Topsport & elleboog: Knallen of verknallen?

Prof. dr. Denise Eygendaal, MD, Phd
Orthopedic surgeon, upper limb unit
Amphia Hospital & University of Amsterdam
The Netherlands

Sports injuries

3.7 million sports injuries/year in the Netherlands

120.000 affect the elbow

CSI

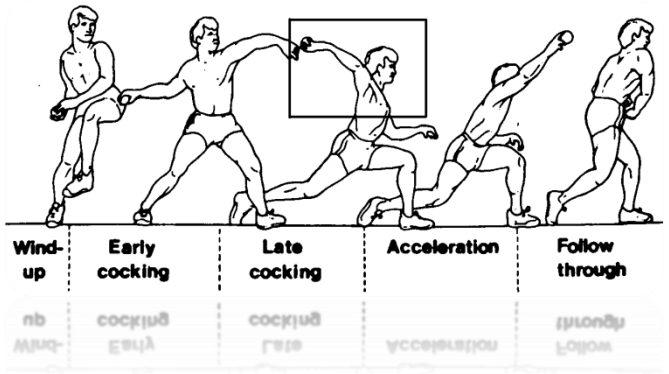
Why elbow injuries in athletes?

Angular velocity 2300 ° / sec

Valgus torque throwing 64 Nm,

Tennis serve 60 Nm

Tensile strength of native MCL; 33Nm



REVIEW

Biomechanics of the elbow joint in tennis players and relation to pathology

Denise Eygendaal, F T G Rahussen, R L Diercks

Br J Sports Med 2007;**41**:820–823. doi: 10.1136/bjsm.2007.038307

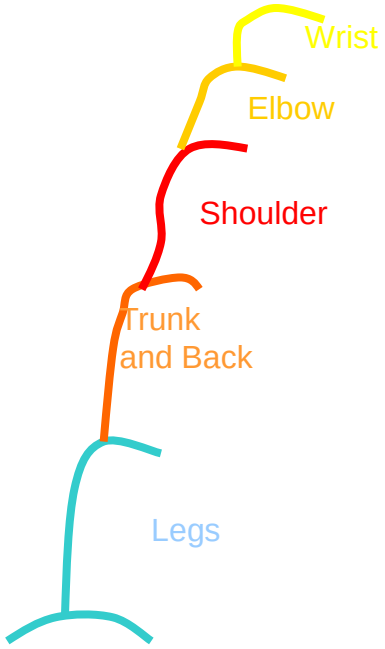
Elbow injuries constitute a sizeable percentage of tennis injuries. A basic understanding of biomechanics of tennis and analysis of the forces, loads and motions of the elbow during tennis will improve the understanding of the pathophysiology of these injuries. All different strokes in tennis have a different repetitive biomechanical nature that can result in tennis-related injuries. In this article, a biomechanically-based evaluation of tennis strokes is presented. This overview includes all tennis-related pathologies of the elbow joint, whereby the possible relation of biomechanics to pathology is analysed, followed by treatment recommendations.

BIOMECHANICS OF THE ELBOW IN TENNIS

In the normal elbow joint, stability is maintained by the combination of joint congruity, capsuloligamentous integrity and well balanced intact muscles. The olecranon and olecranon fossa joint provide primary stability at less than 20° or more than 120° of elbow flexion. In between stability is provided by soft tissue constraints, mainly the UCL.[3 4]

The kinetic chain of the tennis service starts with the feet and knees and travels through legs, trunk/back and shoulder to the elbow joint and finally through the wrist and hand. Biomechanically, the elbow functions primarily as a link in this kinetic chain, allowing transfer of kinetic energy from the body to the racquet.

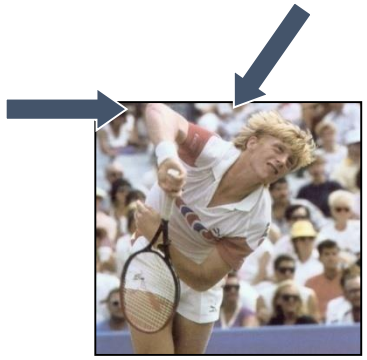
Why elbow injuries in the elbow in athletes?



LINK		Velocity	Mass	Kin. Energ	%
Hip/trunk		2.7	54	197	51
Shoulder		3.3	9	49	13
Elbow		6.4	4	82	21
Wrist		7.8	2	15	15

Kibler, Clin Sports Med, 1995

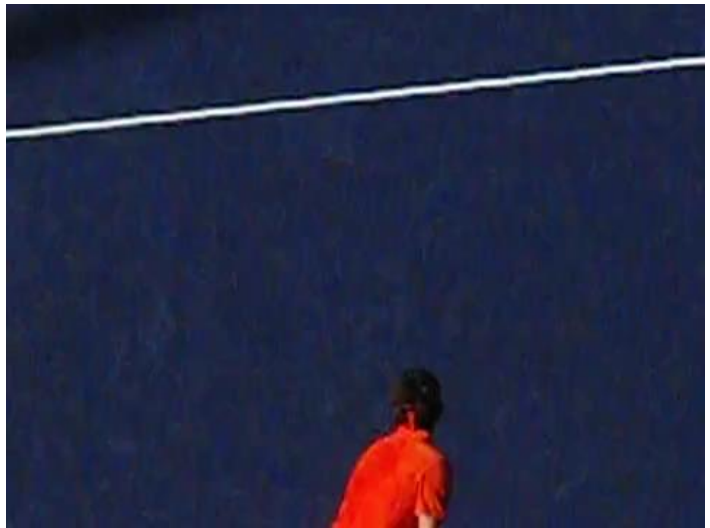
Kinetic chain and elbow



‘Long axis internal rotation’

Pronation lower arm

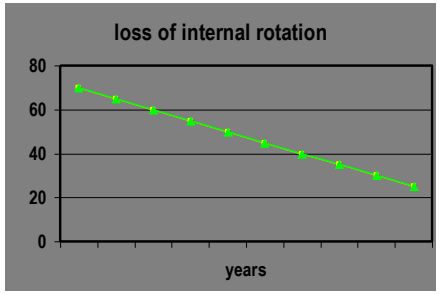
Internal rotation shoulder



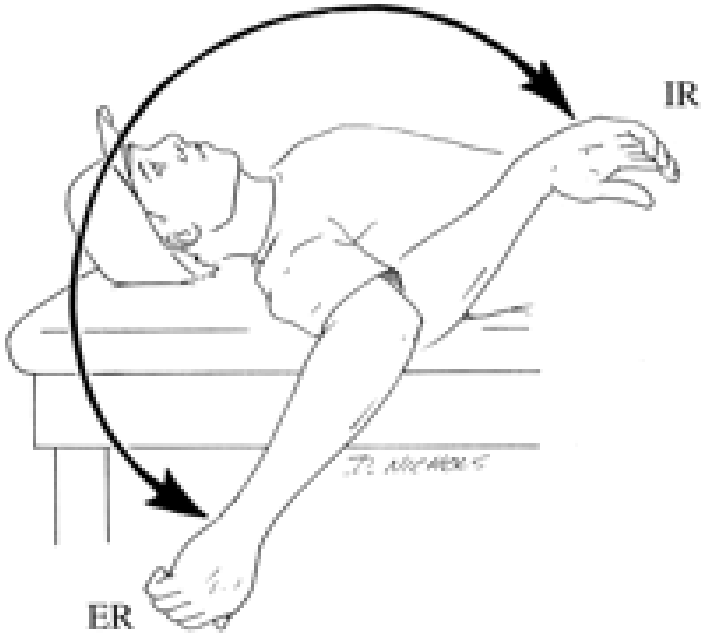
Kibler, Gent,2003

Prof. tennis players and throwing athletes

lose 3-5 deg. of internal rotation



of the shoulder each year!



Shoulder at risk

- IR > 15 º decreased
- Rotational arc < 180 º

Kibler , Gent 2003

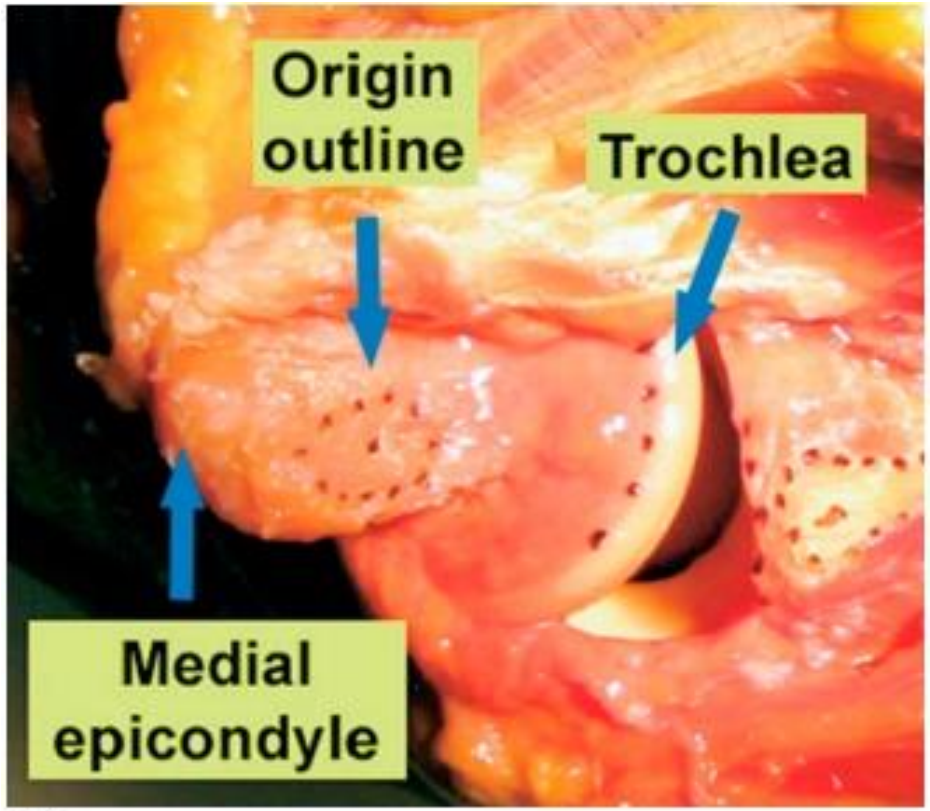


Fig. 2

Origin of the anterior bundle dissected from its osseous attachment on the medial humeral epicondyle. (Reproduced, with permission from Elsevier, from: Dugas JR, Ostrander RV, Cain EL, Kingsley D, Andrews JR. Anatomy of the anterior bundle of the ulnar collateral ligament. J Shoulder Elbow Surg. 2007 Sep-Oct;16[5]:657-60. Copyright [2007]. http://www.sciencedirect.com/science/journal/10582746.)

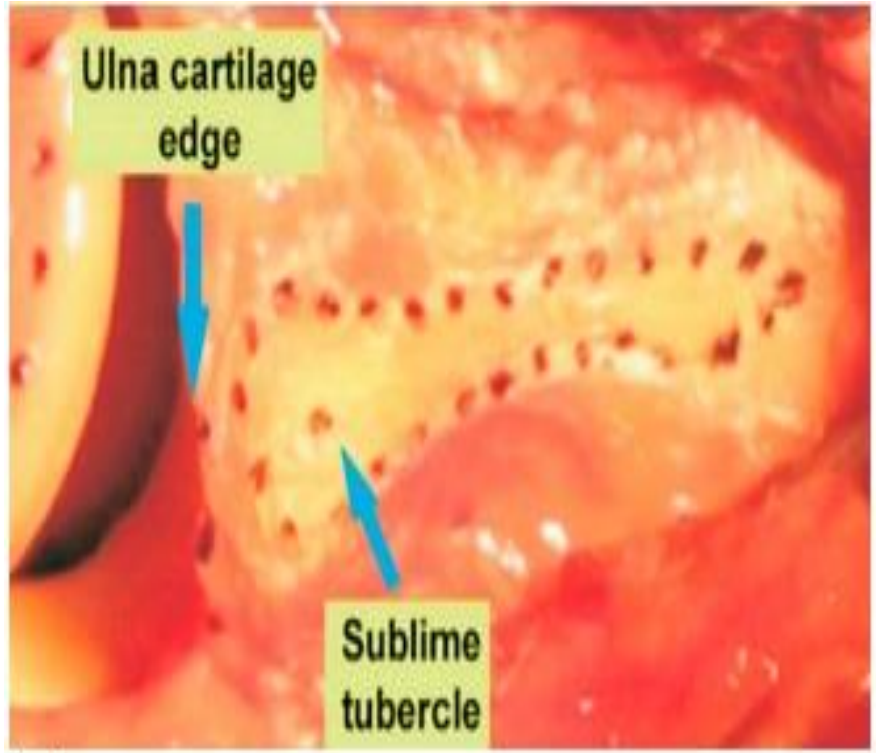


Fig. 3

Insertion of the anterior bundle dissected from its osseous attachment on the medial ulna. Note that the attachment site extends distal to the sublime tubercle. (Reproduced, with permission from Elsevier, from: Dugas JR, Ostrander RV, Cain EL, Kingsley D, Andrews JR. Anatomy of the anterior bundle of the ulnar collateral ligament. J Shoulder Elbow Surg. 2007 Sep-Oct;16[5]:657-60. Copyright [2007]. http://www.sciencedirect.com/science/journal/10582746.)

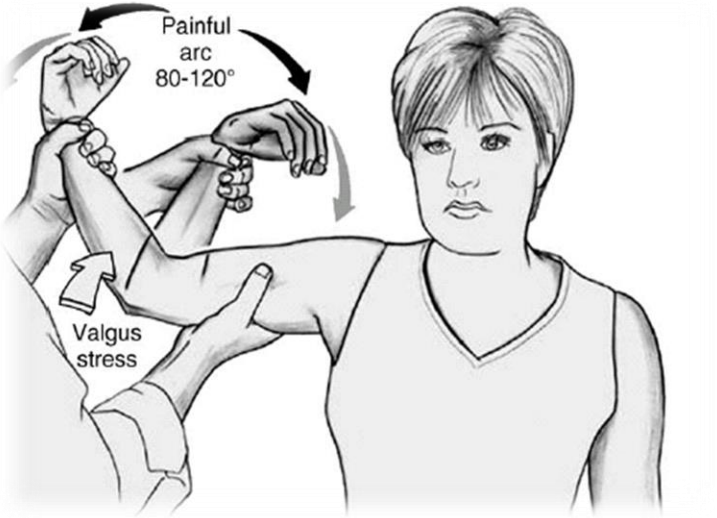
Etiology

"MCL tear and
contact pressures
in the lateral compartment"

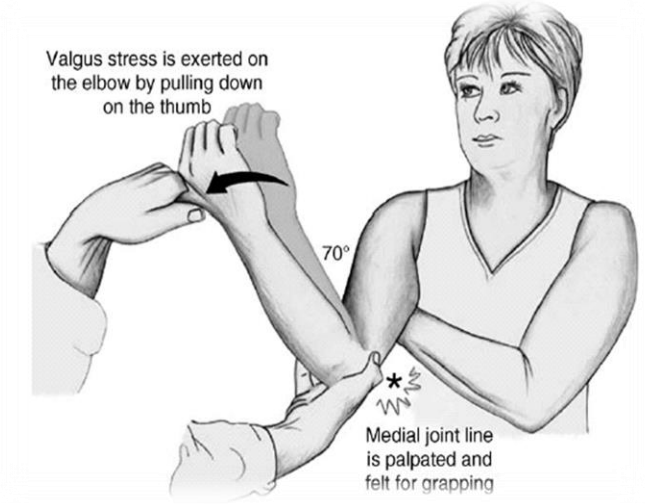
- 67% higher peak
contact pressure MCL rupture

Duggan et al, J SES 2011

Moving valgus stress



Milking test



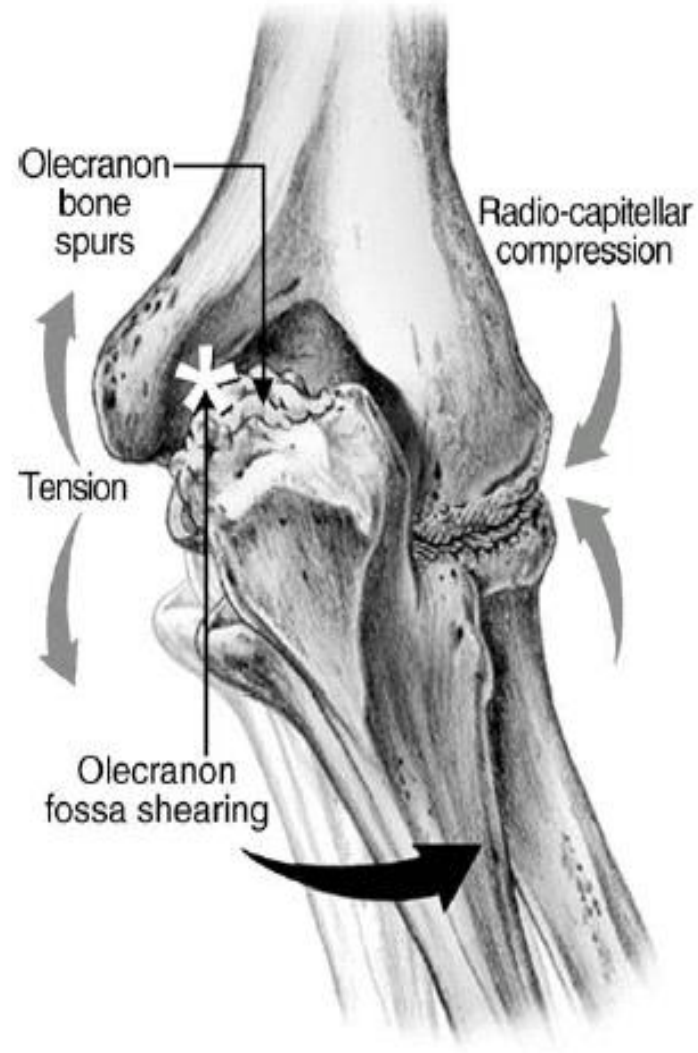
BUT

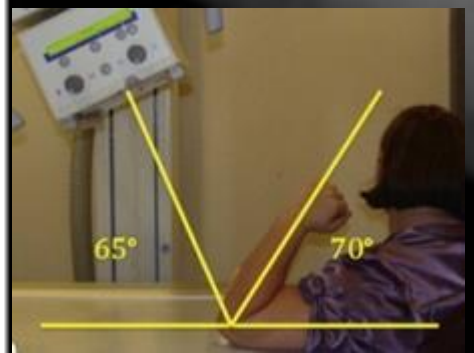
- 10-15% asymptomatic valgus laxity in prof. pitchers

Ellenbecker 1998

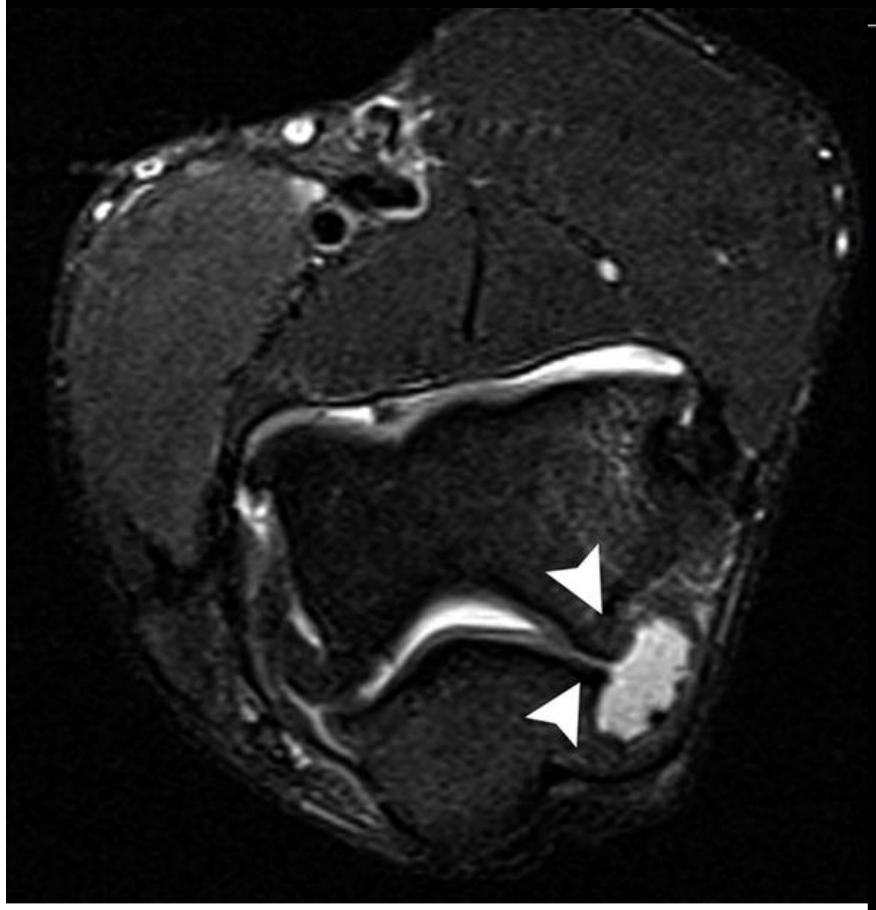
ELLEBOOGKLINIEK.NL

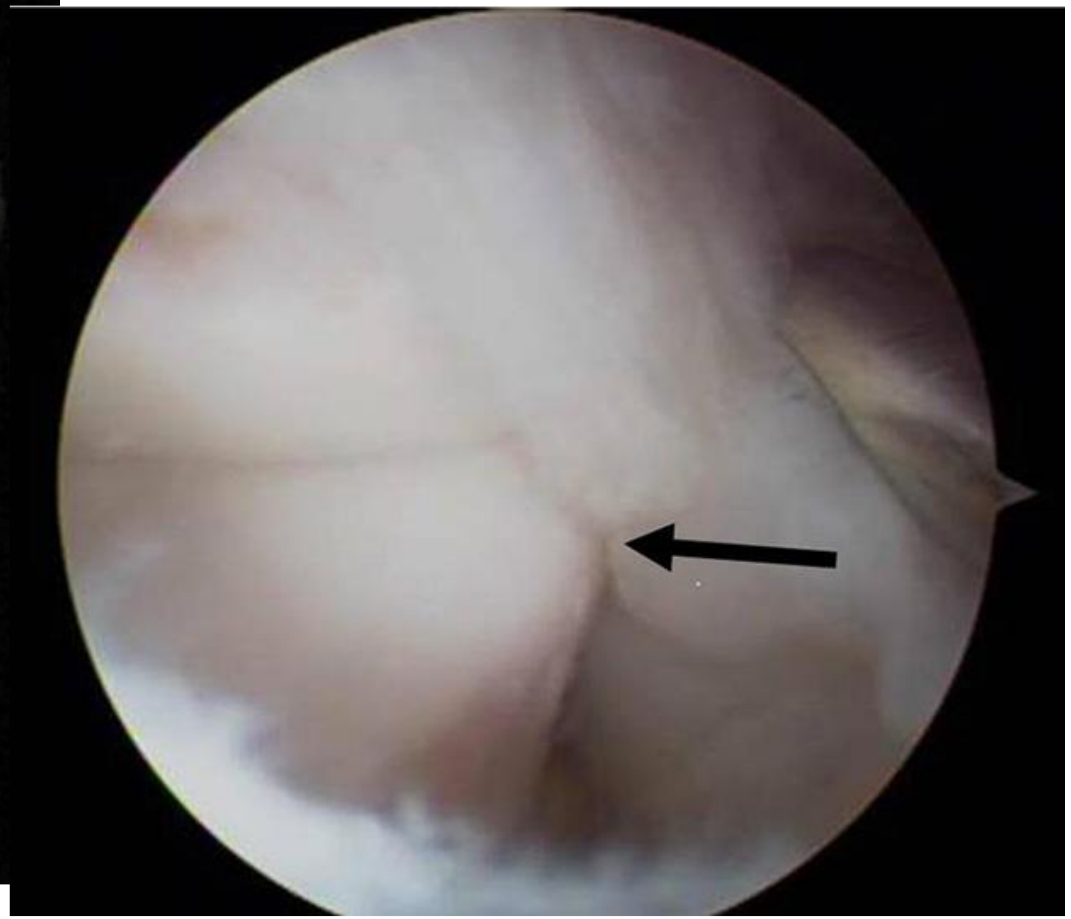

Ulnar nerve
Radio-capitellar compression
UCL
Valgus forces at the medial elbow causing stretching of the UCL and ulnar nerve

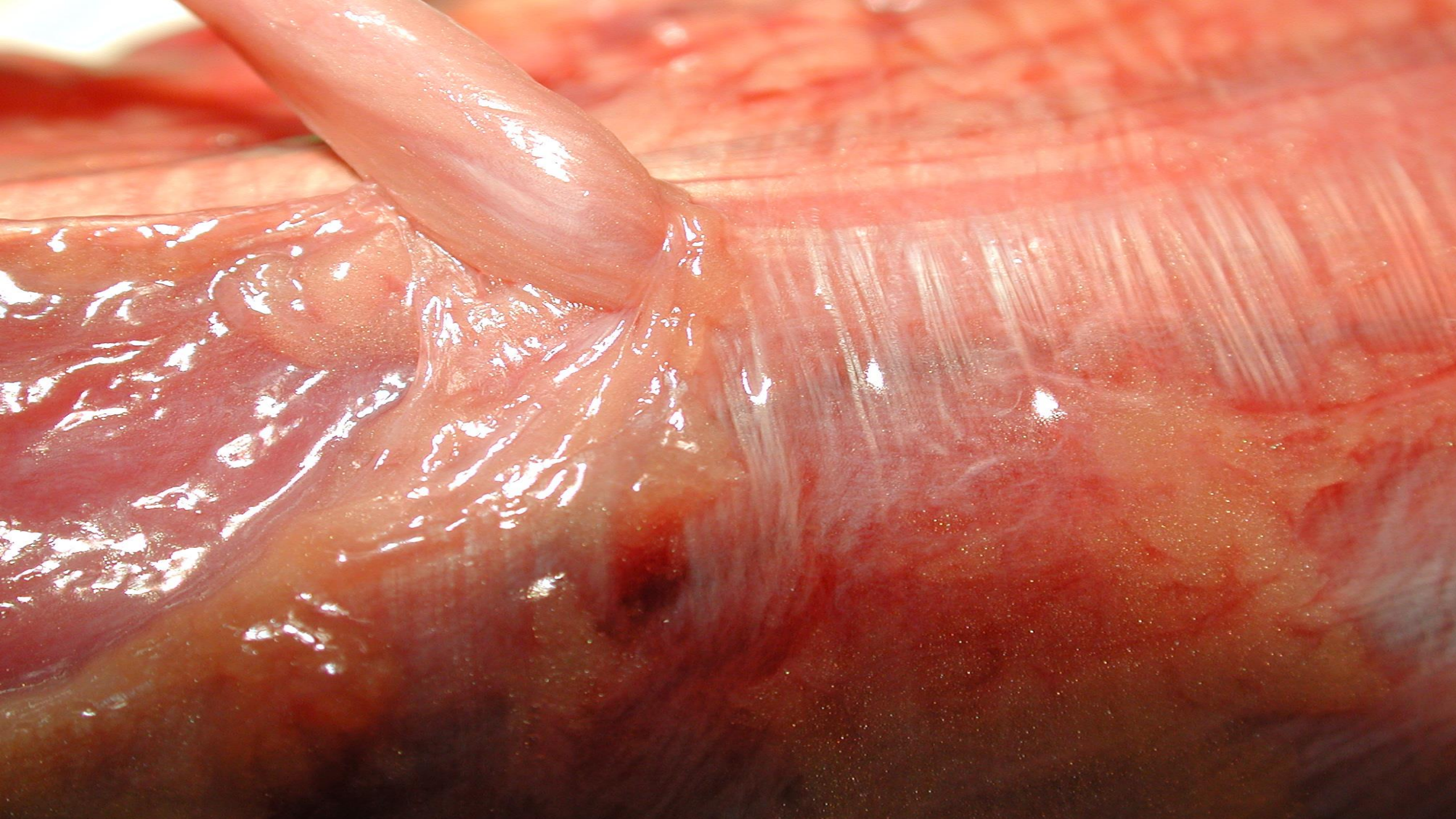

Olecranon bone spurs
Radio-capitellar compression
Tension
Olecranon fossa shearing


65°
70°

24 Y Davis cup tennis player

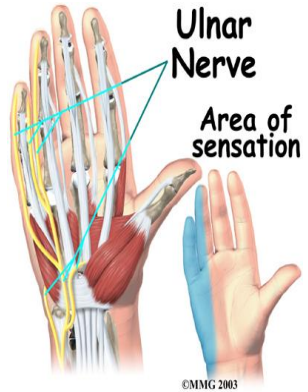


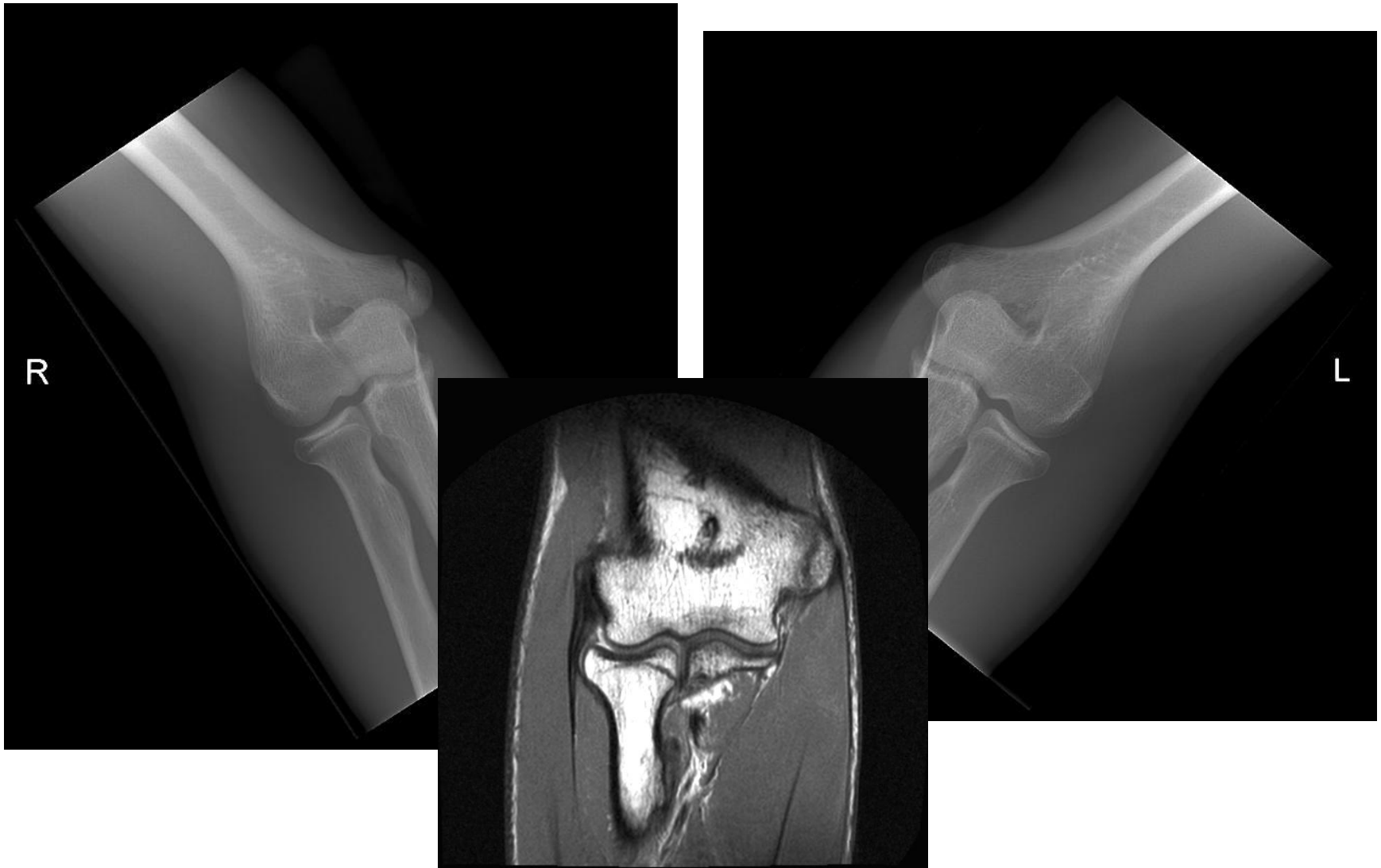




Ulnar neuritis/ neuropathy

- Traction due to valgus stress
- Compression due to muscle hypertrophy, osteophytes, or subluxation (DD snapping triceps)
- Dysesthesia, paresthesia, or even anesthesia in dig IV and V
- Loss of ball control
- EMG




R
L

M, 14 Y, Judo, Left elbow

11,7 MM

-Standard radiographs are not sufficient to measure anterior displacement **nor** medial displacement

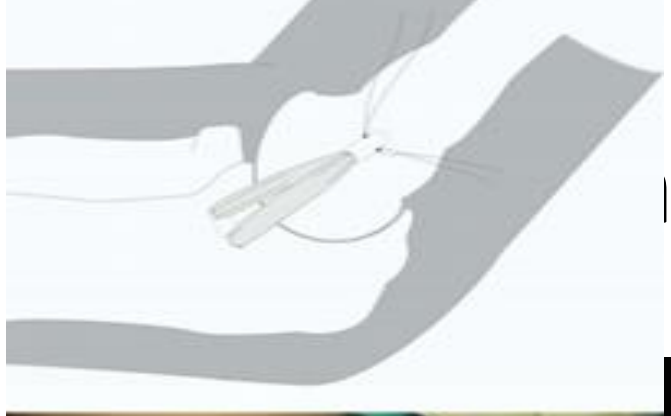
-3Dcomputed tomography is the most accurate

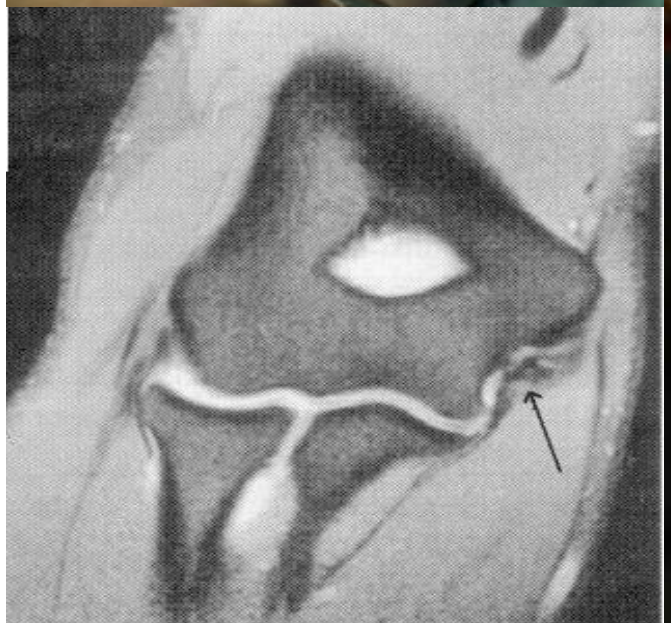
How Displaced Are "Nondisplaced" Fractures of the Medial Humeral Epicondyle in Children? Results of a Three-Dimensional Computed Tomography Analysis

Eric W. Edmonds

J Bone Joint Surg Am. 2010;92:2785-2791. doi:10.2106/JBJS.I.01637

jury





Rehab management post-operative

- **Mobilizing extension ROM of the Elbow**

- **Start Kinetic Chain exercise**

  to restore muscle pattern

- **Mobilizing and stretching the GIRD-phenomen**

- **12 months ‘back to work”**

Outcome of Ulnar Collateral Ligament Reconstruction of the Elbow in 1281 Athletes

Results in 743 Athletes With Minimum 2-Year Follow-up

E. Lyle Cain Jr,*† MD, James R. Andrews,† MD, Jeffrey R. Dugas,† MD, Kevin E. Wilk,‡ PT, DPT, Christopher S. McMichael,† James C. Walter II,§ MD, Reneé S. Riley,‖ MD, and Scott T. Arthur,# MD
Investigation performed at the American Sports Medicine Institute, Birmingham, Alabama

20% does not return to the previous level of competition

The average time from surgery to full competition was 11.6 months (range, 3-72 months) after reconstruction.

Complications occurred in 148 patients (20%), including 16% considered minor and 4% considered major.

Ulnar collateral ligament reconstruction of the elbow in European athletes.

J Shoulder Elbow Surg (2012) ■, 1-8

ELSEVIER

JOURNAL OF SHOULDER AND ELBOW SURGERY

www.elsevier.com/locate/ymse

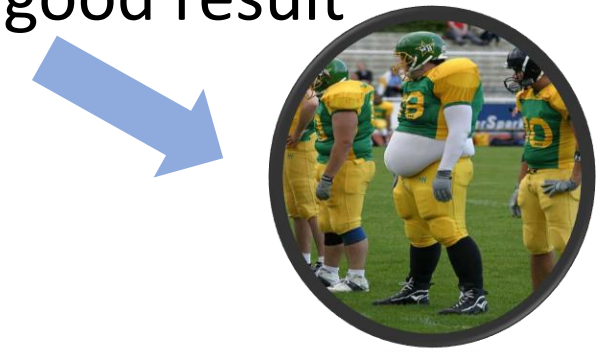
Long-term results after ulnar collateral ligament reconstruction of the elbow in European athletes with interference screw technique and triceps fascia autograft

Izaäk F. Kodde, MD[a,*], Frank T.G. Rahusen, MD[b], Denise Eygendaal, MD, PhD[a]

[a]*Department of Orthopaedics, Upper Limp Unit, Amphia Hospital, Breda, The Netherlands*
[b]*Department of Orthopaedics, St. Jans Gasthuis, Weert, The Netherlands*

Conclusion

- Reliable results (MEPI en Conway score)
- Triceps fascie autograft good alternative for palmaris longus or gracilis
- Dutch athletes quit sports despite good result after surgery



Tommy John

From Wikipedia, the free encyclopedia

Not to be confused with Tommy Johns, Tom John, or Tommy John surgery.

Thomas Edward John Jr. (born May 22, 1943) is a retired American professional baseball pitcher who played in Major League Baseball (MLB) for 26 seasons between 1963 and 1989. He played for the Cleveland Indians, Chicago White Sox, Los Angeles Dodgers, New York Yankees, California Angels, and Oakland Athletics. He was a four-time MLB All-Star.

John's 288 career victories rank as the seventh-highest total among left-handers in major league history. He had 188 career no decisions, an all-time MLB record among starting pitchers (dating back to at least 1908).[1] He is also known for the surgical procedure ulnar collateral ligament reconstruction, nicknamed "Tommy John surgery", which he underwent in 1974 after damaging the ligament in his throwing arm.[2] John was the first pitcher to receive the operation, and despite a poor outlook initially, he returned to being an effective pitcher, as more than half of his career wins came after his surgery. It since become a common procedure among baseball pitchers.

Tommy John

Pitcher	
Born: May 22, 1943 (age 75) Terre Haute, Indiana	
Batted: Right	**Threw:** Left
MLB debut	
September 6, 1963, for the Cleveland Indians	
Last MLB appearance	
May 25, 1989, for the New York Yankees	
MLB statistics	
Win–loss record	288–231
Earned run average	3.34
Strikeouts	2,245

Conclusions: Using eponymous terms is an inaccurate and unreliable method of communication. Descriptive terms are preferable to eponymous terms.

igure 7 Giovanni Battista Monteggia's tomb (author's ollection).

igure 4 Richard von Volkmann. (courtesy of WFB 'erlagsgruppe)

JOINT SURGERY, INCORPORATED

ORT

FO

The Reliability of Orthopaedic E

Matthijs P. Somford, MD, Rebecca A. Nieuwe Weme, MD, Inger Sierevelt, MSc, Jou
C. Niek van Dijk, MD, PhD, David Ring, MD, PhD, Denise Eygendaal, M
and the Orthopaedic Eponymous Terms Study Group*

od of communication. Descriptive terms are

ORT EDICS - ARTHROPLASTY

Eponymous t ey among Dutch orthopedic surge

Matthijs P. Somford[1] · Rebecca A. N
Denise Eygendaal[4,5]

J Shoulder Elbow Surg (2015) 24, 369-375

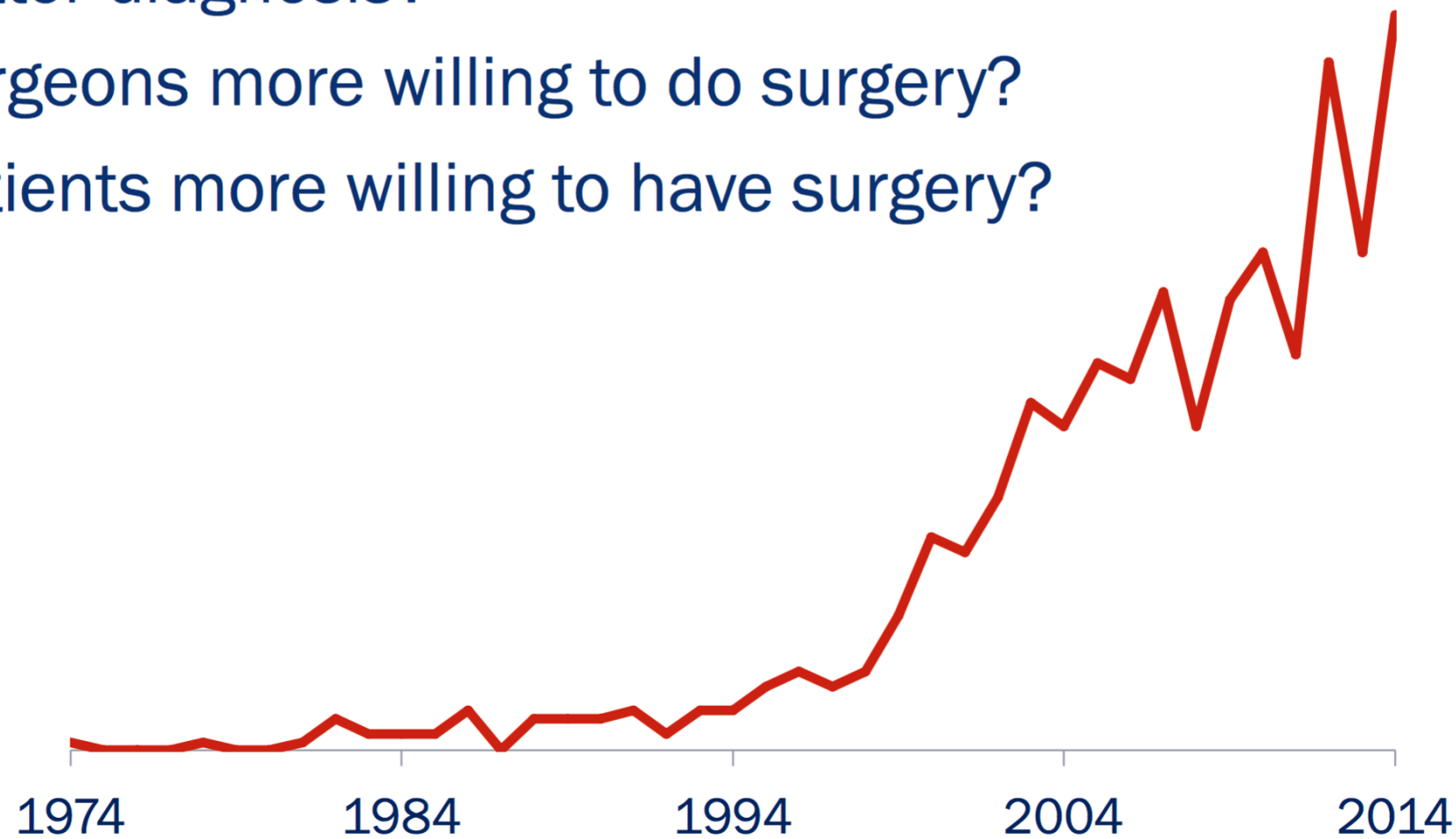
ELSEVIER

Eponyms in elbow fracture surgery

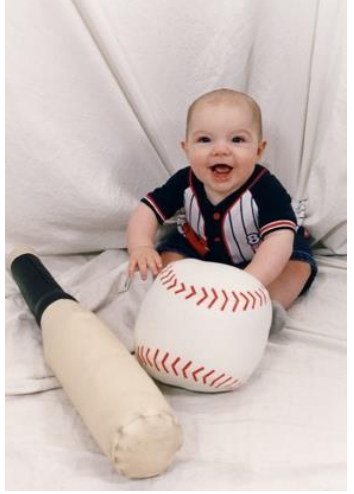
CrossMark

Matthijs P. Somford, MD[a,*], Johannes I. Wiegerinck, MD[b], Daniël Hoornenborg, MD[c], Michel P.J. van den Bekerom, MD[d], Denise Eygendaal, MD, PhD[e]

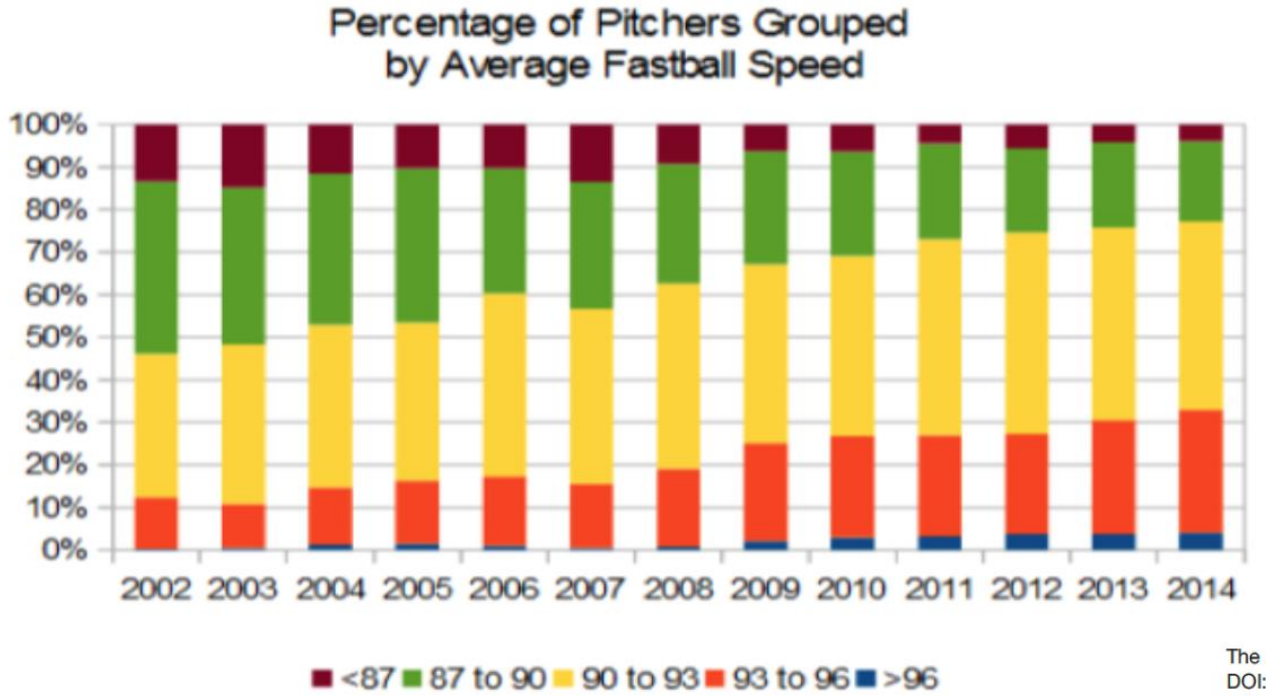
- More injuries?
- Better diagnosis?
- Surgeons more willing to do surgery?
- Patients more willing to have surgery?



Kids aren't playing as many different sports as kids used to play. Nowadays, kids specialize in a sport. If a kid is specializing in baseball, that means that they will be more likely to throw year-round and never give their arm a break.



Average throwing velocities are climbing every year.



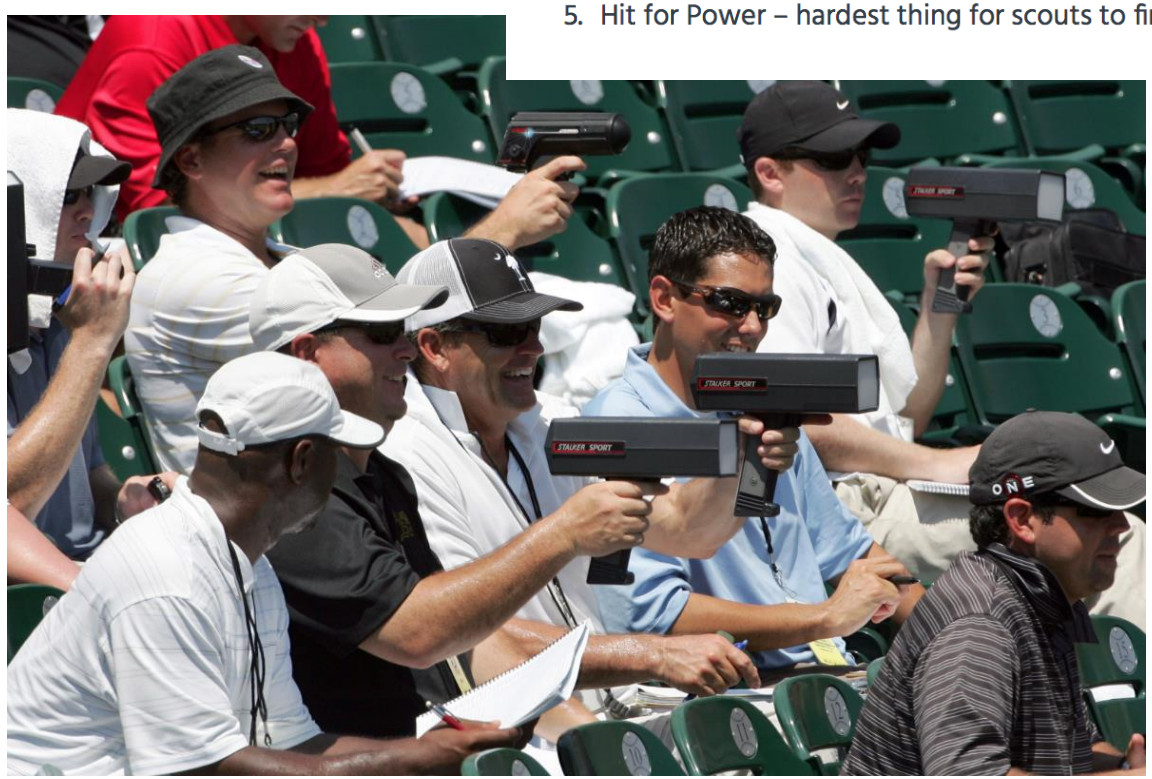
The American Journal of Sports Medicine, Vol. 45, No. 13
DOI: 10.1177/0363546517692548


STALKER SPORT
STALKER SPORT
STALKER SPORT
ONE

What Do MLB Scouts Look For?

What Are the 5 Tools That Scouts Evaluate?

1. Speed – how you run and how much range you have.
2. Arm strength – self-explanatory!
3. Fielding – what's your fielding ability and your actions. How good is your footwork?
4. Hit – can you hit for average? Your overall hitting ability.
5. Hit for Power – hardest thing for scouts to find in baseball. It's a coveted skill set valued by all 30 teams.



BASEBALL TOMORROW FUND

SECTIONS ABOUT APPLY LEARN GET INVOLVED

Orthopaedic Journal of Sports Medicine | SAGE

Orthop J Sports Med. 2014 Feb; 2(2): 2325967114522592.
Published online 2014 Feb 24. doi: 10.1177/2325967114522592

PMCID: PMC4555623
PMID: 26535301

The Effect of Ulnar Collateral Ligament Reconstruction on Pitch Velocity in Major League Baseball Pitchers

Drew A. Lansdown, MD* and Brian T. Feeley, MD*†

Pitchers threw fewer fastballs after reconstruction. Pitch velocity for curveballs, changeups, and sliders did not change significantly after UCL reconstruction. Additionally, pitchers threw fewer innings and pitches following reconstruction and produced fewer wins above replacement relative to their preinjury state.

Am J Sports Med. 2014 Apr;42(4):880-5. doi: 10.1177/0363546513519072. Epub 2014 Feb 4.

Analysis of pitching velocity in major league baseball players before and after ulnar collateral ligament reconstruction.

Jiang JJ[1], Leland JM.

Pitch Velocity Before and After Ulnar Collateral Ligament Reconstruction

Pitch Type[a]	Presurgery Velocity[b]	Postoperative Velocity[b]	*P* Value[c]
Fastball (n = 80)	91.3 (2.61)	90.6 (2.55)	.0034
Curveball (n = 50)	76.9 (4.14)	76.3 (3.10)	.29
Changeup (n = 72)	82.3 (2.62)	82.5 (2.76)	.50
Slider (n = 70)	82.9 (2.49)	82.7 (2.54)	.68

Prevention

Ahmad CS, Grantham WJ, Greiwe RM. Public perceptions of Tommy John surgery. The Physician and sportsmedicine. 2012;40(2):64-72.

They found that 31% of baseball coaches, 28% of players, and 25% of parents do not believe that pitch count is a risk factor for elbow injury.(58)

”Pitch counts > 600 per year = related to elbow pain”

“slider and curveball or sidearm delivery increase risk”

League age (years)	Pitchers per day	Pitch count	Days of rest
13–16	95	61 pitches per day or more	4
11–12	85		
9–10	75	41–60 pitches	3
Under 8	50	21–40 pitches	2
		1–20 pitches	0

Lyman et al, Am J sports med, 2002

Pitch Counts in Youth Baseball and Softball: A Historical Review.

Feeley, Brian T. MD; Schisel, Jessica BA; Agel, Julie MA, ATC

Objective: Pitching injuries are getting increased attention in the mass media. Many references are made to pitch counts and the role they play in injury prevention. The original purpose of regulating the pitch count in youth baseball was to reduce injury and fatigue to pitchers. This article reviews the history and development of the pitch count limit in baseball, the effect it has had on injury, and the evidence regarding injury rates on softball windmill pitching.

Data Source: Literature search through PubMed, mass media, and organizational Web sites through June 2015.

Results: Pitch count limits and rest recommendations were introduced in 1996 after a survey of 28 orthopedic surgeons and baseball coaches showed injuries to baseball pitchers' arms were believed to be from the number of pitches thrown. Follow-up research led to revised recommendations with more detailed guidelines in 2006. Since that time, data show a relationship between innings pitched and upper extremity injury, but pitch type has not clearly been shown to affect injury rates. Current surveys of coaches and players show that coaches, parents, and athletes often do not adhere to these guidelines. There are no pitch count guidelines currently available in softball.

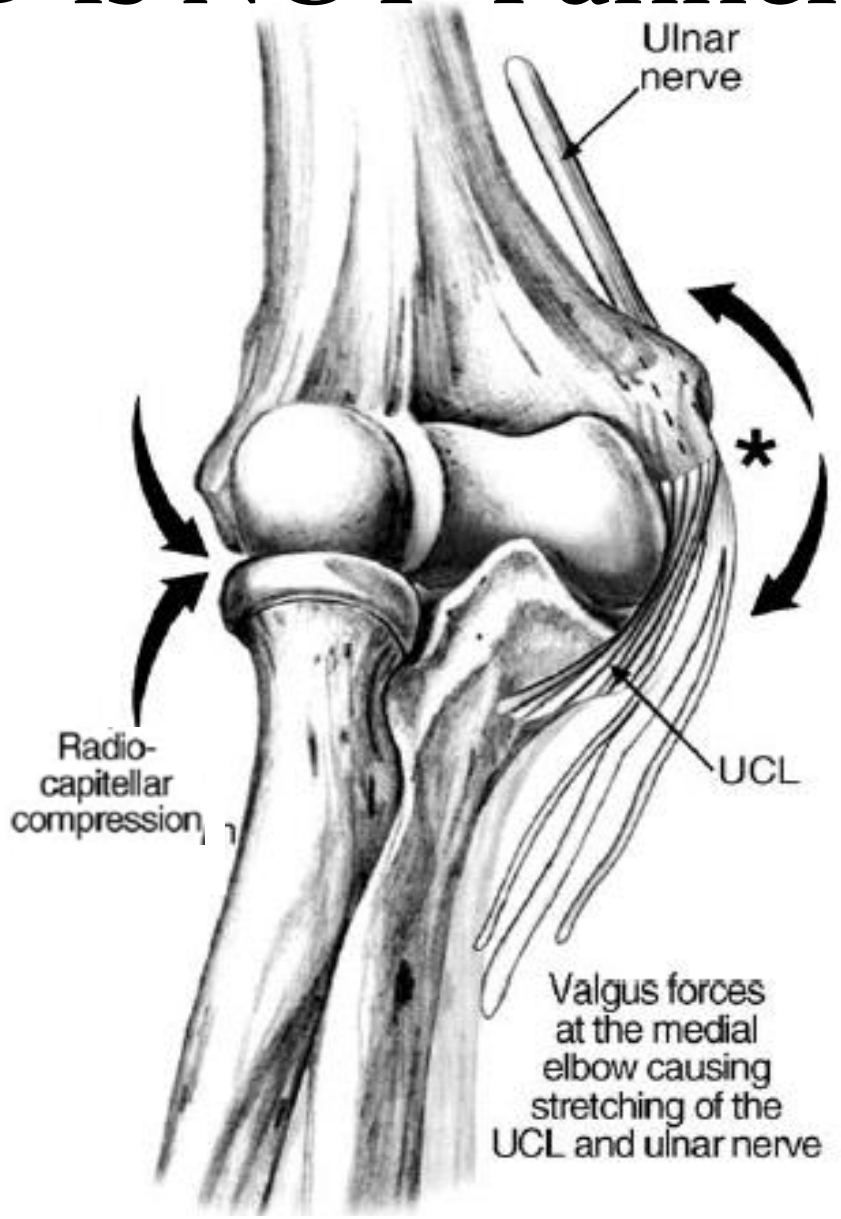
Prevention

294 baseball players 9-12 year: risk factors for elbow injuries

- decrease of ROM of internal rotation of the shoulder
- increase of muscle strength of external and internal rotation of the shoulder

Risk factors for elbow injuries among young baseball players
Mikio Harada
JSES 2010

OCD is NOT Panner disease



SUMMARY

The author reports three cases of an elbow affection, the origin of which was in each instance immediately related to a definite trauma, in boys ten years old or less. The clinical symptoms are mild, consisting only in minor functional disturbances; there is undoubtedly always complete *restitutio ad integrum*, but the course of the disease is lengthy — three years or more.

The roentgen picture is typical. Only the capitulum humeri is affected. At first, there are only some slight rarefactions, resembling fissures, together with a certain blurring of the structural design; later, the osseous centre becomes di-

Fig. 9. The right elbow $^{26}/_{5}$ 1927.

Fig. 10. The right elbow $^{26}/_{5}$ 1927.

Fig. 11. The right elbow $^{19}/_{5}$ 1927.

Fig. 12. The right elbow $^{17}/_{5}$ 1928.

At the meeting of the Northern Association of Medical Radiology in Copenhagen, in 1927, I reported two cases of a peculiar affection in the elbow, the like of which I had not encountered before, and which, in view of its rarity, seems to deserve a somewhat closer description. That I have not made those cases the subject of more detailed publication before is because, before doing so, I wished to observe their development and watch their course until — if possible — complete restoration.

Since my first communication yet another case of the same kind has come under my observation; the fact being, probably, that when once one's eye has been opened to the particular characters of the affection its rarity is found to be somewhat less than at first supposed, with the result that henceforth, on given occasion, it naturally enters as part of one's considerations in weighing the diagnostical possibilities.

I. — My first case was that of *a boy ten years old*, who was brought to me for examination on April 23rd, 1926, about two weeks after he had fallen, in school, in such a manner that his right arm had been twisted beneath his body. As a sequel to this trauma there occurred a slight swelling of the elbow, attended with certain, not very considerable, degree of pain. Already by the time I examined him the symptoms had somewhat abated; but there was still a slight swelling of the elbow, effacing the normal contour of the latter. The function was somewhat restricted, especially as regards the extension, which lacked about 25 degrees

J Shoulder Elbow Surg. 2015 Jan 13. pii: S1058-2746(14)00583-7. doi: 10.1016/j.jse.2014.10.017. [Epub ahead of print]

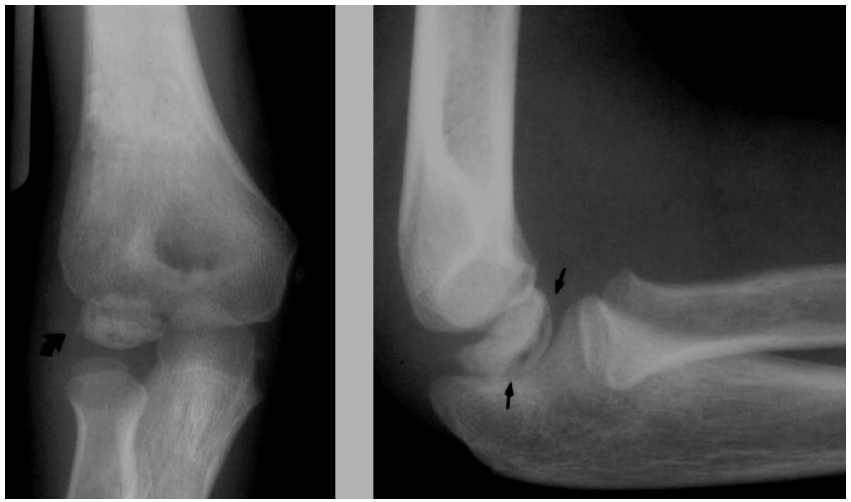
Eponyms in elbow fracture surgery.

Somford MP[1], Wiegerinck JI[2], Hoornenborg D[3], van den Bekerom MP[4], Eygendaal D[5].

Panner

- ✓Epiphyseal growth disturbance

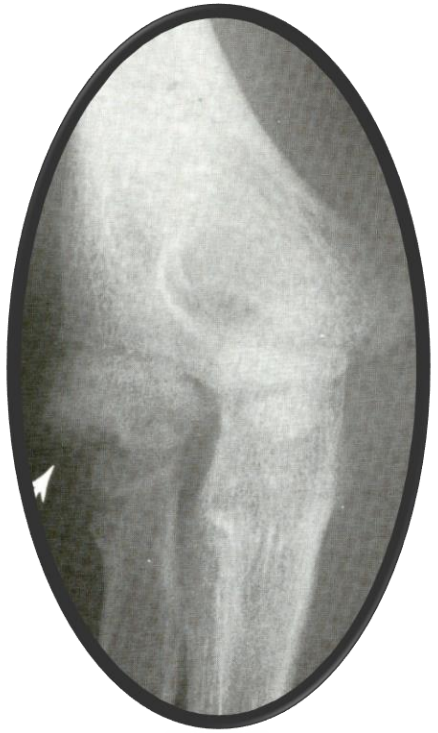
- ✓Osteochondrosis of the Capitellum
- ✓Impaired blood flow



Kobayashi et al. JAAOS, 2004

OCD is NOT Panner disease

- ✓Benigne, self limiting, 7-9 y
- ✓X:capitellar sclerosis
- ✓Tx: conservative
- ✓Prognosis=good



Osteochondritis dissecans

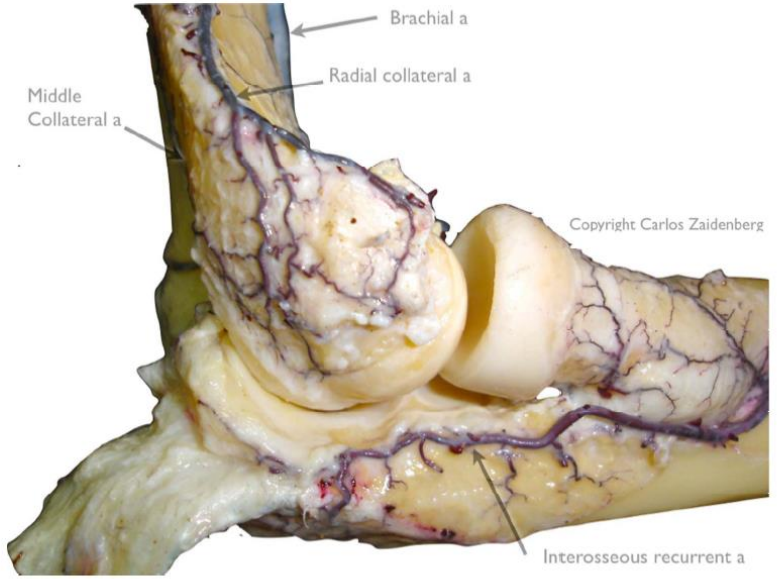
SPORTS RELATED

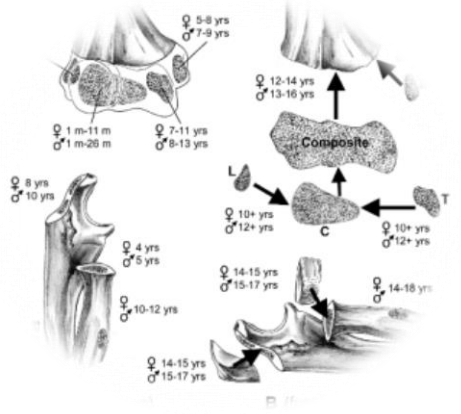
- 6% of all cases of OCD
- > 95% capitellum
- age 10-15 y
- M: F = 85 : 15
- symptoms av. 1-2 y before appropriate treatment

Etiology of OCD:

Others

- Ischemia
- Growth plates/age
- Familial





Kobayashi, JAAOS 2004

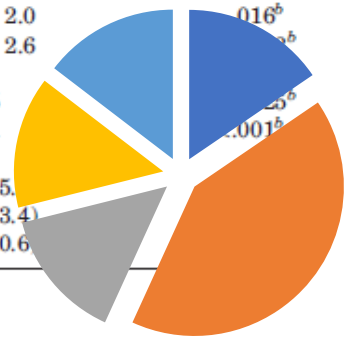
Yamaguchi et al. JBJS-A, 1997

Characteristics of Players by Diagnosis: OCD or Non-OCD[a]

	All Players	OCD	Non-OCD	*P* Value
n	2433	82 (3.4)	2351 (96.6)	
Age, y	14.5 ± 1.5	14.9 ± 1.6	14.5 ± 1.5	.034[b]
Age introduced to baseball, y	9.2 ± 2.0	8.7 ± 1.8	9.2 ± 2.0	.016[b]
Duration of competitive play, y	5.3 ± 2.7	6.2 ± 2.4	5.3 ± 2.6	[b]
Elbow pain, %				
Present	17.1	32.9	16.5	[b]
Past	57.0	81.7	56.1	.001[b]
Position				
Pitcher	634 (26.1)	24 (29.3)	610 (25.	
Catcher	322 (13.2)	6 (7.3)	316 (13.4)	
Fielder	1477 (60.7)	52 (63.4)	1425 (60.6	

[a]Values are expressed as mean ± SD or n (%) unless otherwise indicated. OCD, osteochondritis dissecans.
[b]$P < .05$, between OCD and non-OCD players.

% ocd



- stage 1
- stage 2
- stage 3
- stage 4
- stage 5

✓Ocd players began playing younger

✓Longer duration of competitive play

✓No relation to position

2433 highschool baseball players

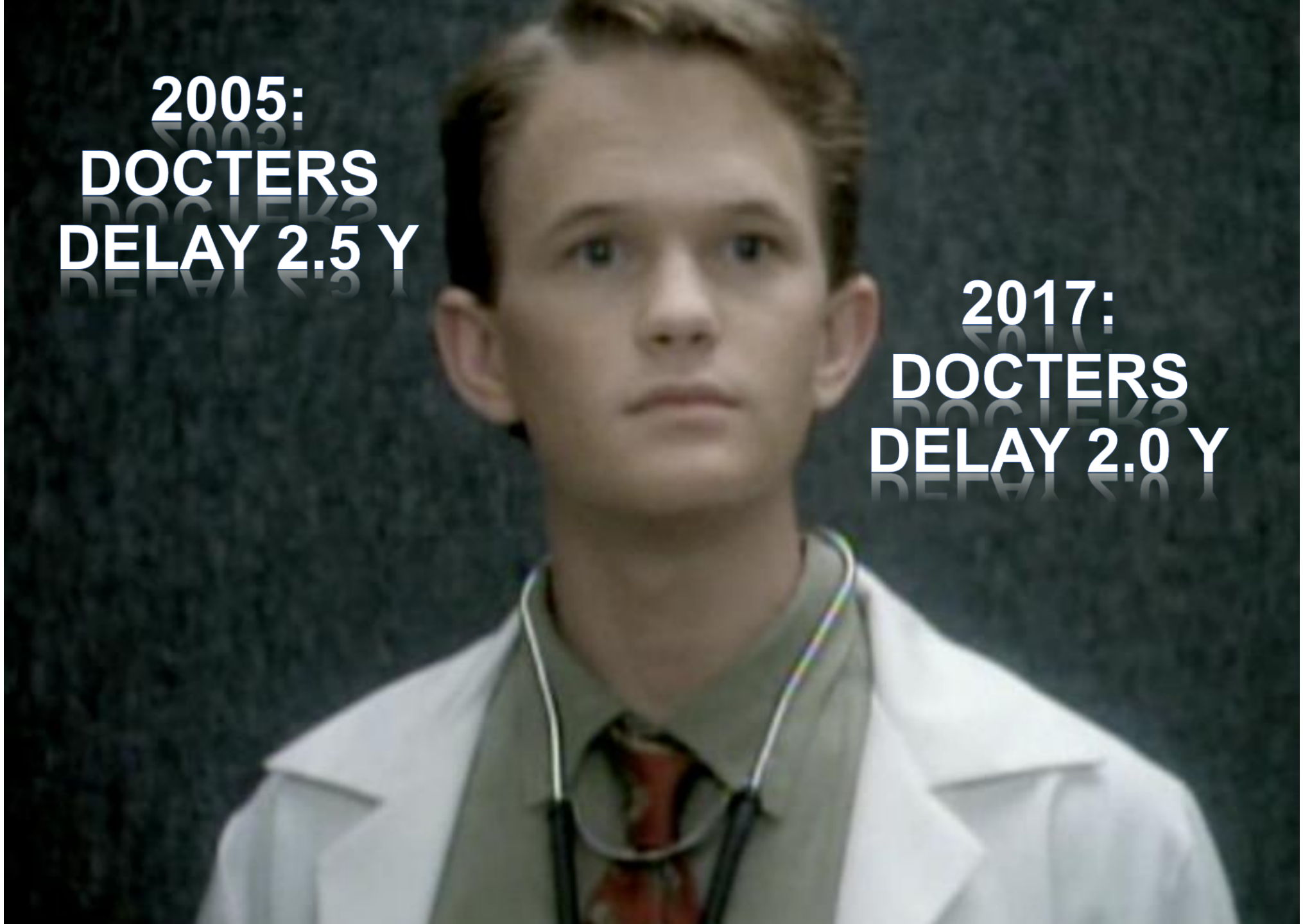
Prevalence and Clinical Characteristics of Osteochondritis Dissecans of the Humeral Capitellum Among Adolescent Baseball Players

Yoshikazu Kida,* MD, PhD, Toru Morihara,* MD, PhD, Yoshihiro Kotoura,* MD, Tatsuya Hojo,† MD, PhD, Hisakazu Tachiiri,* MD, PhD, Tsuyoshi Sukenari,* MD, Yoshio Iwata,* MD, PhD, Ryuhei Furukawa,* MD, Ryo Oda,* MD, PhD, Yuji Arai,* MD, PhD, Hiroyoshi Fujiwara,*‡ MD, PhD, and Toshikazu Kubo,*§ MD, PhD
Investigation performed at Kyoto Prefectural University of Medicine, Kyoto, Japan

TABLE 2
Relationship of OCD Lesion to Age and Duration[a]

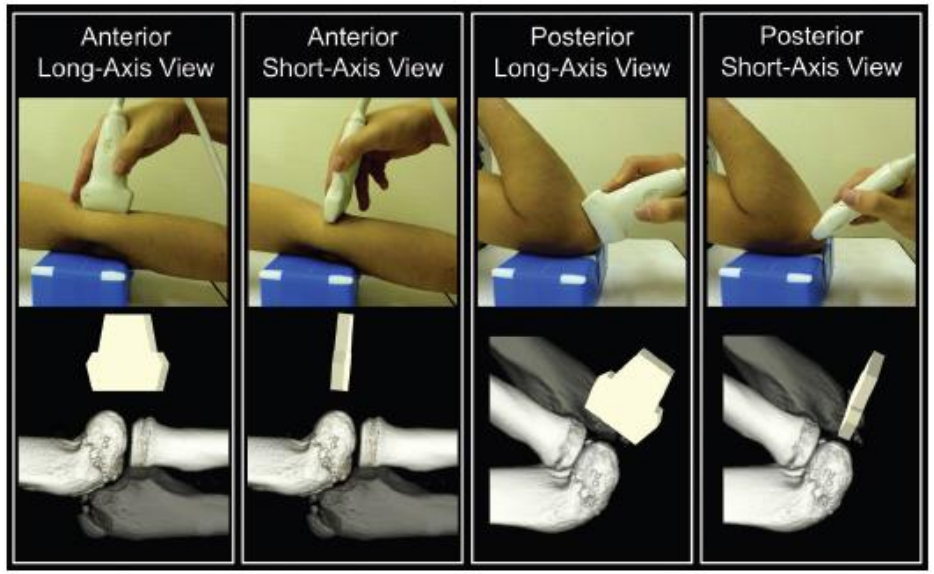
	OR (95% CI)	*P* Value
Age, y	1.16 (1.01, 1.34)	.037[b]
Age introduced to baseball, y	0.88 (0.79, 0.99)	.028[b]
Duration of competitive play, y	1.14 (1.04, 1.23)	.0039[b]

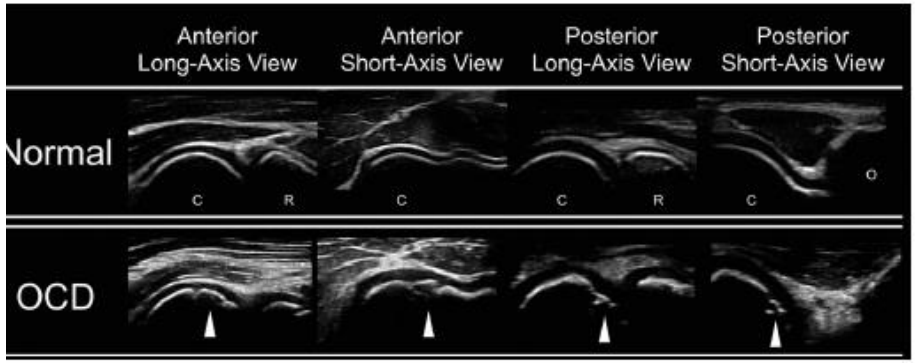
[a]Per each subsequent year. Players, N = 2433; players with OCD, n = 82; rate of OCD, 3.4%. OCD, osteochondritis dissecans; OR, odds ratio.
[b]$P < .05$.


2005:
DOCTERS
DELAY 2.5 Y
2017:
DOCTERS
DELAY 2.0 Y

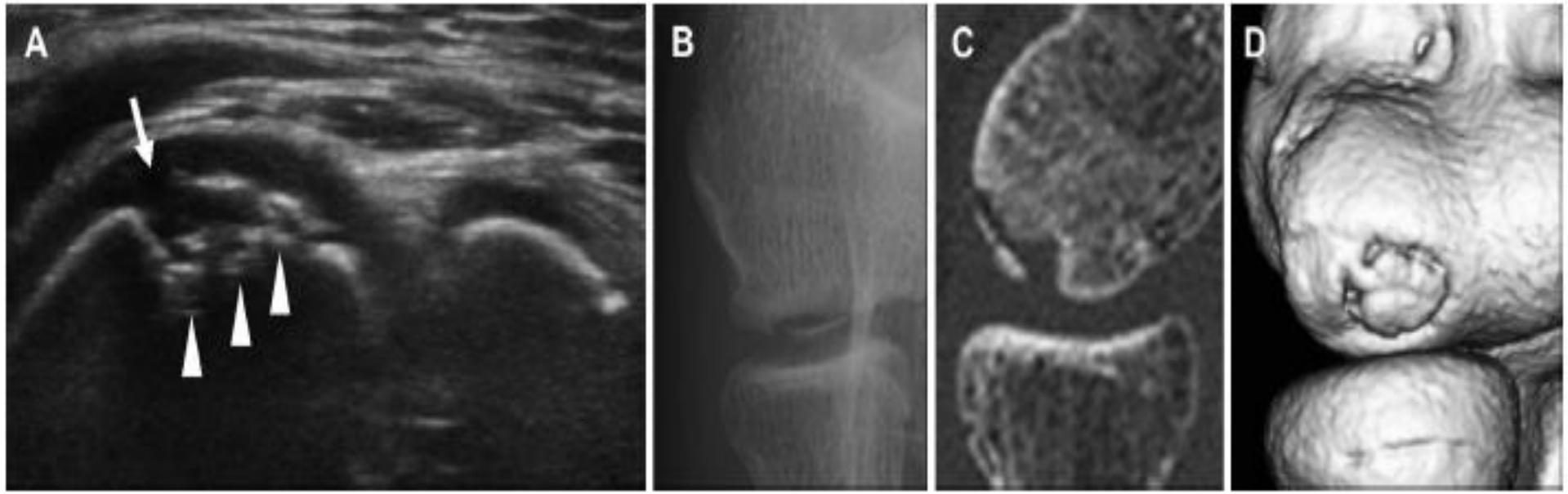
Imaging

- CT


Anterior
Long-Axis View
Anterior
Short-Axis View
Posterior
Long-Axis View
Posterior
Short-Axis View


Anterior
Long-Axis View
Anterior
Short-Axis View
Posterior
Long-Axis View
Posterior
Short-Axis View
Normal
OCD

- Ultrasound


A
B
C
D

t OCD

Inclusion criterion: arthroscopic debridement and microfracture for advanced capitellar OCD not amenable for fixation

N = **71** patients, 41 F, 30 M, 75 elbows (93% follow-up rate)

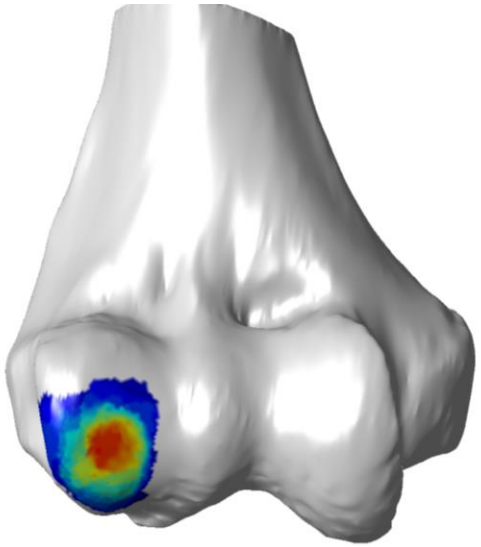
Age = **16** years (SD ± 3.3; range, 11 - 26)

Follow-up length = **3.5** years (SD ± 1.9; range, 1 - 8.2)

Clinical Outcome After Arthroscopic Debridement and Microfracture for Osteochondritis Dissecans of the Capitellum

Rens Bexkens,*†‡§ MD, Kim I.M. van den Ende,† MD, Paul T. Ogink,§‖ MD, Christiaan J.A. van Bergen,† MD, PhD, Michel P.J. van den Bekerom,¶ MD, and Denise Eygendaal,†‡ MD, PhD, Prof.
Investigation performed at the Amphia Hospital, Breda, the Netherlands

The American Journal of Sports Medicine, Vol. XX, No. X
DOI: 10.1177/0363546517704842



Results (I)

- Intraoperative classification
- Grade I: 3 (4%), grade II: 2 (3%), grade III: 10 (14%), grade IV: 1 (1%), grade V: 58 (78%).

- Outcome
- Mean OES at final follow-up = 40.8 (SD ± 8.0)

- Predictors of good outcome:
- Open capitellar physis → 5.6 point OES increase (p = .04)
- Loose body removal (grade IV-V) → 5.8 point OES increase (p = .005)
- Shorter duration of symptoms → 2.4 point OES increase per year (p = .03)

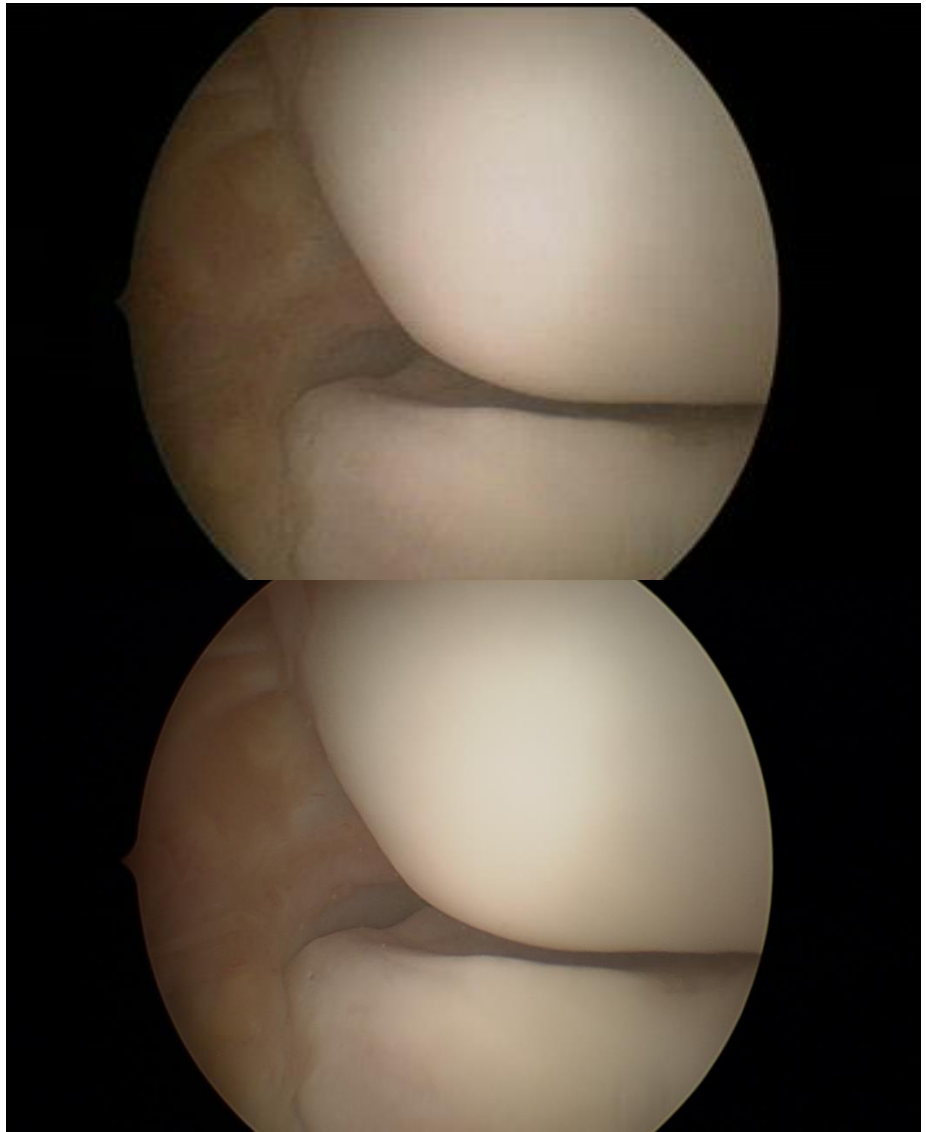
Results (II)

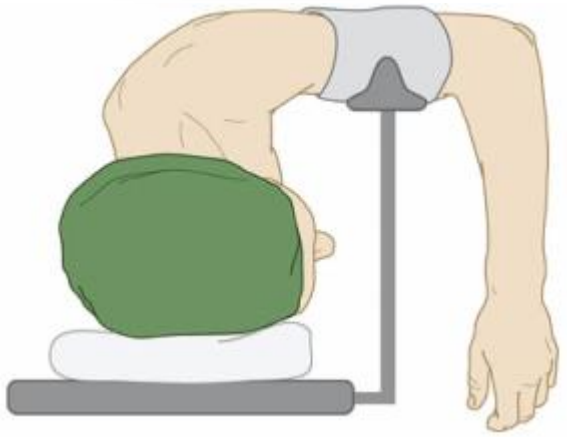
- Range of motion
- Flexion: 134° to 139° ($p < .001$)
- Extension deficit: 9° to 4° ($p < .001$)
- Pronation and supination did not improve.

- Return to sports
- Return to primary sport at previous level: 40 patients (56%)
- Return to lower level: 5 patients (7%)
- No return due to elbow complaints: 17 patients (23%)
- No return due to non-elbow related reasons: 10 patients (14%)

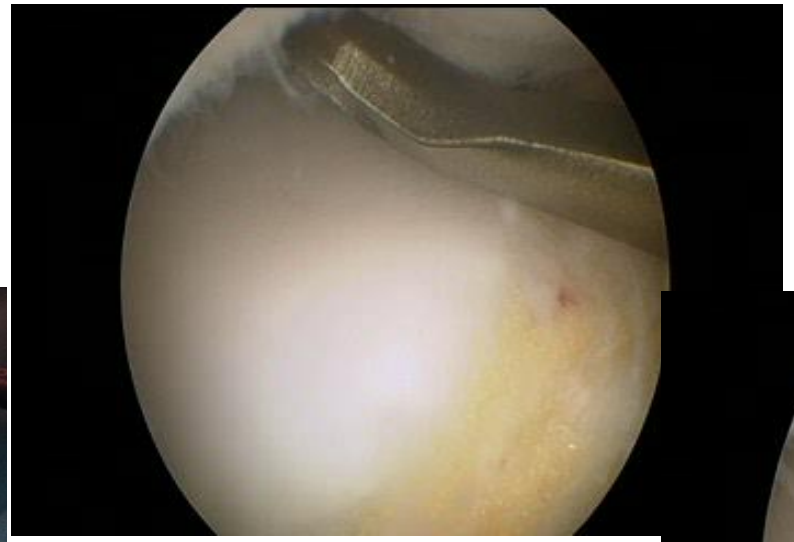
- No permanent complications were recorded.

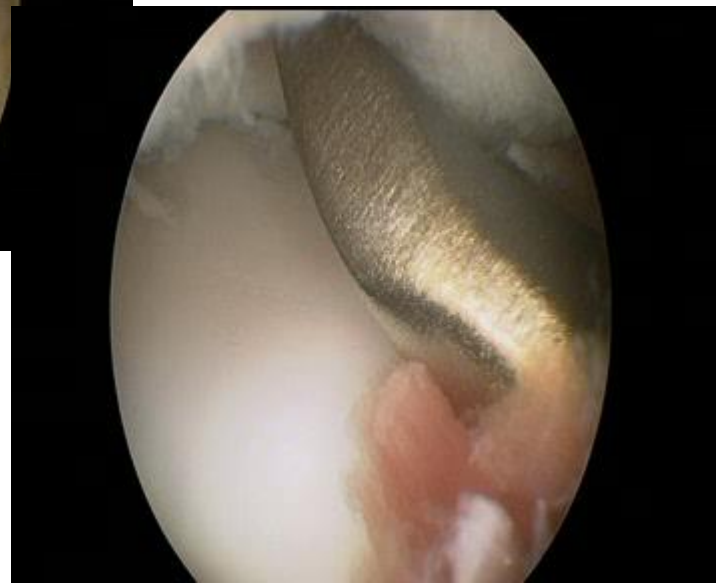
Camera proximal medial





Chondropick softspot portal camera mid- posterior

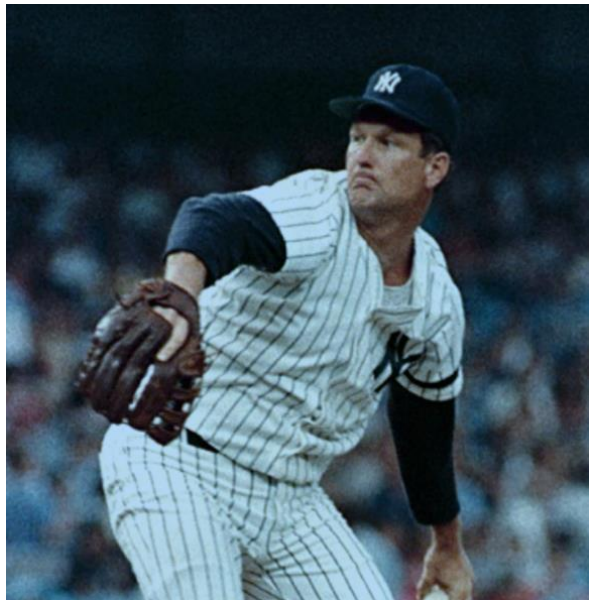




Camera softspot portal
2nd soft-spot portal for shaver

Chronic medial ligament insufficiency: Is Tommy John the name to remember? YESS but not as eponyme!

- New fixation techniques less demanding, but rehab = long
- Misperception in athletes/parents/coaches/media over results
- Return to play is 80%
- ‘ Society support’ for prevention



Conclusion

- MCL ‘corner stone’ of the athletes elbow
- Elbow sports injuries : GIRD! Prevention!
- Sporting kid lateral elbow pain 11-16 has OCD

Conclusion

- OCD lesion of the capitellum is not always visible on X-ray
- CT ‘best’ imaging technique
- Loose bodies are often missed, especially on standard X-rays and MRIs

Thank you!