen: 19. März 2016
Online publiziert: 2. August 2016
© Springer-Verlag Berlin Heidelberg 2016

J. Pogorzelski¹ · K. Beitzel¹ · A. B. Imhoff¹ · P. Millett² · S. Braun¹
¹Abteilung für Sportorthopädie, Klinikum rechts der Isar, Technische Universität München, München, Deutschland
²The Steadman Clinic, Vail, USA

Die operative Therapie des anterosuperioren Schulterimpingements

Redaktion
A. B. Imhoff, München
Zeichner
R. Himmelhan, Mannheim

 CrossMark

Methods:

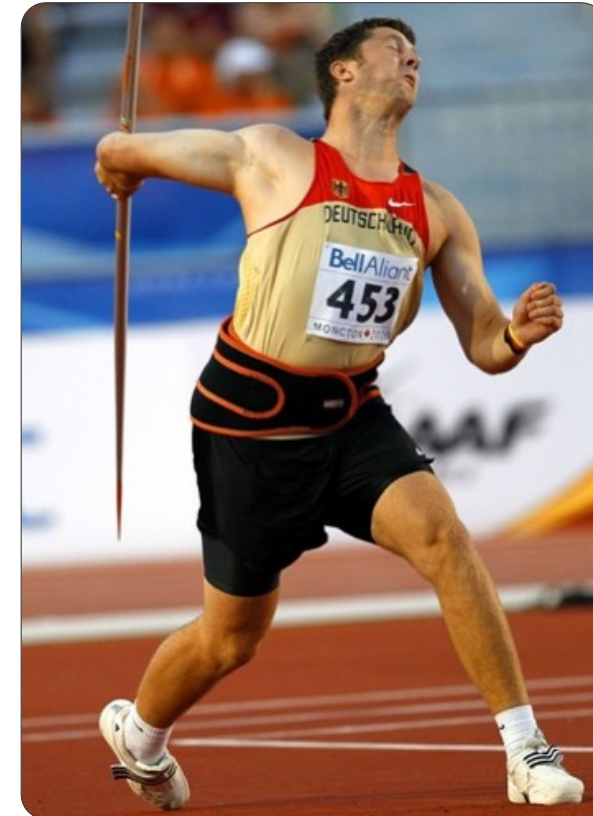
- 18 overhead athletes (6 w / 12 m) with PSI
(without SLAP (no SLAP or rotator cuff tear))
- Isolated plication of the anteroinferior capsule.

Results:

- **16 / 18 patients returned to their pre-injury sports activity level at 9 months FU.**
- Walch Duplay Score was 82.9 +/- 8.3 for men and 73.8 +/- 5.9 for women at mean FU of 27 months.



- Multiple Factors identified
- Low Evidence
- Check and treat the „5 keys“
 - 1 GIRD
 - 2 Scapula
 - 3 Stability
 - 4 SLAP / LHB
 - 5 Rotator cuff
- Combined Treatment (conservative)
- Prevention is a very important factor
- Keep them “on the edge” – do not let them fall “of the edge”





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Thank you !