Highlights of Hip and Knee Societies/AAHKS Specialty Day 2012

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California Orthopaedic Association
2012 Annual Meeting
Carlsbad

Conflicts

- Research support: Biomet, OREF, and Robert Wood Johnson Foundation
- Consultant: Biomet, Smith and Nephew, Zimmer, and Porosteon
- Stock options: Porosteon

Hip Symposium Topics

- Hip Preservation
- Bearing Dilemma
- Diagnosis of Failed MOM
- Registries
- Socket Positioning
- Complications
- Revisions

Hip Outline

- XLPE
- MOM
- Cup Position

John Charnley Award

- “Clinical Multi-centric Studies of the Wear Performance of Highly Cross-linked Re-melted Polyethylene in THR”

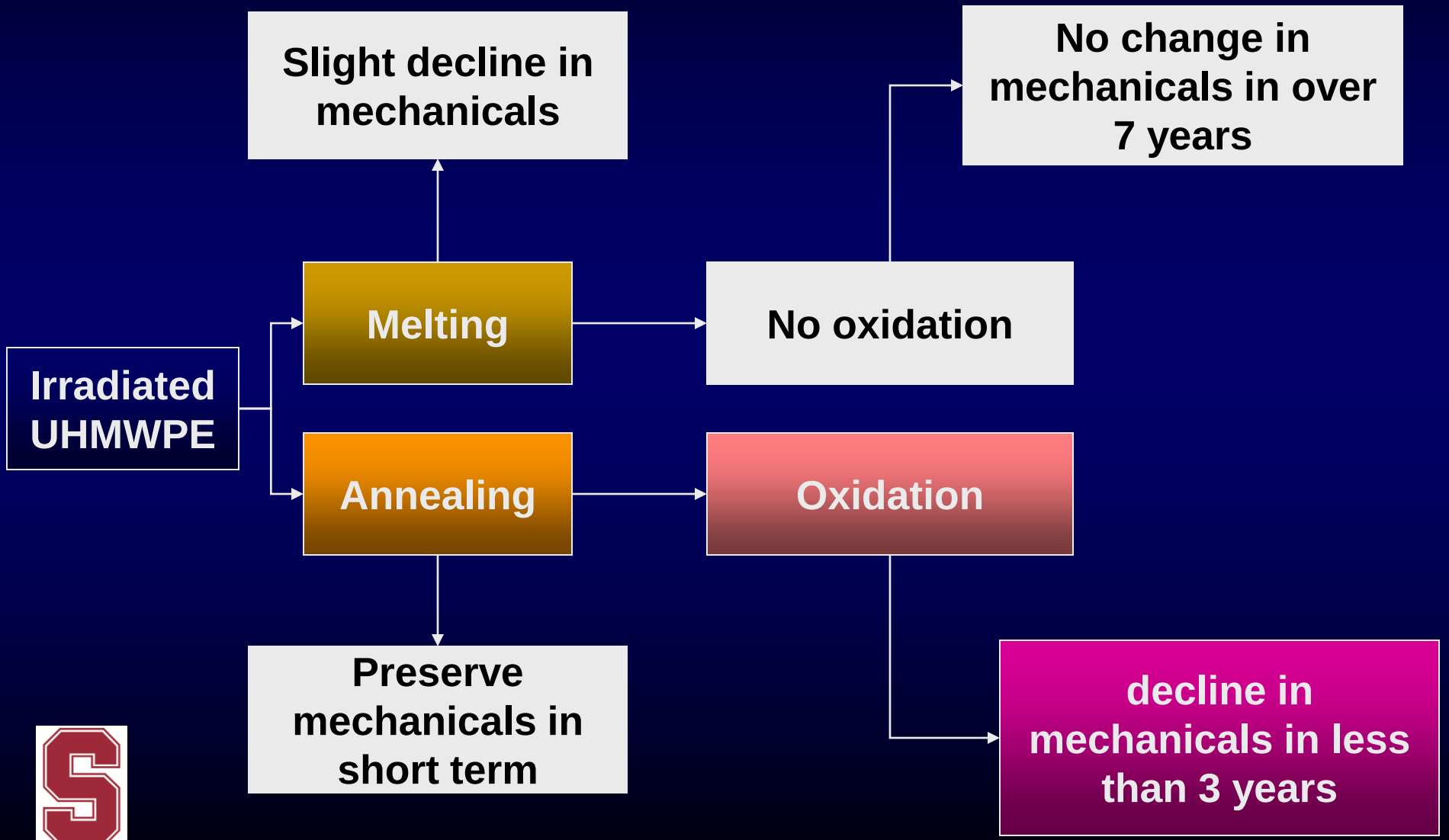
- Bragdon C, Malchau H, et al.

- MGH, Rush, U Chicago, Washington U, Chapel Hill, Albuquerque, Mayo Clinic, Utah Bone and Joint Center, Sahlgrenska U, and Hvidovre Copenhagen U

John Charnley Award

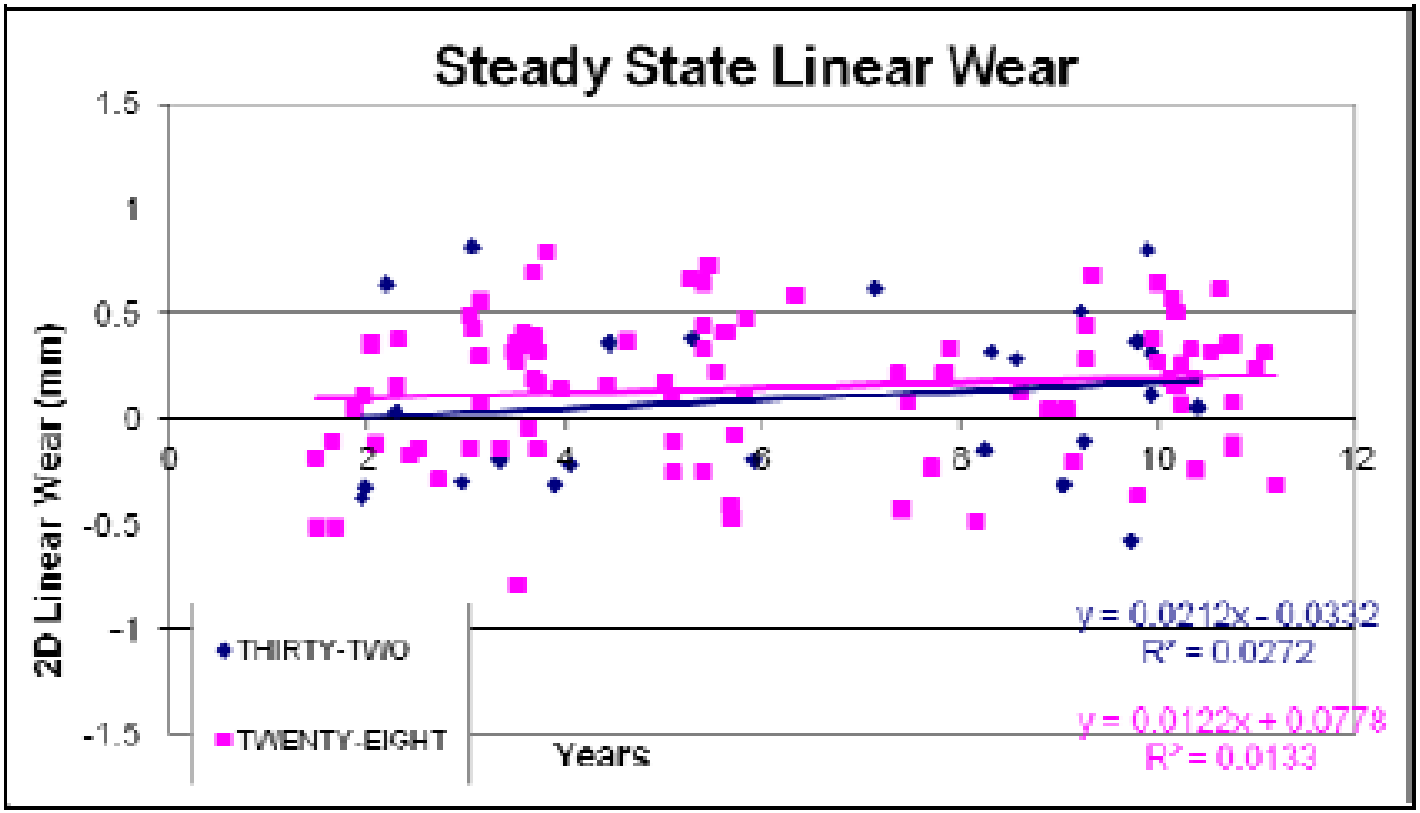
- 900 THA patients, 3 studies, up to 13 years follow-up
- 26, 28, 32, and 36mm heads
- Plain radiographs- NO osteolysis
- Femoral head penetration rate extremely low and did not correlate with time *in vivo*
- Higher wear rates with 36 mm heads, may not be of clinical significance

1st generation XLPEs



Minimum Ten Year Follow-Up of Highly Cross-linked Polyethylene Liners in Total Hip Arthroplasty

+[1]Bragdon, CR; [1]Jarrett, B; [1]Doerner, M; [1]Burke, D; [1]Freiberg, AA; [1]Rubash, HE; [1]Malchau, H
Harris Orthopaedic Laboratory, Massachusetts General Hospital, Boston, MA
cbragdon@partners.org



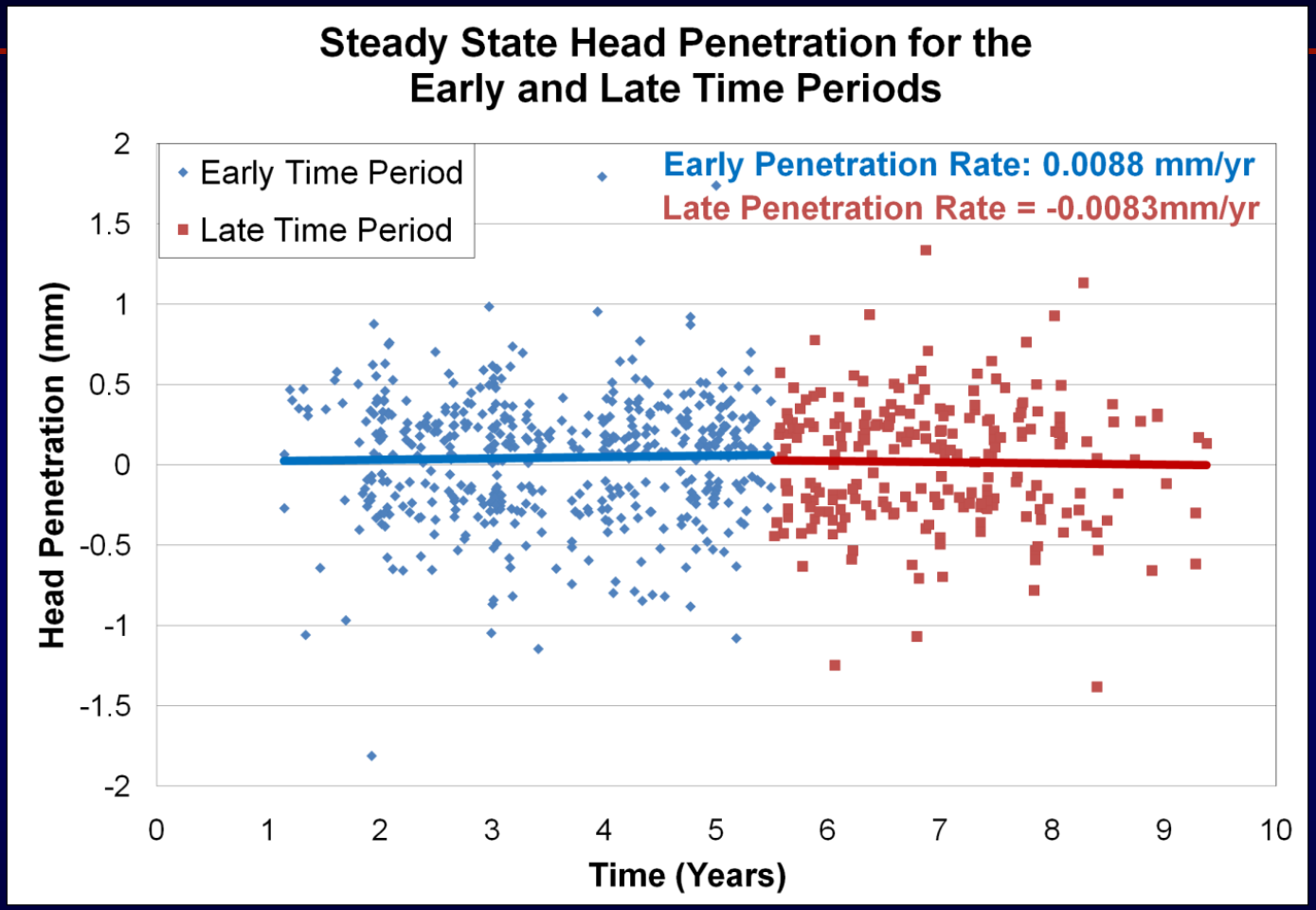
1153, ORS Annual Meeting 2011

Results-Multicenter

- 176 hips
  - Average follow-up: 6.5 ± 1.1 years
    - range 4.5-9.3 years

- 2676 film comparisons
  - 417 film comparisons were excluded
  - Short interval between films of <0.5 years
  - Pelvic rotation between films of >25º
  - Poor film quality

Group Regression

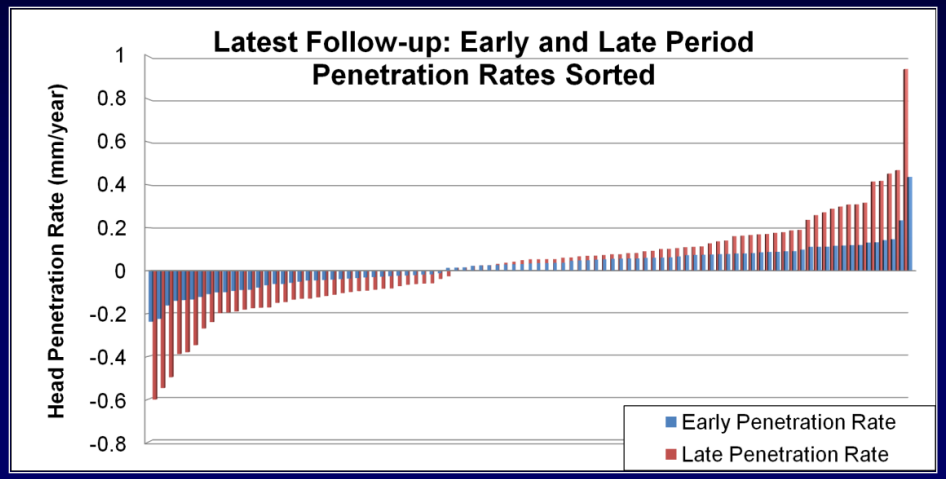


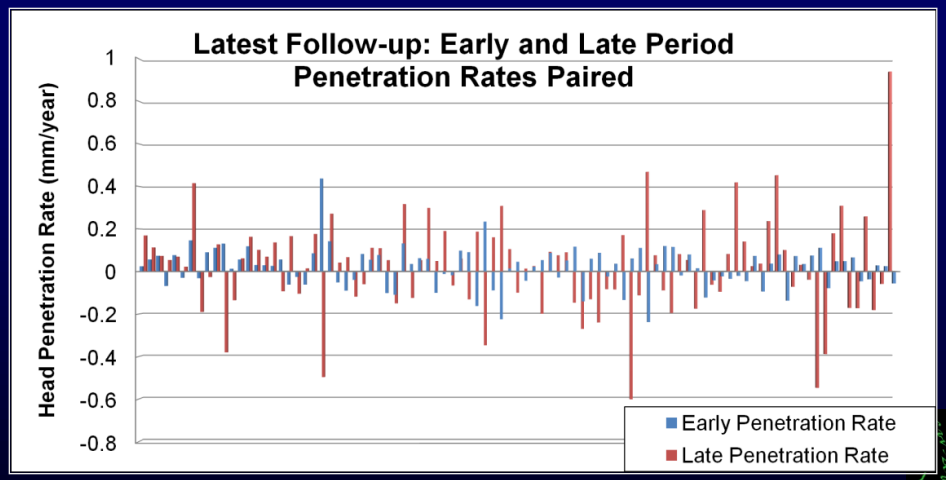
Early period: **8.8** µm/year Late period: **- 8.3** µm/year

(p=0.456)

Individual Latest Follow-up

- 93 hips with paired early and late rates
- Early period
  - **19.6** ± 95 µm/year
- Late period
  - **24.5** ± 226 µm/year
- Student's t-test p=0.848





Conclusions

- No significant increase in femoral head penetration in late period (> 5 years f/u)

Otto Aufranc Award

- “The Interpretation of Metal Ion Levels in Unilateral and Bilateral Hip Resurfacing: Practical Guidelines for Hip Resurfacing Follow-Up”

- De Smet et al., Belgium

Otto Aufranc Award

- Goal: determine “safe” upper limits of ion levels
- 453 unilateral and 139 bilateral resurfacings
- “Well-functioning” group 251 unilateral (55%) and 58 bilateral (42%)
- Majority males in well-functioning group, majority females in “non-optimal” group ($p<0.001$)

Otto Aufranc Award

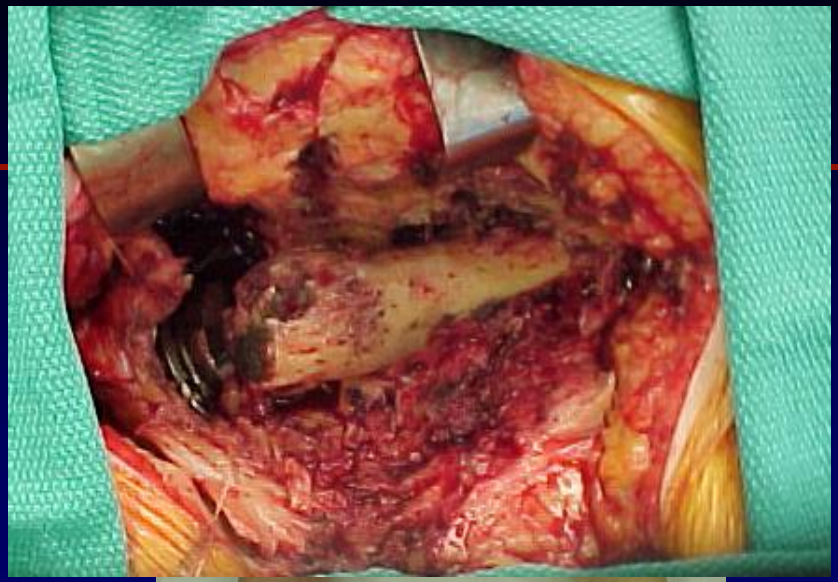
- Optimal group
  - Larger size implants ($p<0.001$)
  - Uni and bilateral lower ion levels ($p<0.001$)
- Safe upper limits
  - Chromium 4.6 µg/l and cobalt 4.0 µg/l for uni
  - Chromium 7.4 µg/l and cobalt 5.5 µg/l for bilateral
  - Uni ion levels lower than bilateral ($p<0.001$)

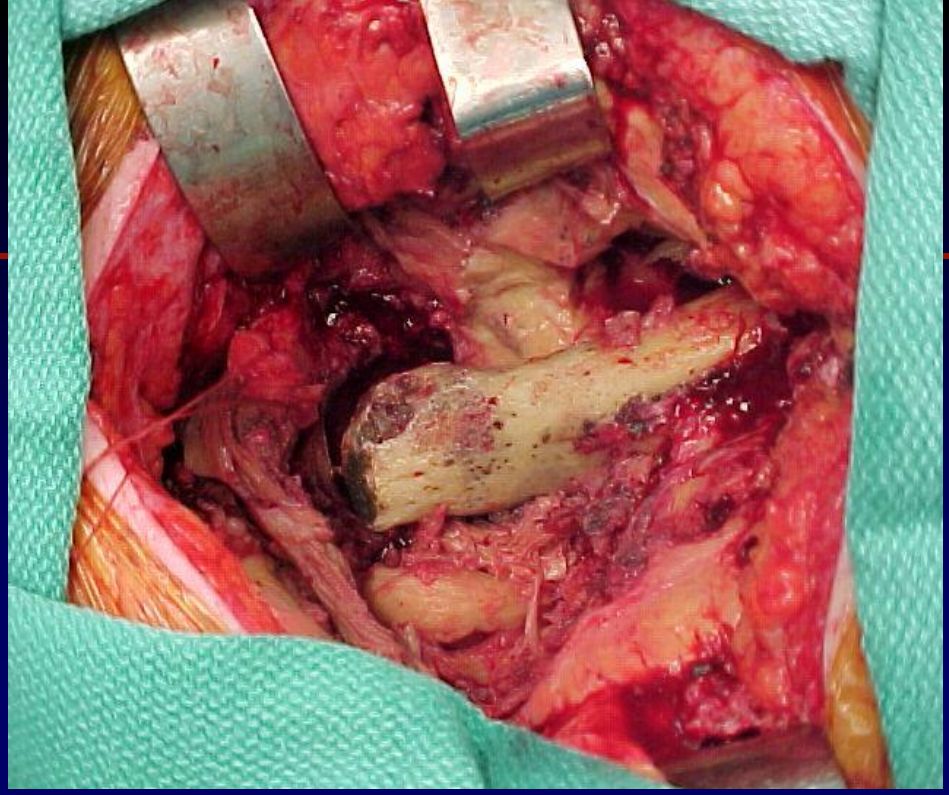
Otto Aufranc Award

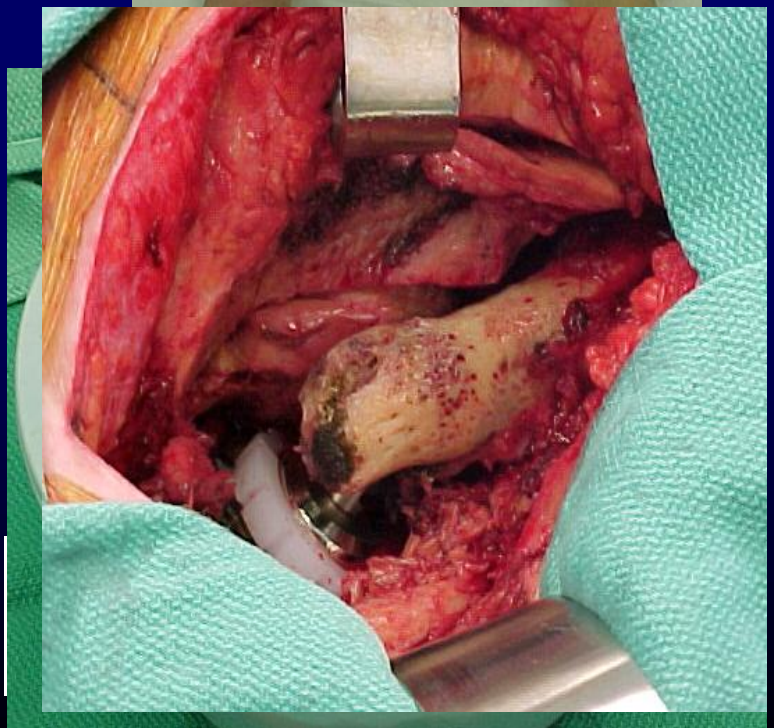
- Use of upper limits in predicting poor function:
  - Specificity >95%
  - Sensitivity ≤ 25%

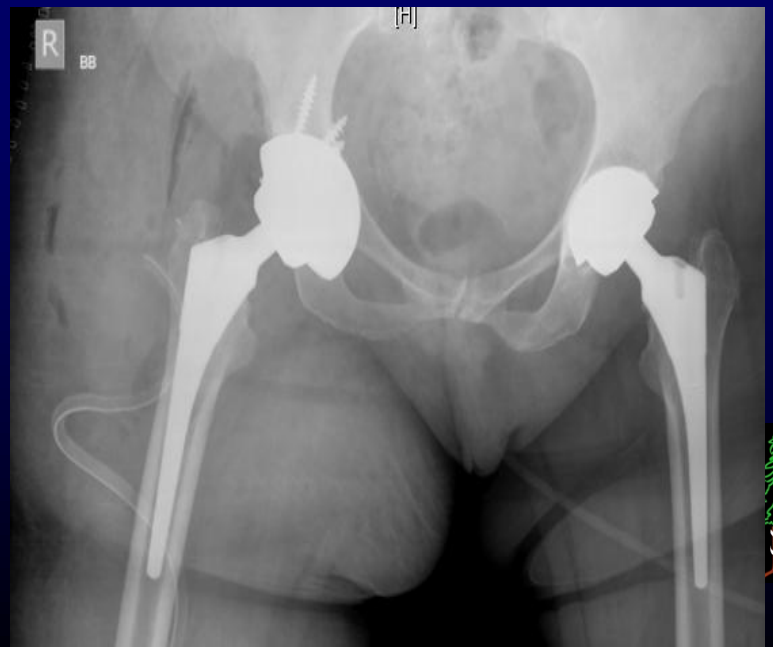
Diagnosis of Failed MOM

- Blood work
  - Serum/whole blood cobalt and chromium levels
  - www.orthopaedicanalysis.com
  - ESR/CRP
- Imaging
  - MARS MRI
  - Ultrasound
- Aspiration r/o infection

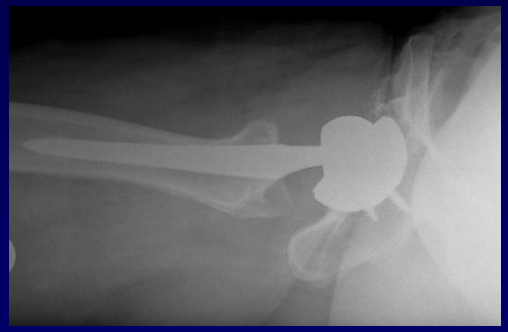


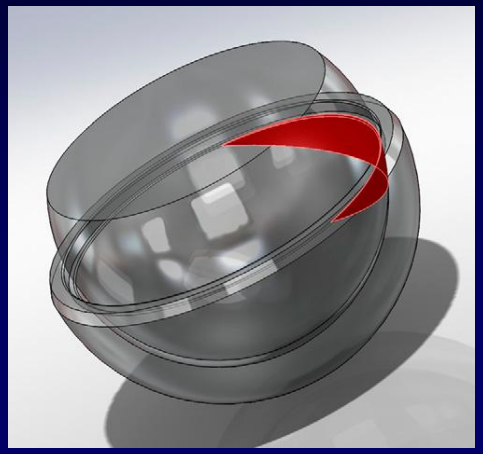





R
BB

Cobaltism





Arthroprosthetic Cobaltism: Neurological and Cardiac Manifestations in Two Patients with Metal-on-Metal Arthroplasty

A Case Report

By Stephen S. Tower, MD*

Investigation performed at the Anchorage Fracture and Orthopedic Clinic, Anchorage, and the Alaska WWAMI Biomedical Program, Anchorage, Alaska

Stephen S. Tower
J Bone Joint Surg Am. 2010;92:2847-2851. published Oct 29, 2010; doi:10.2106/JBJS.J.00125

Cobaltism

- 54 yo F primary THA for OA 2006
- Pain free after 3 months
- Several “squeaking” episodes at 6 months, none since
- Severe, constant groin, trochanteric and buttock pain last few years
- Fatigue, vertigo, heart palpitations and flutters, headache, shortness of breath, nose bleeds, tingling in bilateral hands and feet, tinnitus, and general irritability

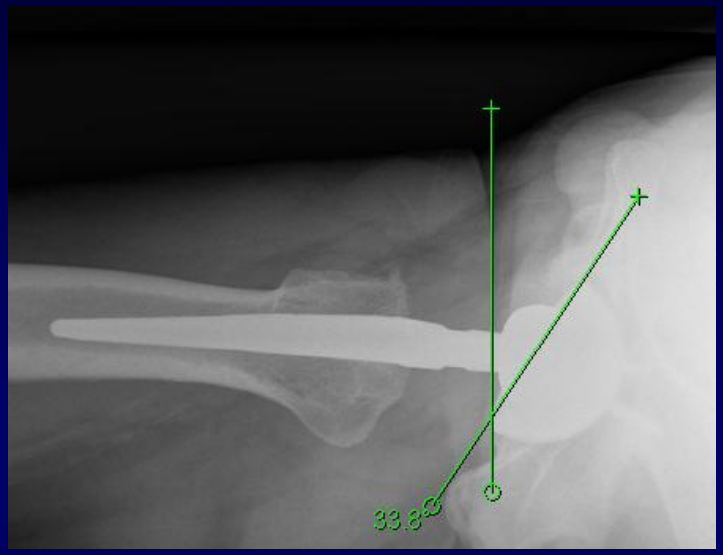
Cobaltism

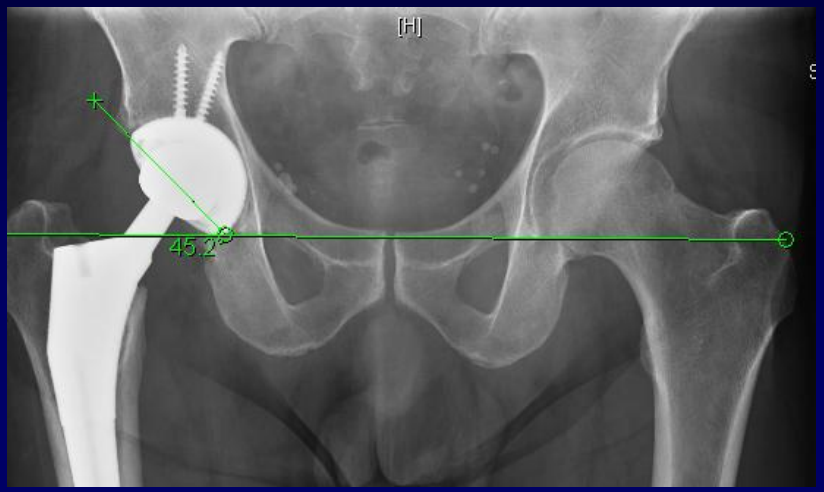
- Aspiration 1-2011: 7 cc brownish fluid, cx neg
- Serum cobalt: 167 ppb
- Serum chromium: 120 ppb
- Serum creatinine 0.9 mg/dl
- Operative findings 4-2011: extensive metallosis with brown fluid, implants osseointegrated and osteolysis @ socket rim
- Cup revised because unable to remove 36 mm ID Pinnacle metal liner after 20 minutes

Socket Positioning

- Great unsolved problem in THA today
- “Cup Positioning in THA Improves with Clinical Feedback”- MGH group
  - Abduction improved ($p<0.01$)
  - Anteversion worsened ($p<0.01$)
  - Sweet spot improved 7% ($p=0.01$)
- Hip Sextant- Steve Murphy, MD
- Robot- Larry Dorr, MD
  - 4 degrees

“Safe Zone”





anteversion
0^0-30^0

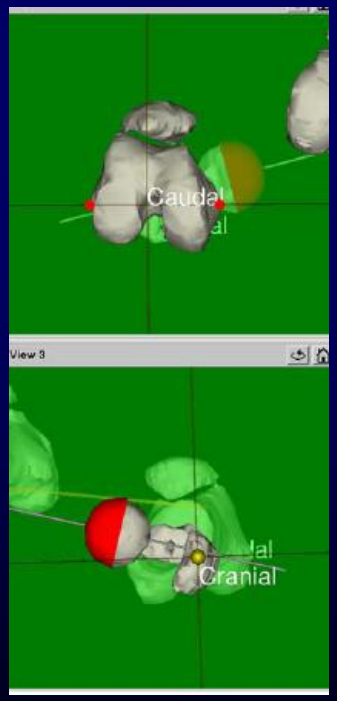
abduction
inclination
30^0-50^0

Kummer FJ, J Arthroplasty 1999
Lewinnek GE, JBJS-A 1978
Widmer KH, J Orthop Res 2004

Combined Anteversion

McKibbin B. Anatomical factors in the stability of the hip joint in the newborn. *J Bone Joint Surg Br.* 1970;52:148–159.

- Sum of acetabular and femoral anteversion
- Infant cadavers
- 30^0-40^0 acetabular anteversion
- 15^0 femoral anteversion
- Prevent impingement
  - dislocation, wear, liner fracture, and pain



Combined Anteversion

Ranawat CS, Maynard MJ. Modern Techniques of Cemented Total Hip Arthroplasty. *Tech Orthopedics.* 1991;6:17–25.

"Ranawat Sign"

- 25^0-30^0 men
- Up to 45^0 women

Widmer KH, Zurfluh B. Compliant positioning of total hip components for optimal range of motion. *J Orthop Res.* 2004;22: 815–821.

- Finite element analysis
- 37^0 optimal

Combined Anteversion

Combined Anteversion Technique for Total Hip Arthroplasty

Lawrence D. Dorr MD, Aamer Malik MD,
Manish Dastane MD, Zhinian Wan MD

Clin Orthop Relat Res (2009) 467:119–127

- 25^0- 50^0
- anterior dislocations only when > 50^0

- Individual variation!

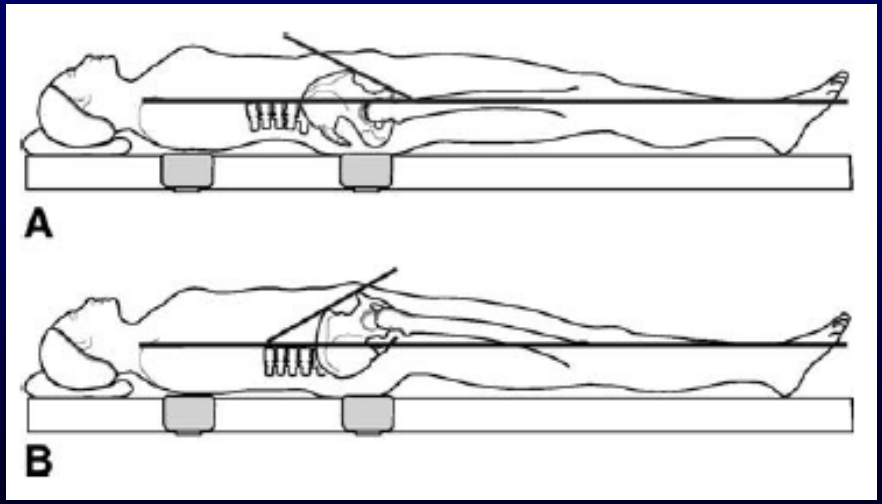
Pelvic Tilt

Quantification of Pelvic Tilt in Total Hip Arthroplasty

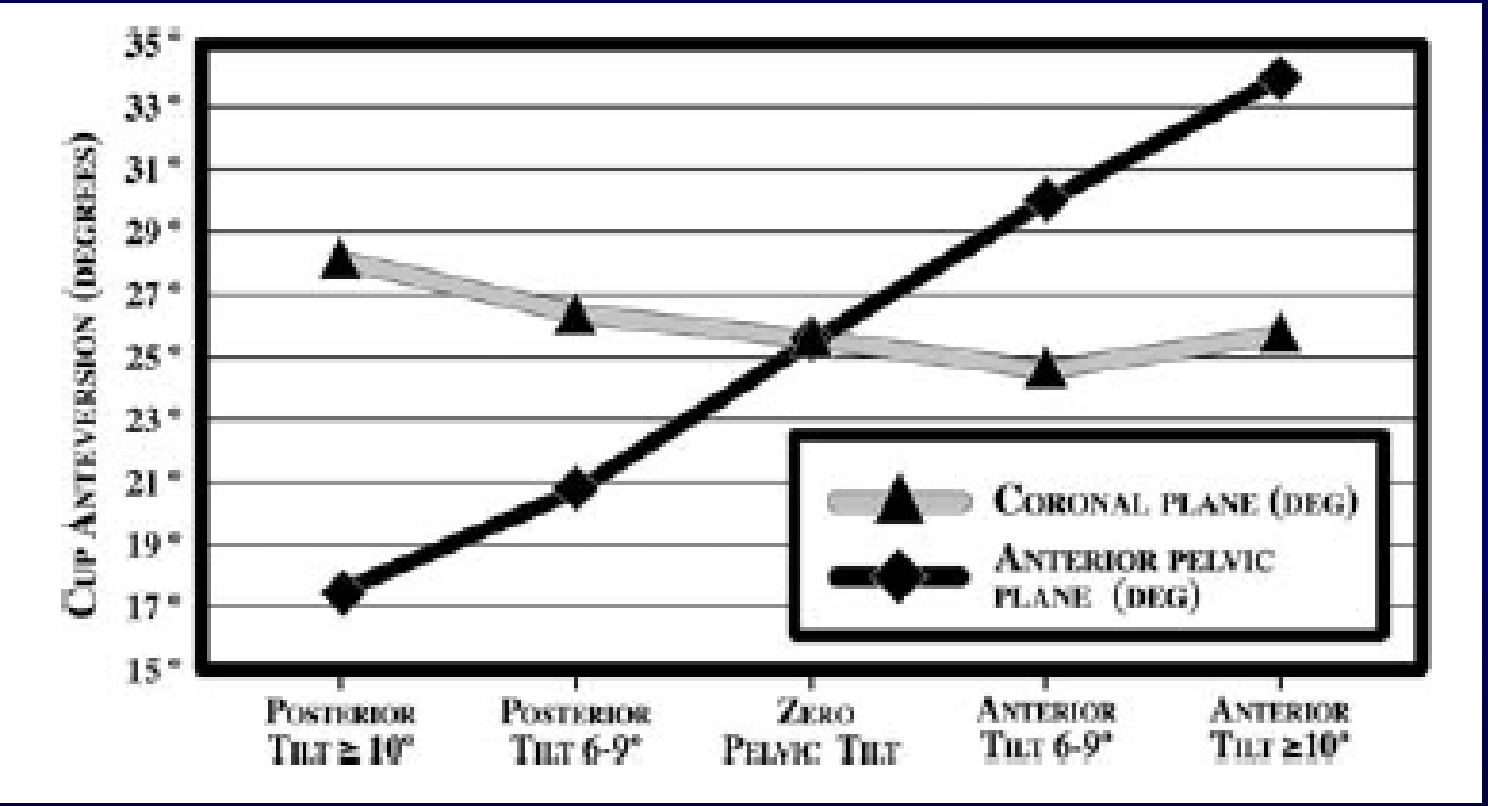
Jinjun Zhu MD, Zhinian Wan MD, Lawrence D. Dorr MD

Clin Orthop Relat Res (2010) 468:571–575

- 477 hips, lateral decubitus
- Range 20^0 anterior to 25^0 posterior
- 6% had zero tilt
- 50% 1^0- 5^0
- 25% 6^0- 9^0



Pelvic Tilt


Cup Anteversion (Degrees)
35°
33°
31°
29°
27°
25°
23°
21°
19°
17°
15°
Coronal Plane (Deg)
Anterior Pelvic Plane (Deg)
Posterior Tilt ≥ 10°
Posterior Tilt 6-9°
Zero Pelvic Tilt
Anterior Tilt 6-9°
Anterior Tilt ≥10°

Prevalence

Clin Orthop Relat Res (2011) 469:319–329
DOI 10.1007/s11999-010-1487-1

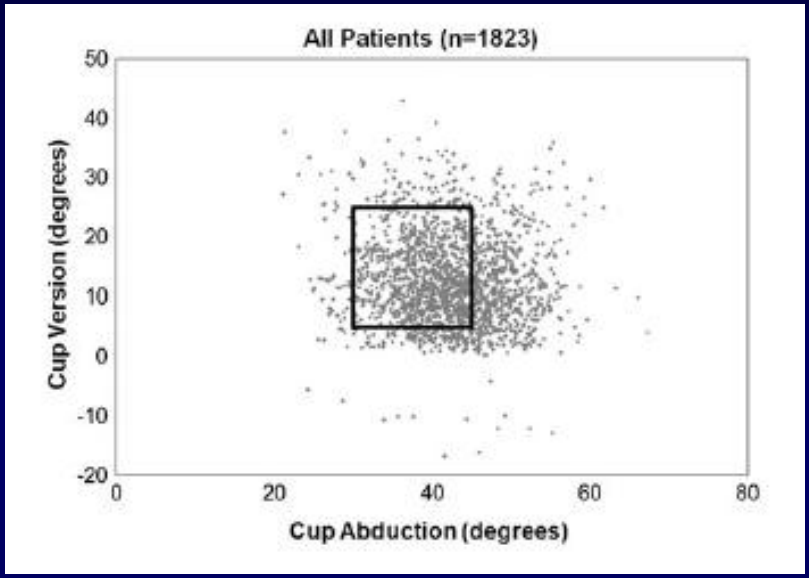
SYMPOSIUM: PAPERS PRESENTED AT THE HIP SOCIETY MEETINGS 2010

The John Charnley Award

Risk Factors for Cup Malpositioning

Quality Improvement Through a Joint Registry at a Tertiary Hospital

Mark C. Callanan MA, Bryan Jarrett BS, Charles R. Bragdon PhD, David Zurakowski PhD, Harry E. Rubash MD, Andrew A. Freiberg MD, Henrik Malchau MD, PhD



Surgeon volume			
High	1619	827 (51.1%)	792 (48.9%)
Low	264	90 (34.1%)	174 (65.9%)

Risk Factors- MGH

Table 4. Odds ratios for increased risk of malpositioning

Factor	Odds ratio (95% confidence interval)		
	Abduction	Version	Abduction and version
Body mass index (obese versus not obese)	1.33 (1.1–1.6)	1.35 (1.0–1.8)	1.35 (1.1–1.7)
Head size			
32 mm versus > 32 mm		*	
< 32 mm versus > 32 mm		†	
Approach			
Anterolateral versus posterolateral	1.81 (1.5–2.3)	2.05 (1.5–2.7)	2.02 (1.6–2.5)
Direct lateral versus posterolateral	*	2.17 (1.0–4.7)	†
Minimally invasive surgical versus posterolateral	4.81 (3.0–7.7)	1.76 (1.0–3.0)	6.10 (3.5–10.7)
Surgeon volume (low versus high)	1.41 (1.1–1.9)		2.07 (1.5–2.8)

* Comparison not significant ($p > 0.70$); †comparison not significant ($p > 0.07$); variable not significant.

Prevalence

Table 6. Comparison of results to recent literature

Authors	Number of hips	Average abduction angle	Average version angle	% of optimally positioned cups	Factors affecting position	Factors NOT affecting position
Bosker et al. [5]	200	49.7° ± 6.7°	16 ± 8.1	85.2% (30–50° abduction criteria), 82.7% (5–25° anteversion criteria), 70.5% combined, 21.5% (± 5°)	Surgeons versus residents (abduction only)	BMI, gender, (un)cemented fixation, surgical approach
Leichtle et al. [24]	950	48.7° ± 7° (28°–75°)	18.6 ± 9 (−9–50)	22.7% (45 ± 5° abduction, 20 ± 5° version), 65.5% (± 10°)		Surgeon qualifications, implanted model, operated side
Myers et al. [36]	64 (BHR)	37.5° (56°–50°) for posterior approach 43° (30°–56°) for lateral approach				Surgical approach
Pirard and DeLint [44]	323					BMI
Reize et al. [45]	85			41% (30–50° abduction, 5–25° abduction criteria)		Surgical experience
Saxler et al. [48]	105	45.8° ± 10.1° (23°–71.5°)	27.3° ± 15 (−23.5°–59°)	25.7% (30–50° abduction, 5–25° abduction criteria)		
Todkar [53]	111	44.5°, 46.8°, 44° for healthy, overweight, obese	11.6°, 12.2°, 10.7° for healthy, overweight, obese			BMI
Callanan et al. [current study]	1952	42.2° ± 6.8° (21°–73°)	12.7° ± 7.4° (−17°–43°)	62% (30–45° abduction), 79% (5–25° version), 47% combined	BMI, surgeon volume, surgical approach, head size (version alone)	Age, gender, cup outer diameter, (un)cemented fixation, diagnosis, primary/revision

Dislocation

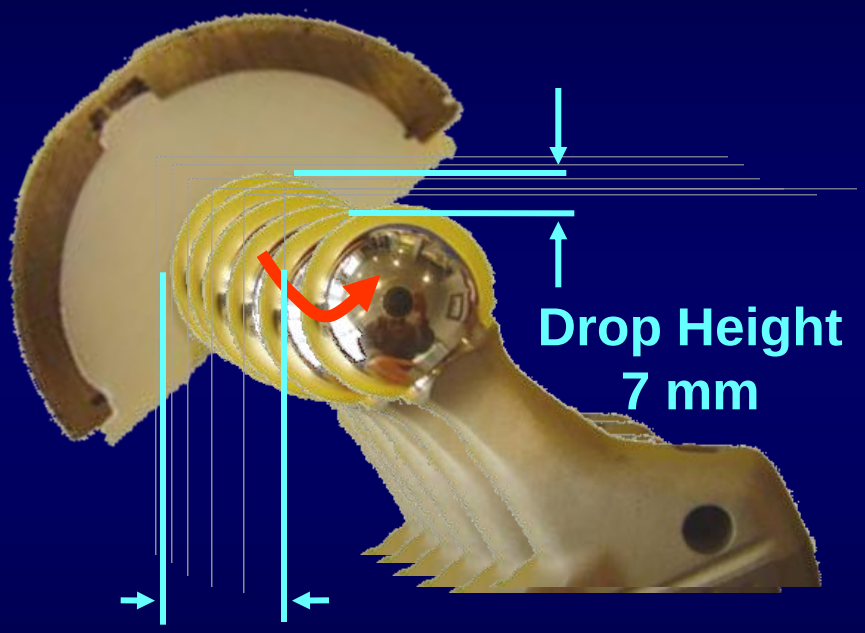
- Dislocation
  - Biedermann R, JBJS-B 2005
  - Ali Khan MA, JBLS-B 1981
  - Kelley SS, Clin Orthop Rel Res 1998
  - Kummer FJ, J Arthroplasty 1999
  - Lewinnek GE, JBJS-A 1978
  - Morrey BF, Clin Orthop Rel Res 1997
  - Newington DP, JBJS-B 1990
  - Pederson DR, Med Eng Phys 2005
  - Widmer KH, J Orthop Res 2004

22.5%

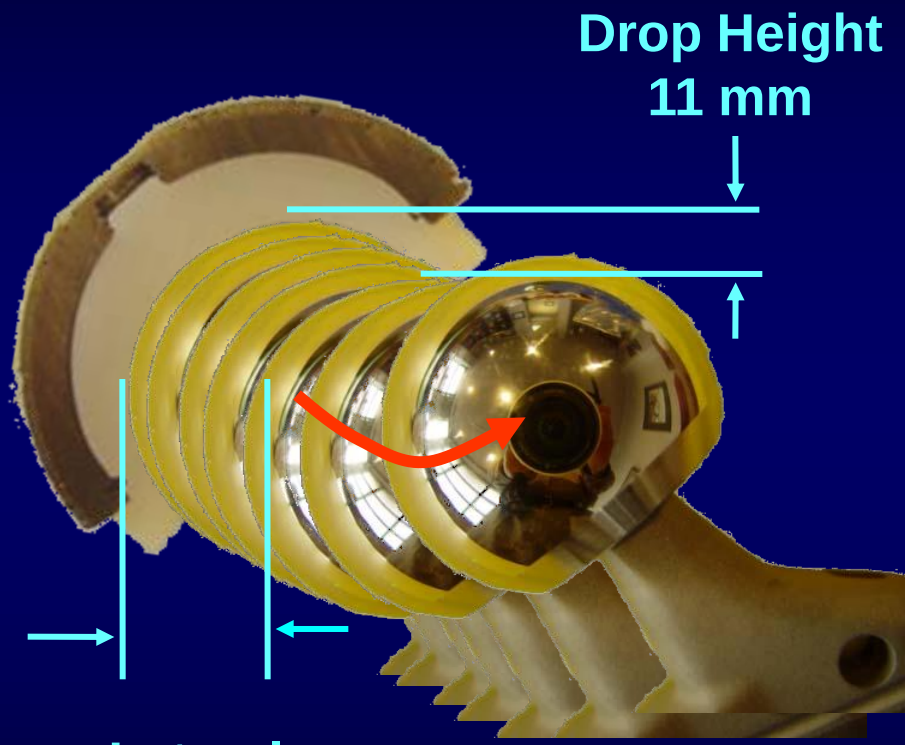
Medicare revisions 2006
$504 million charges /year
$200 million pay out /year
Bozic et al., JBJS-A, 2009

@ 45 degrees of cup abduction

22 mm Head Dislocation



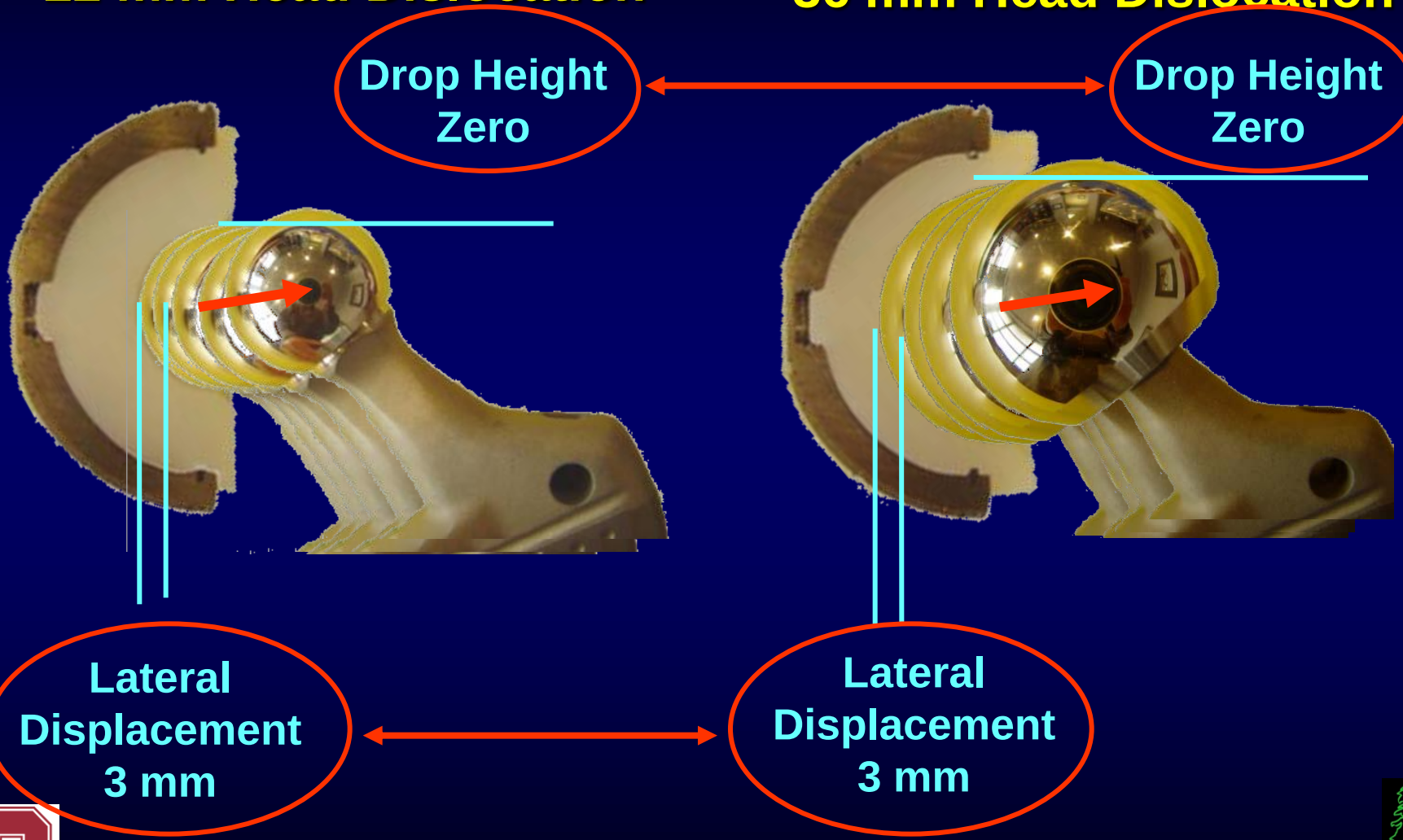
36 mm Head Dislocation



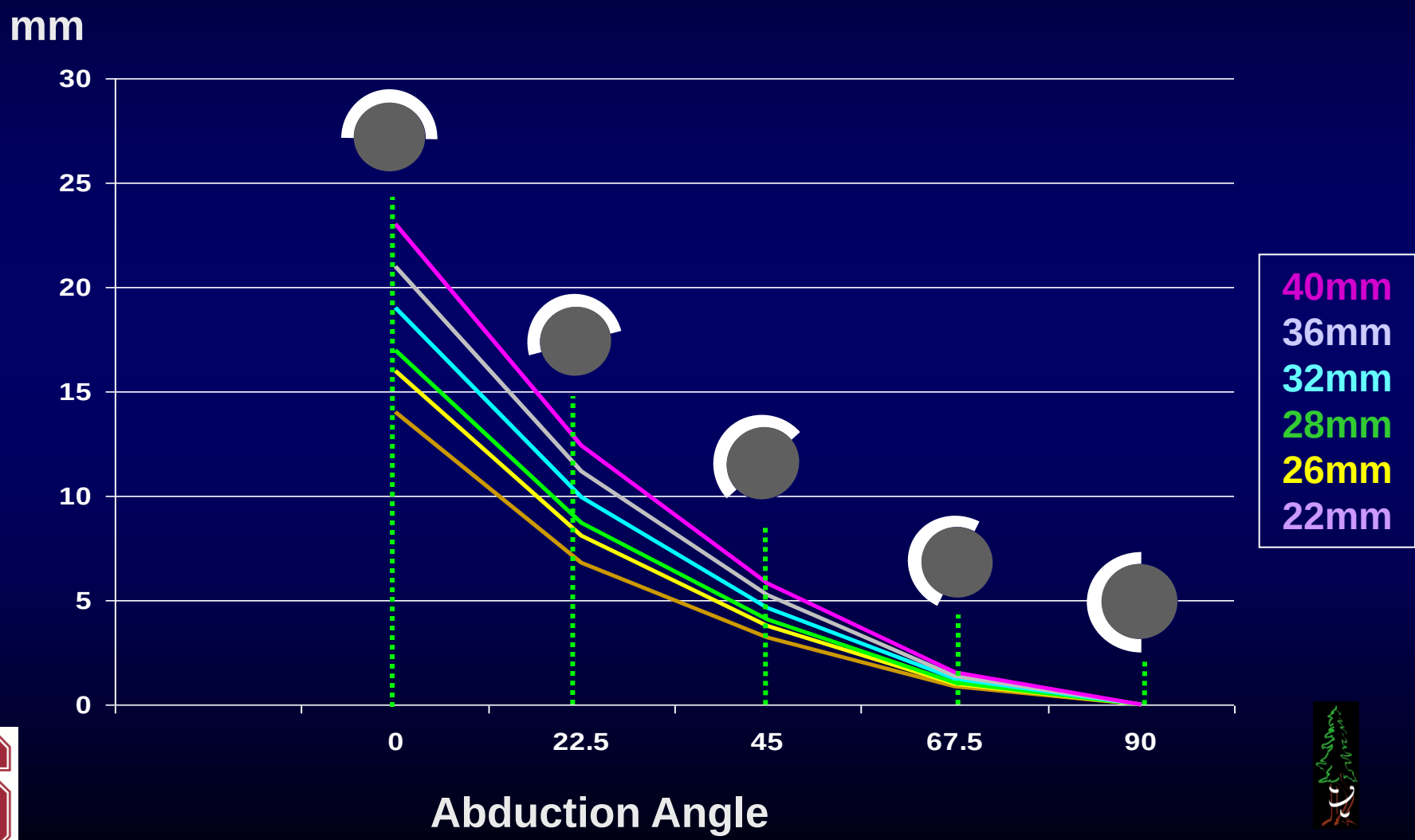
@ 90 degrees of cup abduction

22 mm Head Dislocation

36 mm Head Dislocation



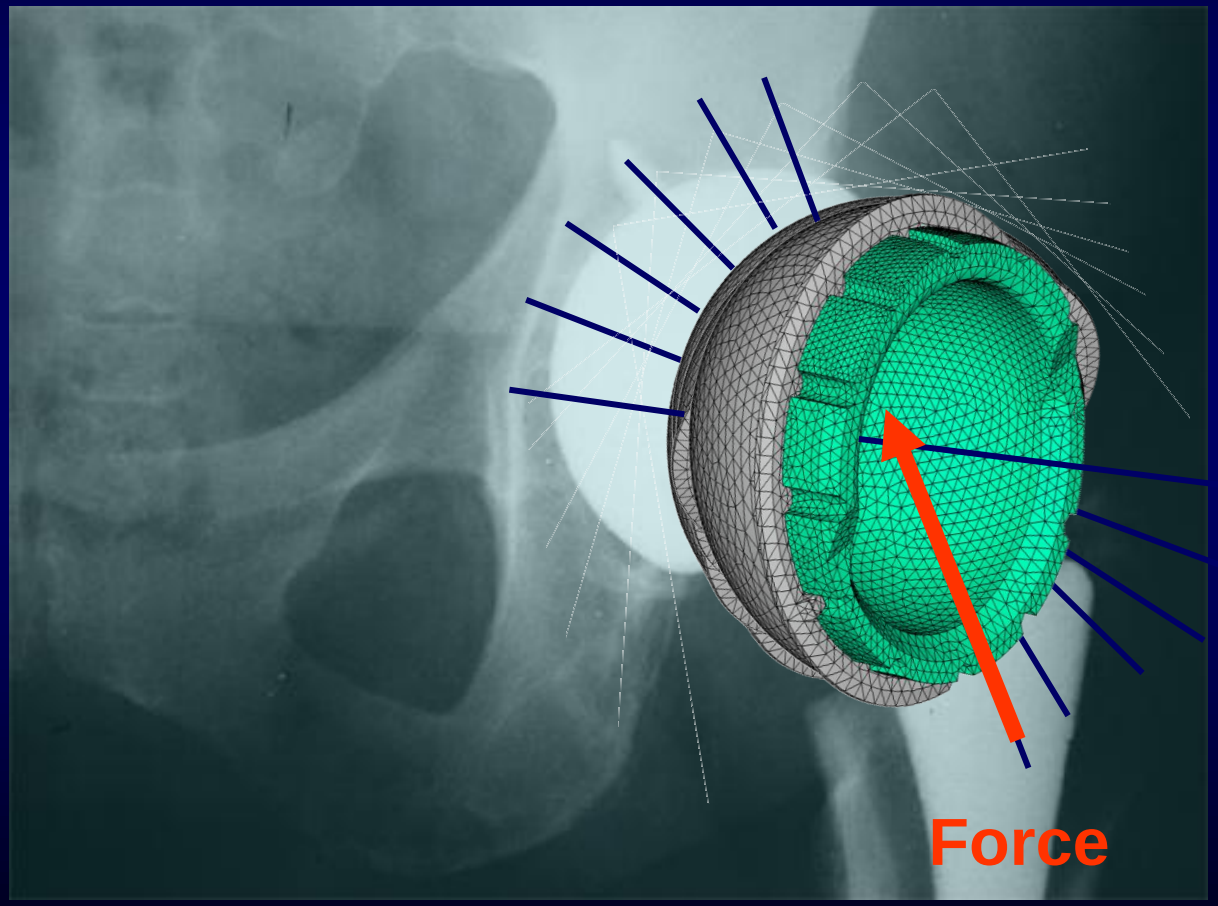
Femoral Head Drop Height Before Dislocation



Impingement

- Impingement- liner cracking
  - Shon WY, J Arthroplasty 2005
  - Ali Khan MA, JBJS-B 1981
  - Widmer KH, J Orthop Res 2004
  - Yamaguchi M, J Arthroplasty 2000

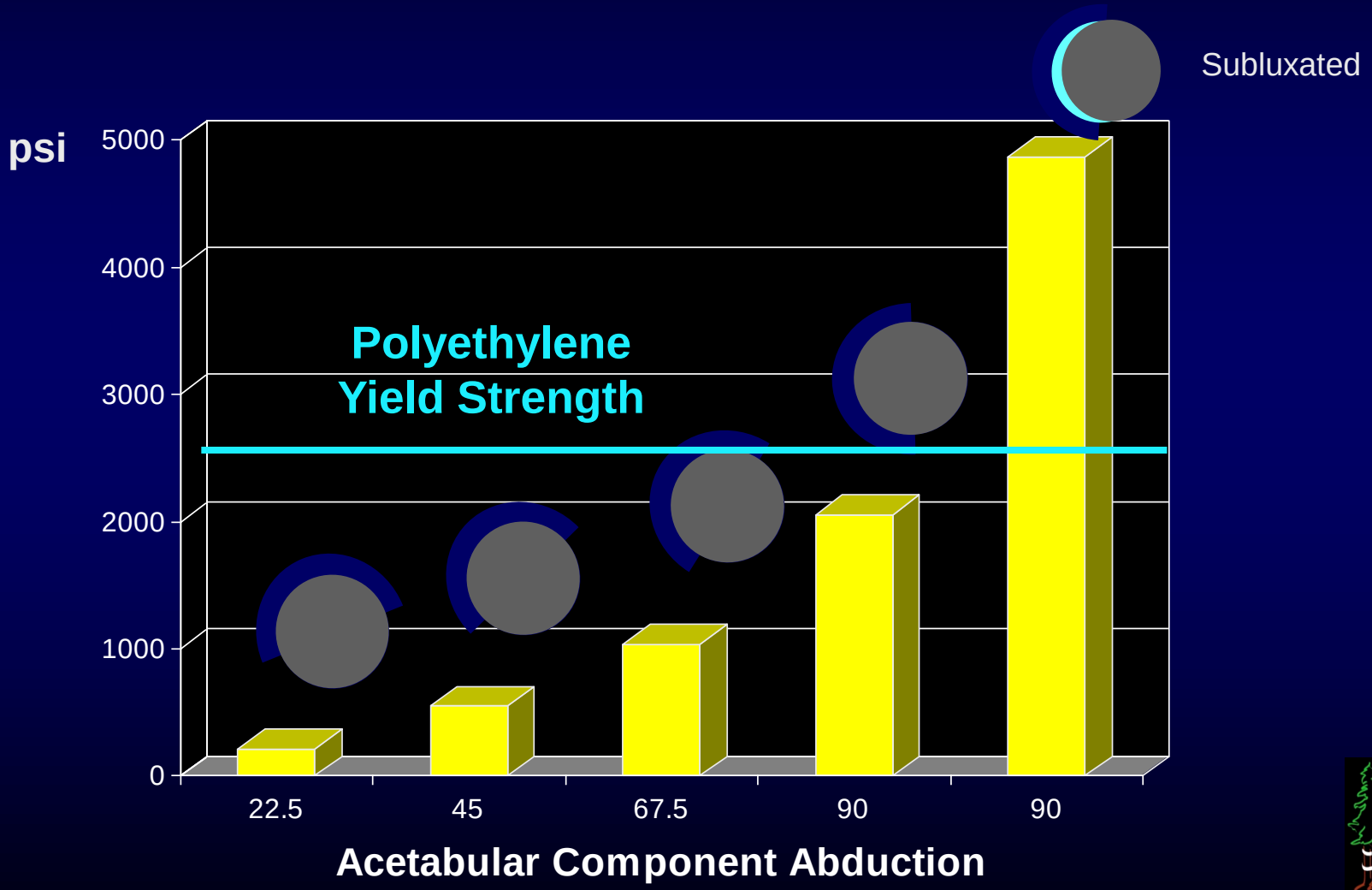
Acetabular Component Stress Analysis



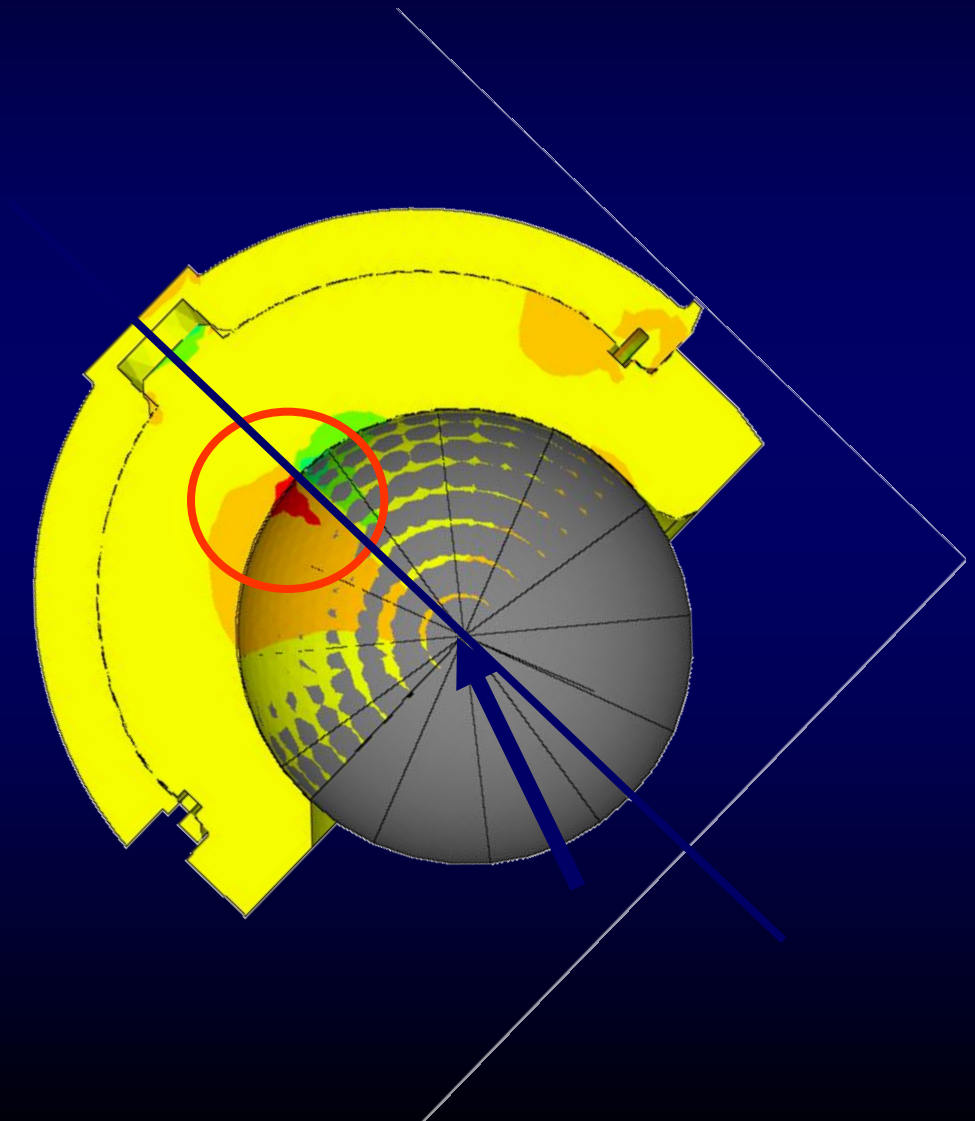
40mm Head Changing Abduction Angle

Cup Position And Polyethylene Stress

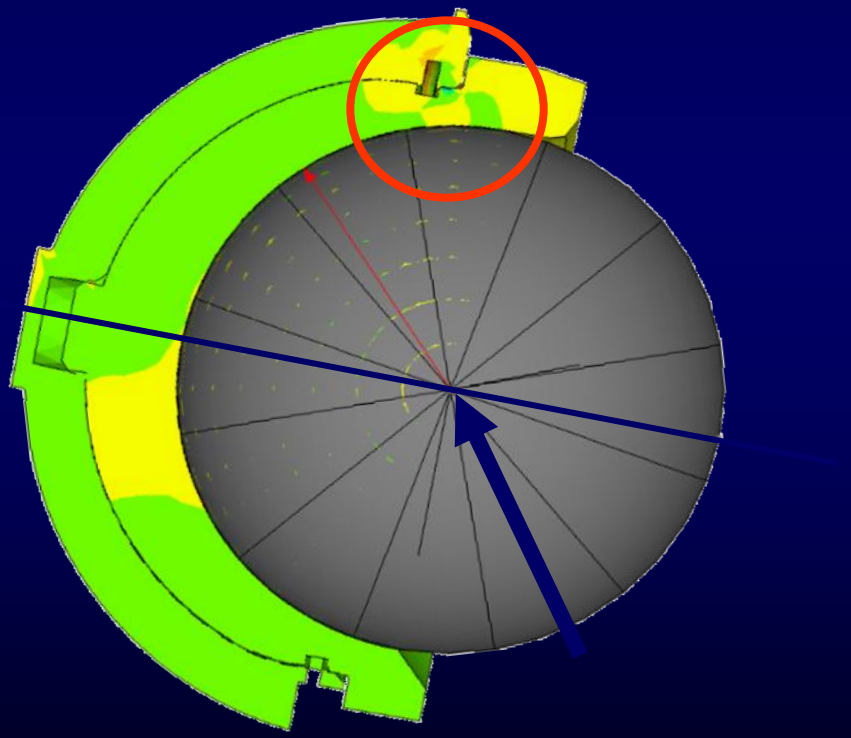
40mm Head, 58mm Cup, 600 lbs Joint Load



At 45 of abduction the maximum polyethylene tension occurs on the articular surface



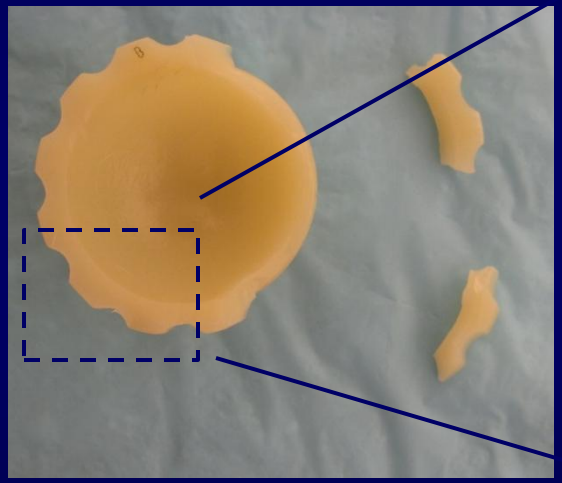
With high abduction orientation the maximum polyethylene tension occurs at the shell edge



Vitamin E Stabilized XLPE

- 55 yo F
  - RA, primary THA 1996
  - Revised 2008 osteolysis
  - 45^0 abduction and 44^0 anteversion
  - 36mm +5 offset vitamin E infused liner

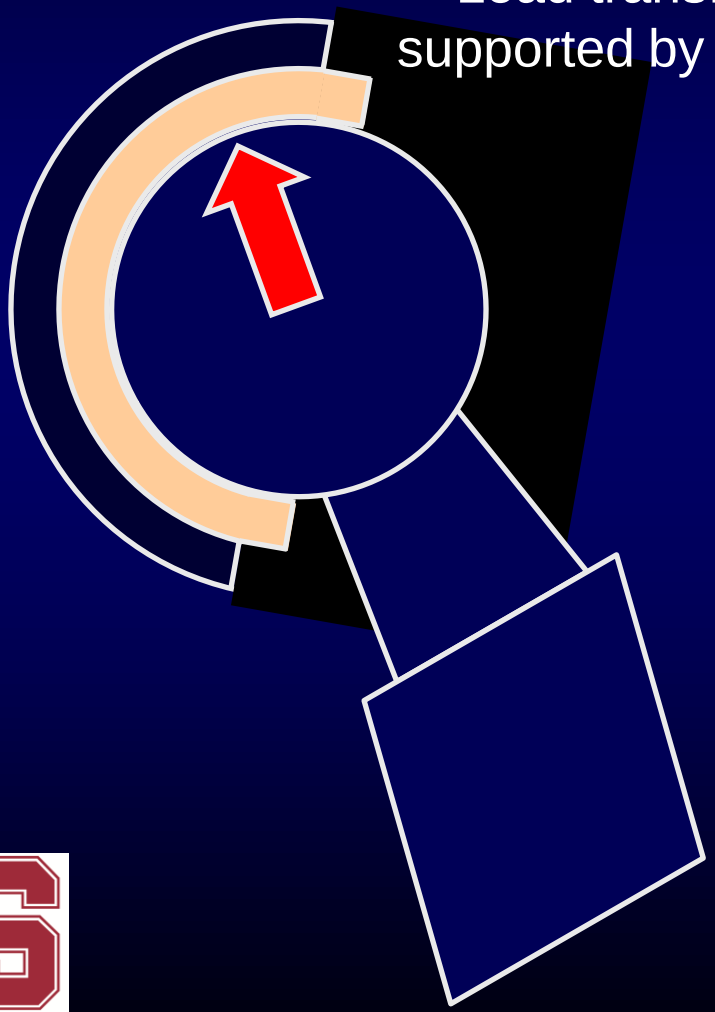
Liner Fracture

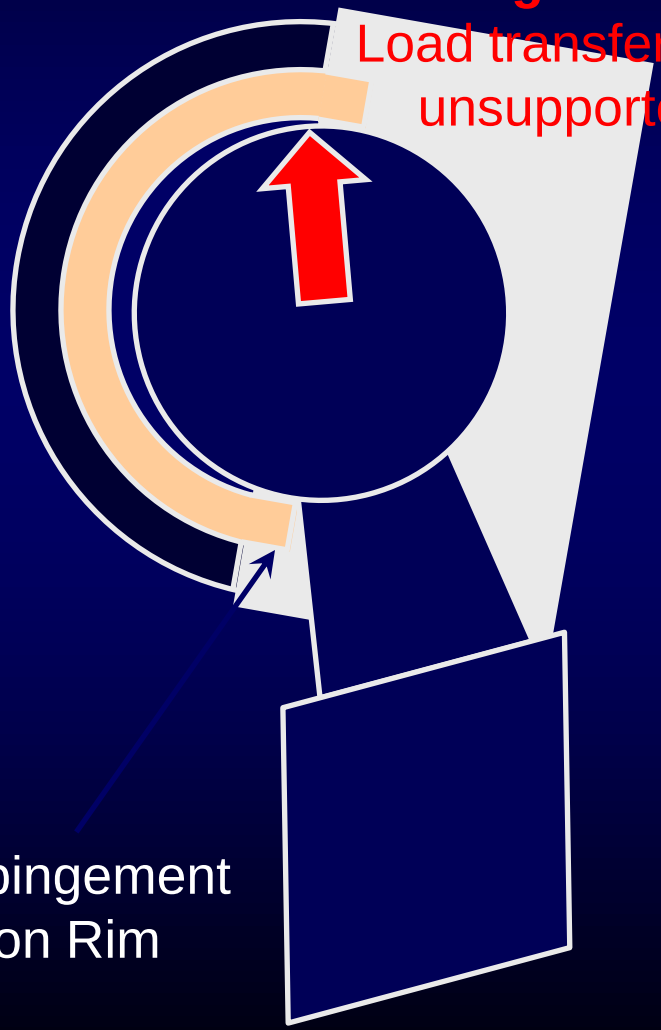


Plastic Deformation
Due to Impingement

Normal

Subluxation





Accelerated Wear

- Accelerated Wear
  - Yamaguchi M, J Arthroplasty 2000
  - Leslie IJ, Clin Orthop Rel Res 2009
  - Gallo J, Int Orthop 2010

Problems

- Long-term complications
  - Wear
  - Osteolysis
  - Aspetic loosening

- 2006, wear-related complications most common reason for revision
  - 27.7% revisions in the US Healthcare Cost and Utilization Project Nationwide Inpatient Sample

Bozic KJ, Kurtz SM, Lau E, Ong K, Vail TP, Berry DJ. The epidemiology of revision total hip arthroplasty in the United States. J Bone Joint Surg Am. 2009 Jan;91(1):128-33.

Indications for Revision THA

Number of Reoperations per Reason and Year

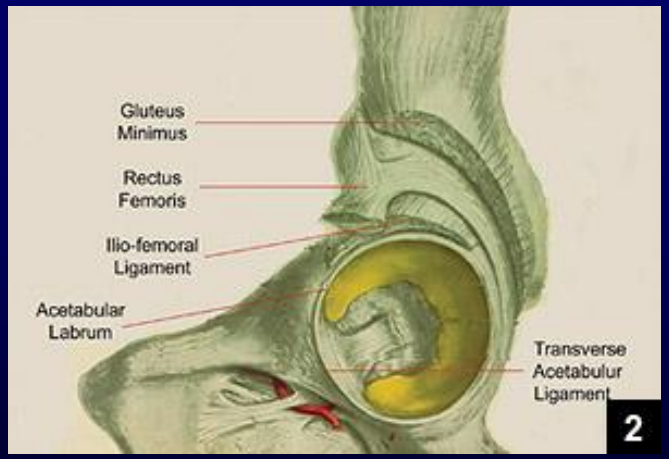
Primary THRs 1979-2006

Reason for reoperation	1979-2001	2002	2003	2004	2005	2006	Total	Share
Aseptic loosening	13,702	1,143	1,104	986	989	972	18,896	59.1%
Dislocation	2,338	242	255	314	258	244	3,651	11.4%
Deep infection	1,965	216	236	269	239	233	3,158	9.9%
Fracture	1,493	163	166	170	171	148	2,311	7.2%
2-stage procedure	907	84	107	98	98	75	1,369	4.3%
Technical error	807	24	17	17	18	13	896	2.8%
Miscellaneous	759	29	19	33	25	15	880	2.8%
Implant fracture	318	20	34	33	22	23	450	1.4%
Pain only	261	8	10	16	8	14	317	1.0%
Secondary infection	0	0	0	1	1	0	2	0.0%
(missing)	36	1	1	0	3	0	41	0.1%
Total	22,586	1,930	1,949	1,937	1,832	1,737	31,971	100%

Transverse Acetabular Ligament

Archbold HA, Mockford B, Molloy D, McConway J, Ogonda L, Beverland D. The transverse acetabular ligament: an aid to orientation of the acetabular component during primary total hip replacement: a preliminary study of 1000 cases investigating postoperative stability. *J Bone Joint Surg Br.* 2006;88:883–886.

Archbold HA, Slomczykowski M, Crone M, Eckman K, Jaramaz B, Beverland DE. The relationship of the orientation of the transverse acetabular ligament and acetabular labrum to the suggested safe zones of cup positioning in total hip arthroplasty. *Hip Int.* 2008;18:1–6.



Orthop Traumatol Surg Res. 2011 May;97(3):241-5. Epub 2011 Feb 1.
Is transverse acetabular ligament an anatomical landmark to reliably orient the cup in primary total hip arthroplasty?
Viste A, Chouteau J, Testa R, Chèze L, Fessy MH, Moyen B.

Acetabular Component Positioning Using the Transverse Acetabular Ligament

Can You Find It and Does It Help?

Noah J. Epstein MD, Steven T. Woolson MD, Nicholas J. Giori MD

Calcified, hypertrophied

Mechanical Navigation

Improving Cup Positioning Using a Mechanical Navigation Instrument

Simon D. Steppacher MD, Jens H. Kowal PhD,
Stephen Barry Murphy MD

Clin Orthop Relat Res (2011) 469:423–428

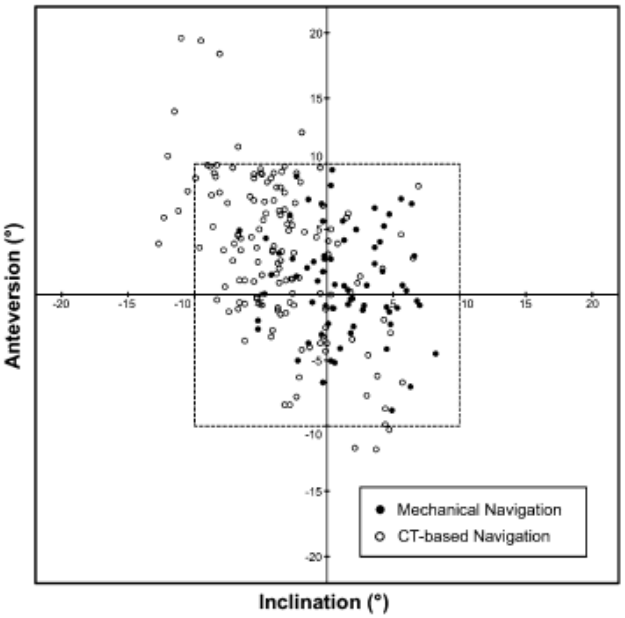
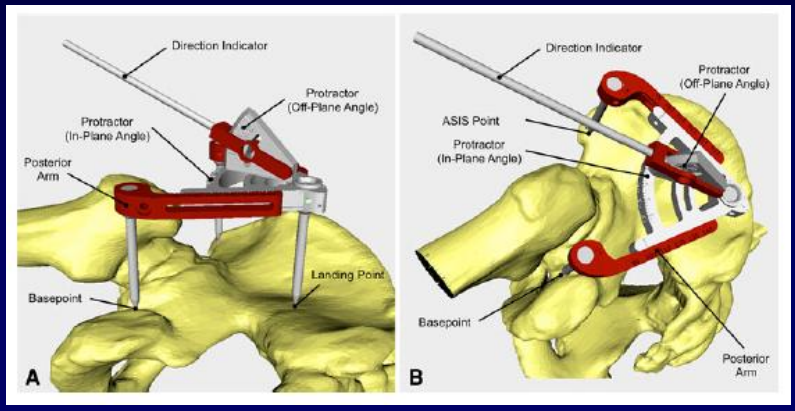
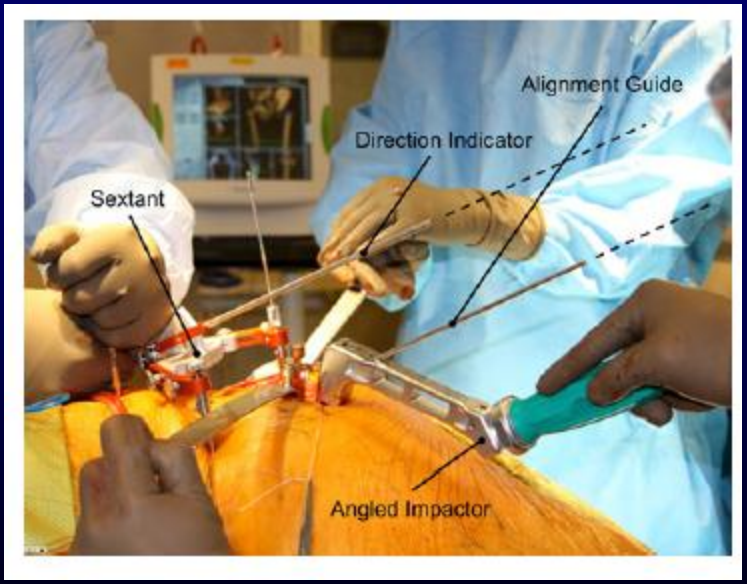


Fig. 4 Scatterplot showing cup orientation using mechanical navigation and CT-based navigation. There were no outliers using mechanical navigation. The control group of CT-based navigation had a higher percentage (9.6%, p = 3.4%) of outliers.





CT

Computer-Assisted Navigation

Nogler M, Kessler O, Prassi A, Donnelly B, Streicher R, Siedge JB, Krismer M. Reduced variability of acetabular cup positioning with use of an imageless navigation system. *Clin Orthop Relat Res.* 2004;426:159–163.

Leenders T, Vandevelde D, Mahieu G, Nuyts R. Reduction in variability of acetabular cup abduction using computer assisted surgery: a prospective and randomized study. *Comput Aided Surg.* 2002;7:99–106.

Hube R, Birke A, Hein W, Klima S. CT-based and fluoroscopy-based navigation for cup implantation in total hip arthroplasty (THA). *Surg Technol Int.* 2003;11:275–280.

Jolles BM, Genoud P, Hoffmeyer P. Computer-assisted cup placement techniques in total hip arthroplasty improve accuracy of placement. *Clin Orthop Relat Res.* 2004;426:174–179.

Murphy SB, Ecker TM, Tannast M. Two- to 9-year clinical results of alumina ceramic-on-ceramic THA. *Clin Orthop Relat Res.* 2006;453:97–102.

time, cost, complexity

Summary-Cup Malposition

- Common
- Impingement
  - Dislocation, accelerated wear, liner fracture, and psoas tendonitis
- Anatomical landmarks
  - Unreliable
- Mechanical and computer-assisted navigation
  - Reduces outliers
- Fluoroscopy
  - No better than traditional

Knee Symposium Topics

- TKA in the Younger Patient
- Long-term Follow-up
- Registries
- Sepsis Prevention
- Sepsis Treatment
- 2022: XLPE and CAS
- Revisions

Knee Outline

- MIS
- Perioperative analgesia
- Insert exchange for infection

John Insall Award

- “A Randomized Controlled Trial of Minimally Invasive TKR: Comprehensive Gait and Strength Testing Outcomes”
- Mark Pagnano et al.
- 40 patients randomized into 2 groups: mini subvastus or standard medial parapatellar
- Assessed at pre-op and 2 months post-op
- SF-12, KSS, KOOS, UCLA, activity logs

John Insall Award

- Substantial improvements for both groups in:
  - functional scores and QOL ($p<0.0001$-0.003)
  - kinematics and kinetic gait parameters during level walking and stairs ($p<0.0001$-0.048)
  - isometric quad strength ($p=0.022$-0.038)

- Marginally higher speed of stair ascent for MIS group ($p=0.018$)

John Insall Award

- No differences between groups in:
  - SF-12, KOOS, UCLA, and patient activity diaries
  - Isometric quad strength or 3D gait parameters (p=0.65-1.00)

The Journal of Arthroplasty Vol. 24 No. 4 2009

Minimal Incision Surgery as a Risk Factor for Early Failure of Total Knee Arthroplasty

Robert L. Barrack, MD,* C. Lowry Barnes, MD,† R. Stephen J. Burnett, MD, FRCS(C),‡ Derek Miller, DO,* John C. Clohisy, MD,* and William J. Maloney, MD§

- Time to revision
  - 14.8 months MI TKA
  - 80 months standard TKA
  - P<0.001

Personal Experience

- Time to revision
  - 29 months MI TKA
  - 65 months standard TKA
  - p=0.032, OR 14.7
- Reasons for revision
  - Aseptic loosening 55%
  - Pain/stiffness 27%
  - Malrotation 9%
  - Instability 9%

Chitranjan Ranawat Award

- “Efficacy of Postoperative Intraarticular Analgesia Following TKA: A Randomized, Double-Blinded, Placebo-Controlled, Prospective Study”
- Sharkey P, Hozack W, et al.
- 75 patients continuous infusion 300cc of 0.5% bupivicaine (5cc/hour)
- 75 patients 0.9% saline

Chitranjan Ranawat Award

- Outcome measures:
  - VAS, opioid consumption, opioid side effects, and adverse events
- Experimental group:
  - VAS lower highest (p=0.01), lowest (p=0.01), and current (p=0.03) on POD 1
  - VAS lower highest (p=0.04) on POD 2
  - 33% reduction in opioids POD 2 (p=0.021)
  - 54% reduction in opioids POD 3 (p=0.038)

Insert Exchange for Infection

- “Efficacy of Perioperative Irrigation and Debridement for the Treatment of Periprosthetic Infection” Thomas Fehring, MD

- Rapid formation of biofilm layer
- 3x failure rate for these failed insert exchanges when 2-stage needed
- MRSA and MRSE 84% failure rate

Clin Orthop Relat Res (2011) 469:18–25
DOI 10.1007/s11999-010-1434-1

SYMPOSIUM: PAPERS PRESENTED AT THE ANNUAL MEETINGS OF THE KNEE SOCIETY

The Chitranjan Ranawat Award

Fate of Two-stage Reimplantation After Failed Irrigation and Débridement for Periprosthetic Knee Infection

J. Christopher Sherrell MD, Thomas K. Fehring MD, Susan Odum MEd, Erik Hansen MD, Benjamin Zmistowski BS, Anne Dennos BS, Niraj Kalore MD, the Periprosthetic Infection Consortium

- 1994-2008
- 83 knees failed I+D and insert exchange
- 28/83 (34%) failed 2 stage exchange

The Journal of Arthroplasty Vol. 26 No. 6 Suppl. 1 2011

Irrigation and Debridement for Periprosthetic Infections

Does the Organism Matter?

Susan M. Odum, MEd,* Thomas K. Fehring, MD,† Adolph V. Lombardi, MD,‡
Ben M. Zmistowski, BS,§ Nicholas M. Brown, BS,‖ Jeffrey T. Luna, MD,¶
Keith A. Fehring, MD,#[1] and Erik N. Hansen, MD**[1]
and The Periprosthetic Infection Consortium[1]

- *Strep* 65% (20/31) vs. others 71% (84/119)
- *Staph* sensitive (48/67) 72% vs. 76% (22/29) resistant

Thank You