

Keramikbruch extrem selten

Aktuelle Registerdaten und Behörden-datenbanken zeigen, dass der Bruch eines keramischen Kugelkopfes aus Mischkeramik wie BIOLOX®*delta* extrem selten ist. Das australische Endoprothesenregister 2014 weist für Kugelköpfe aus Mischkeramik auf 10.000 Eingriffe eine Frakturrate von lediglich 0,17 aus. Die Auswertung der Registerdaten bestätigt damit die CeramTec-Datenbank, die für 4,08 Millionen BIOLOX®*delta*-Kugelköpfe eine Bruchrate von 0,001 % ausweist.

MEHR INFORMATION >

Metallabrieb schädigt Knochen

Eine Studie der Charité und des DRK Klinikums Westend hat nachgewiesen, dass die Freisetzung von Chrom und Kobalt aus Metall/Metall-Gleitpaarungen zum implantatnahen Knochenverlust beiträgt. Die gelösten Bestandteile erreichen das Knochenmark und schädigen dort die mesenchymalen Stammzellen. Bei metallbelasteten Patienten hatten sie ihr Potential zum Knochenaufbau vollständig eingebüßt.

MEHR INFORMATION >

Keramik/Keramik: Überlebensrate von 99,7 %

Eine südkoreanische Studie von Kim et al. hat 1.131 Hüften mit Keramik/Keramik-Gleitpaarungen (BIOLOX®*forte*, 28 mm) über einen Zeitraum von 15-20 Jahren (Ø 18,8) retrospektiv untersucht. Osteolyse, aseptische Lockerung und Keramikfraktur kamen nicht vor. Die Kaplan-Meier-Überlebensrate nach 20 Jahren betrug für den Schaft 100 %, für die Pfanne 99,7 %.

Kim YH, Park JW, Kim JS. Long-term results of third-generation ceramic-on-ceramic bearing cementless total hip arthroplasty in young patients. *J Arthroplasty* (2016), doi: 10.1016/j.arth.2016.03.058.

MEHR INFORMATION >

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Editorial board:
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Keramik gegen Fretting Corrosion

Fretting Corrosion der Konusverbindung am Kobalt-Chrom-Hüftkopf auf Titanschäften gehörte zu den meistdiskutierten Themen auf dem vergangenen EFORT-Kongress in Genf. Die Symptome, die beim Patienten auftreten, ähneln denen, die bei Metall/Metall-Paarungen beobachtet wurden. Das Ausmaß des Problems werde momentan zwar etwas überzogen dargestellt, eine detaillierte Auseinandersetzung mit der Thematik sei jedoch äußerst wichtig, da die Konsequenzen für den Patienten schwerwiegend seien, betonte Prof. Dr. Michael M. Morlock in seinem ausführlichen Vortrag zu diesem Thema. Er führte aus, dass viele Faktoren zur Entstehung der Reibkorrosion beitragen können.

Vor allem die Kopfgröße und das Fügen der Konusverbindung spielten eine Rolle. Prof. Morlock beschrieb die Versagensmechanismen und wies auf die Gefahr der verstärkten Freisetzung von potenziell biologische Reaktionen auslösenden Metallionen hin. Die Korrosion könne bei bestimmten Materialkombinationen bis zum Halsbruch führen. Durch die Verwendung von keramischen Kugelköpfen werde das Risiko der Reibkorrosion nahezu vollständig ausgeschlossen. Diese Schlussfolgerung entspricht den Aussagen anderer Referenten und der aktuellen Literatur.

Morlock MM, Bunte D, Gührs J, Krull A, Haschke H.
The end of the taper disaster. EFORT 2016

MEHR INFORMATION >

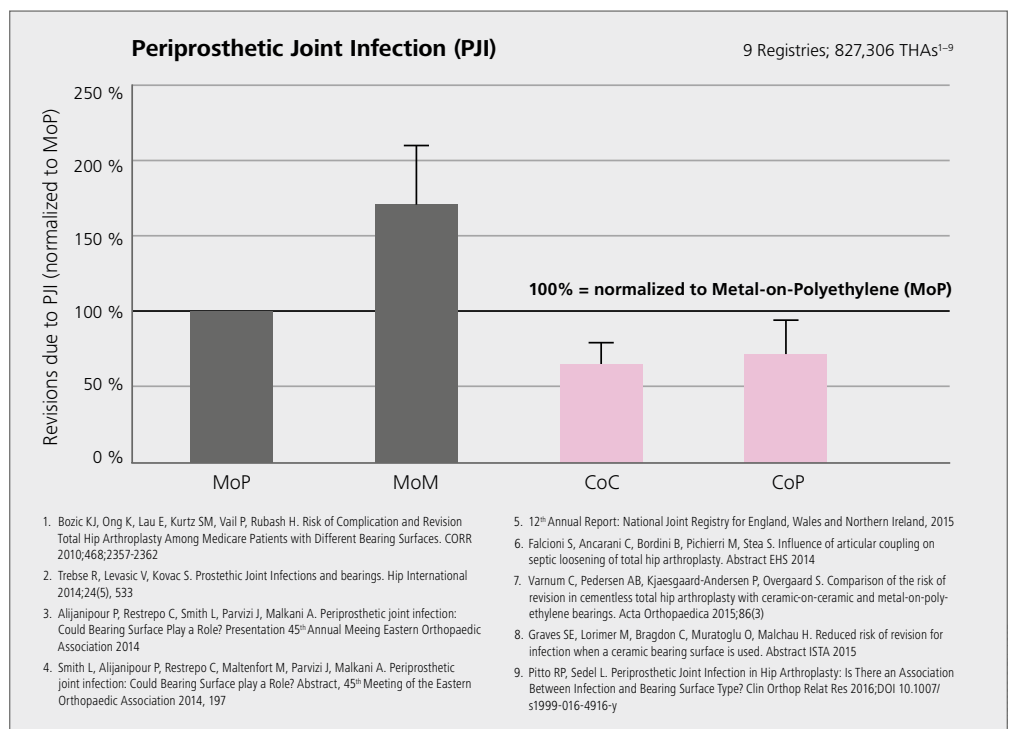
Infektionsbedingtes Revisionsrisiko mit Keramik-Artikulationskomponenten reduziert

Die Auswertung von Registerdaten aus Neuseeland von Pitto et al. lässt auf einen Zusammenhang zwischen infektionsbedingtem Revisionsrisiko und Gleitpaarungsmaterial schließen. Die retrospektive Studie erfasst 84.894 Hüftendoprothesen, der Beobachtungszeitraum beträgt 15 Jahre. Am niedrigsten war das Risiko (Hazard-Ratio = HR) bei der Verwendung von Keramik/Keramik-Gleitpaarungen (HR = 1), Keramik/PE hat eine HR von 1,3. Dagegen liegt die HR für Metall/PE mit 2,12 mehr als doppelt so hoch. Metall/Metall hat eine HR von 1,75.*

Pitto RP, Sedel L. Periprosthetic Joint Infection in Hip Arthroplasty: Is There an Association Between Infection and Bearing Surface Type? *Clin Orthop Relat Res*, DOI 10.1007/s11999-016-4916-y

*Die Autoren haben bei ihrer Analyse nicht nach Art des Polyethylens differenziert.

MEHR INFORMATION >



Die Auswertung von neun Endoprothesenregistern deutet auf einen statistischen Zusammenhang zwischen Gleitpaarungsmaterial und infektionsbedingter Revisionsrate hin. Mit metallischen Komponenten in der Gleitpaarung ist die Rate höher als ohne. Die niedrigsten infektionsbedingten Revisionsraten werden mit Keramik/Keramik-Gleitpaarungen erreicht.

The end of the taper disaster



Michael M. Morlock

Dennis Bunte, Julian Gührs, Annika Krull, Henning Haschke

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Institute of Biomechanics
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Disclosures



- Consultant, Speakers Bureau, Research Grants:
 - Aesculap
 - Biomet
 - Corin
 - Lima
 - Mathys
 - S&N
 - Bayer
 - Ceramtec
 - DePuy
 - Link
 - Peter Brehm
 - Zimmer
- No Royalties



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• Disaster 1

HIP
ISSN 1120-7000

Hip Int 2015; 25 (4): 339-346
DOI: 10.5301/hipint.5000269

REVIEW

The taper disaster - how could it happen?

Michael M. Morlock

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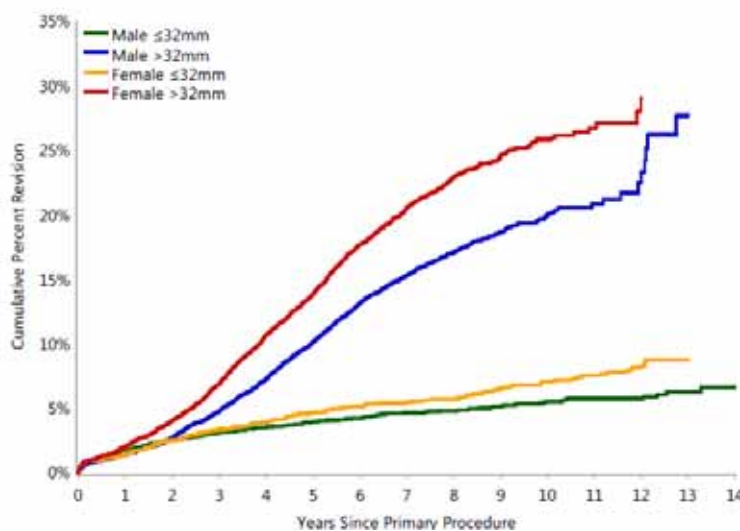


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Disaster 1

Figure MM6 Cumulative Percent Revision of Metal/Metal Primary Total Conventional Hip Replacement by Gender and Head Size (Primary Diagnosis OA)



HR - adjusted for age

Male ≤32mm vs Male >32mm

0 - 1.5Yr: HR=1.06 (0.80, 1.40), p=0.702

1.5Yr - 3Yr: HR=0.33 (0.22, 0.50), p<0.001

3Yr+: HR=0.14 (0.11, 0.19), p<0.001

Male >32mm vs Female >32mm

Entire Period: HR=0.71 (0.66, 0.77), p<0.001

Male ≤32mm vs Female ≤32mm

Entire Period: HR=0.77 (0.62, 0.97), p=0.026

Female ≤32mm vs Female >32mm

0 - 2.5Yr: HR=0.60 (0.48, 0.75), p<0.001

2.5Yr - 3Yr: HR=0.28 (0.19, 0.40), p<0.001

3Yr - 6.5Yr: HR=0.14 (0.11, 0.18), p<0.001

6.5Yr - 7Yr: HR=0.12 (0.08, 0.20), p<0.001

7Yr+: HR=0.18 (0.13, 0.25), p<0.001

Edited by Hans-Joachim Helm
Editorial Board
Orthopaedics



SUPPLEMENTARY REPORT
2016



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Table MM1 Number of Revisions of Metal/Metal Primary Total Conventional Hip Replacement by Year of Implant

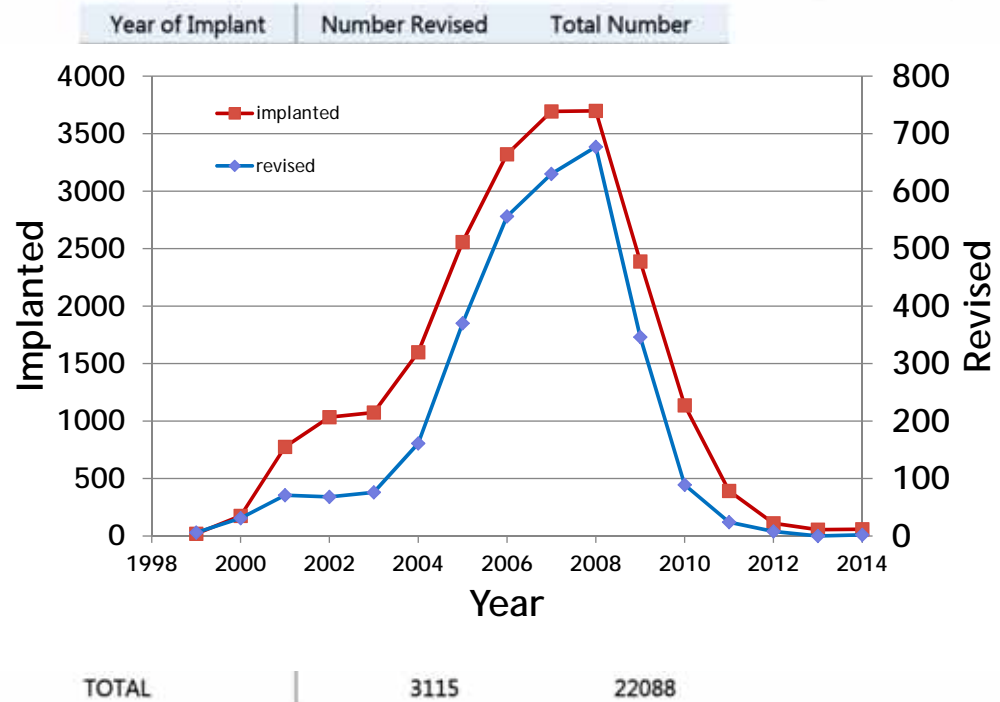


Table MM9 Cumulative Percent Revision of Metal/Metal Primary Total Conventional Hip Replacement using Head Size >32mm by Head and Acetabular Surface (Primary Diagnosis OA)

Head Surface	Acetabular Surface	N Revised	N Total	1 Yr	3 Yrs	5 Yrs	7 Yrs	10 Yrs	14 Yrs
ASR	ASR	1473	3980	1.8 (1.4, 2.2)	9.8 (8.9, 10.7)	24.4 (23.1, 25.8)	36.7 (35.2, 38.3)		
Articul/Eze	Pinnacle	118	1627	1.9 (1.3, 2.6)	3.0 (2.3, 4.0)	4.8 (3.8, 6.0)	7.4 (6.1, 9.0)	9.9 (8.2, 12.0)	
BHR	BHR	199	2223	1.0 (0.7, 1.5)	3.3 (2.6, 4.1)	6.1 (5.1, 7.2)	8.9 (7.8, 10.3)	12.3 (10.3, 14.5)	
BHR	R3	65	535	2.1 (1.1, 3.7)	7.0 (5.1, 9.6)	11.1 (8.7, 14.1)			
BMHR	BHR	16	278	1.8 (0.8, 4.3)	3.7 (2.0, 6.8)	5.7 (3.3, 9.9)			
Bionik	Bionik	77	377	3.7 (2.2, 6.2)	8.1 (5.8, 11.4)	15.6 (12.2, 19.8)	22.0 (17.8, 27.1)		
Icon	Icon	50	341	2.4 (1.2, 4.7)	7.2 (4.9, 10.6)	12.4 (9.2, 16.5)	14.2 (10.7, 18.8)		
M2a	M2a	79	779	1.8 (1.1, 3.0)	4.3 (3.1, 6.0)	6.4 (4.9, 8.4)	8.2 (6.4, 10.4)	11.3 (9.1, 14.0)	
M2a Magnum	Recap	59	924	1.5 (0.9, 2.6)	2.5 (1.7, 3.8)	4.4 (3.2, 6.0)	7.0 (5.4, 9.0)		
Metasul	Durom	101	1100	1.2 (0.7, 2.0)	3.9 (2.9, 5.2)	5.4 (4.2, 6.9)	8.7 (7.1, 10.7)	12.6 (9.3, 16.9)	
Mitch TRH	Mitch TRH	68	648	1.7 (0.9, 3.0)	5.1 (3.7, 7.1)	8.5 (6.6, 11.0)	11.5 (9.1, 14.6)		
Optimom	Cornet	64	701	1.3 (0.7, 2.5)	3.5 (2.3, 5.1)	5.0 (3.6, 7.0)	9.0 (6.9, 11.9)	15.1 (11.4, 19.9)	
S-Rom	Pinnacle	18	283	2.1 (1.0, 4.7)	3.6 (1.9, 6.5)	3.9 (2.2, 7.0)	4.3 (2.5, 7.5)	8.0 (5.0, 12.7)	
Other (24)		95	621	2.6 (1.6, 4.2)	6.4 (4.7, 8.6)	9.5 (7.4, 12.2)	13.2 (10.5, 16.5)	17.0 (13.5, 21.2)	
TOTAL		2482	14417						

Note: Only combinations with over 200 procedures have been listed.



Friction in hip-joint prostheses and its influence on the fixation of the artificial head

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The head of an implanted hip joint endoprosthesis is exposed to torques, which are transferred during gait due to the friction between the head and the cup prosthesis. In prostheses with ceramic ball heads, which are widely used now, and in which the head is fixed onto the stem by conical clamping, these torques could possibly affect the connection. In this study, torques transferred from the cup to the head are compared to the torques which are required to loosen the head from the metallic spigot. The results show that for the investigated head and taper types and sizes, under normal conditions the connection is safe with respect to undesired rotation. However, it is shown that for polluted sliding surfaces the fixation strength could possibly be exceeded. © 1998 Kluwer Academic Publishers



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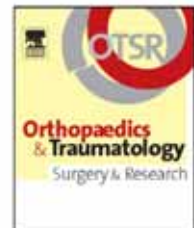
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ORIGINAL ARTICLE

European multidisciplinary consensus statement on the use and monitoring of metal-on-metal bearings for total hip replacement and hip resurfacing

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- Disaster 1
- Disaster 2



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Disaster 2

The Journal of Arthroplasty 30 (2015) 1265–1268



Contents lists available at ScienceDirect

The Journal of Arthroplasty

journal homepage: www.arthroplastyjournal.org



A High Prevalence of Corrosion at the Head–Neck Taper with Contemporary Zimmer Non-Cemented Femoral Hip Components



Brian J. McGrory, MD ^{a,b,c}, Johanna MacKenzie, BA ^c, George Babikian, MD ^{a,b,c}

“Prevalence of 1.1% in a series of 1356 contemporary Zimmer uncemented THAs followed for a minimum of 2 years. Delay in treatment led to irreversible soft tissue damage in three patients.” (AAOS 2016: 2.6%)



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- It has always been there

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Formation of a Fulminant Soft-Tissue Pseudotumor after Uncemented Hip Arthroplasty

A CASE REPORT*

BY OLLE SVENSSON, M.D., PH.D.†, ERIK B. MATHIESEN, M.D.†, FINN P. REINHOLT, M.D., PH.D.†,
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no
head size
specified



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Introduction

- It has always been there
- Magnitude of attention / occurrence is new



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- It has always been there
- Magnitude of attention / occurrence is new
- How big is the problem?



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Revision Reasons AOA 2015



Table HT10 Primary Total Conventional Hip Replacement by Reason for Revision

Reason for Revision	Number	Percent
Loosening/Lysis	2935	28.0
Prosthesis Dislocation	2528	24.2
Fracture	1907	18.2
Infection	1811	17.3
Pain	191	1.8
Leg Length Discrepancy	145	1.4
Malposition	125	1.2
Implant Breakage Stem	99	0.9
Instability	94	0.9
Implant Breakage Acetabular Insert	81	0.8
Implant Breakage Acetabular	79	0.8
Incorrect Sizing	79	0.8
Wear Acetabular Insert	77	0.7
Metal Related Pathology	74	0.7
Implant Breakage Head	30	0.3
Other	209	2.0
TOTAL	10464	100.0

Note: All procedures using metal/metal prostheses with head size larger than 32mm have been excluded

If we exclude disaster 1



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- It has always been there
- Magnitude of attention / occurrence is new
- How big is the problem? (not that big in comparison to other revision reasons - IF we exclude large MoM)



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Hip replacement survival

Modular primary THA is unbelievable successful!



Stem/cup brand	Bearing surface	n	Median (IQR) age at primary	Percentage (%) males	Cumulative percentage probability of revision (95% CI) at:					
					1 year	3 years	5 years	7 years	10 years	
Uncemented										
Corail / Pinnacle	MoP	36,776	71 (65-77)	40%	0.86 (0.76-0.96)	1.46 (1.33-1.61)	1.81 (1.65-1.99)	2.36 (2.11-2.64)	3.59 (2.59-4.96)	
	CoP	12,187	64 (58-69)	44%	0.62 (0.49-0.79)	1.11 (0.91-1.36)	1.67 (1.35-2.06)	1.73 (1.39-2.14)	2.19 (1.40-3.41)	
	CoC	32,309	60 (53-66)	47%	0.83 (0.74-0.94)	1.79 (1.63-1.95)	2.43 (2.23-2.65)	3.13 (2.83-3.47)	3.95 (3.32-4.71)	

© National Joint Registry 2015



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- It has always been there
- Magnitude of attention / occurrence is new
- How big is the problem (not that big in comparison to other revision reasons - IF we exclude large MoM)
- What causes it?



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CLINICAL ORTHOPAEDICS AND RELATED RESEARCH
Number 401, pp. 149–161
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A Multicenter Retrieval Study of the Taper Interfaces of Modular Hip Prostheses

*Jay R. Goldberg, PhD**; *Jeremy L. Gilbert, PhD***;
Joshua J. Jacobs, MD†; *Thomas W. Bauer, MD, PhD‡*;
Wayne Paprosky, MD§; and *Sue Leurgans, PhD‡*

Findings

- Flexural rigidity of the neck predictor
- Larger diameter necks have higher increased stiffness and may reduce fretting corrosion
- Mechanically assisted crevice corrosion
- Corrosion and fretting more observed inside the head



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Taper and head size development

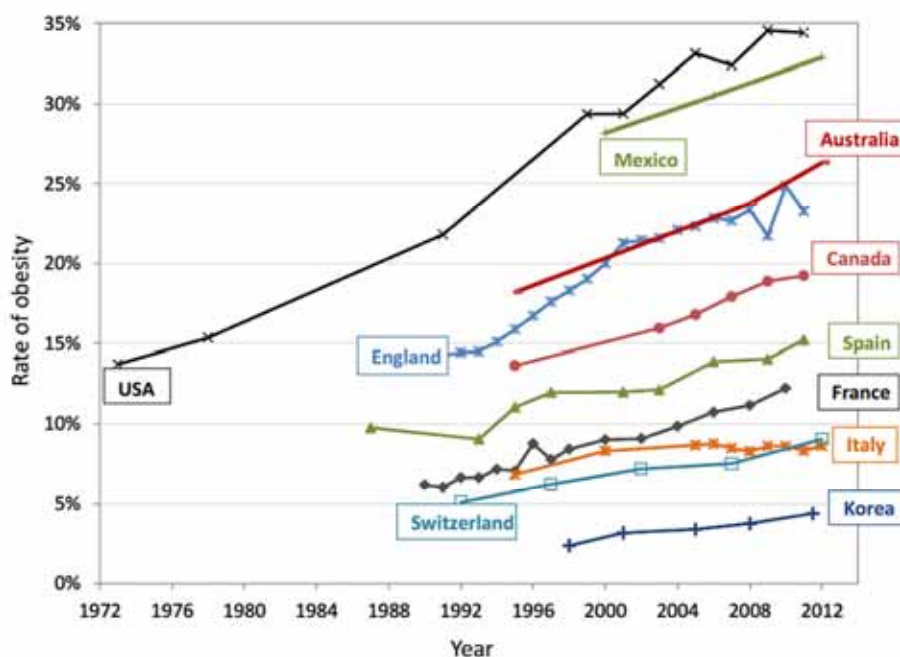


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Loading development

Figure 2. Obesity rates



Note: Age- and gender-adjusted rates of obesity and overweight, 2005 OECD standard population. Measured height and weight in Australia, England, Korea, Mexico and the United States; self-reported in other countries. Source: OECD analysis of health survey data.



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Why is anybody surprised?



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Taper Corrosion

The complete story...

- Every metal being put in the body corrodes and the alloy components will be released
- Looking for it will always reveal corrosion
- Every (!) taper junction can get loose
- Tapers are made for loading along taper axis NOT bending
- The larger the head (friction), offset, distance of the taper from the load - the larger the bending moment (bad.....)



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What is the decisive parameter to make corrosion (which always takes place) a clinical problem?

There is no single one...

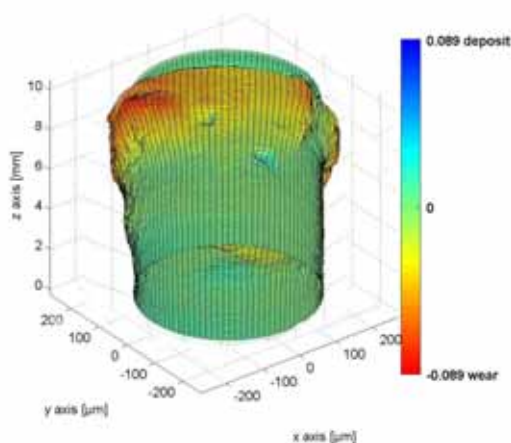


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Movement / separation at the taper interface is a prerequisite for the start of mechanically induced tribocorrosion (fretting).

Residuals [mm] of selection 70% of Data Points



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Movement / separation at the taper interface is a prerequisite for the start of mechanically induced tribocorrosion (fretting).

No movement - no problem.



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Example

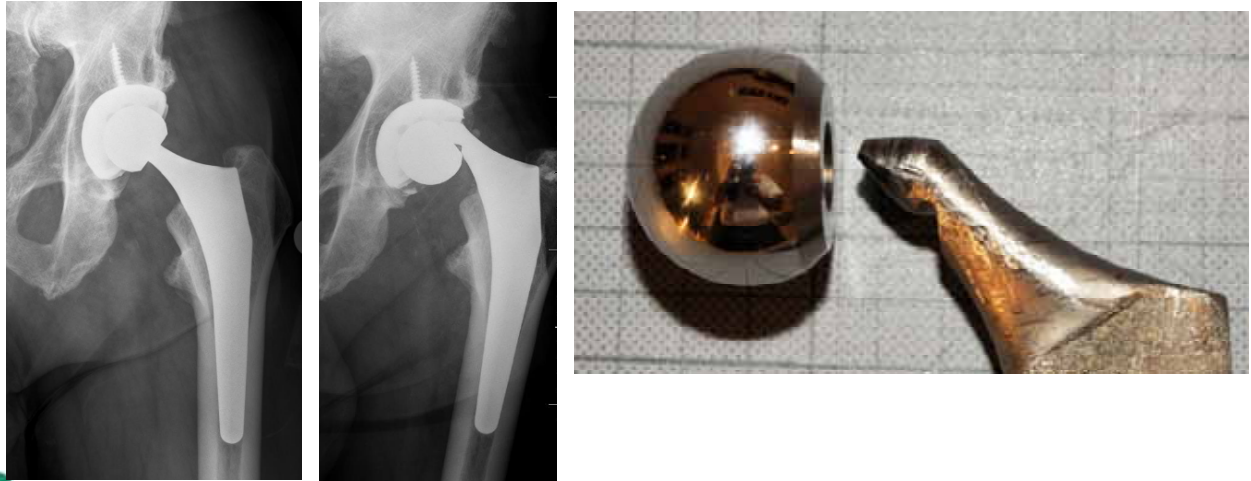
- Active patient
- 9 years in situ



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- Active patient
- 9 years in situ
- Dislocated without warning
- Taper „problem“ - what caused it?



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Taper Corrosion

Movement / separation at the taper interface is a prerequisite for the start of mechanically induced tribocorrosion (fretting).

No movement - no problem.

Goal: Prevent (minimize)
micromotion at the taper
interface!

How?



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Factors:

- Design
- Assembly
- Load



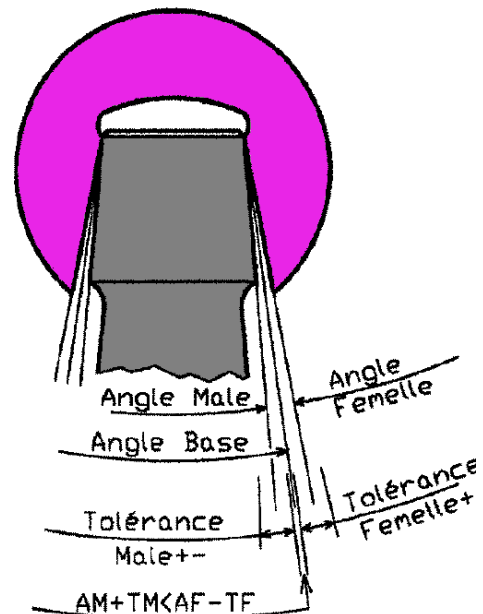
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Factors:

- Design (material, diameter, length, TAD, tolerances)

What is best?



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- For nearly all taper types, some failures are reported (only descriptive)
- Little hard data yet, how taper design influences the rate of problems
- No valid pre-clinical testing set-up



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Factors:

- Design
- Assembly (matching, contamination, force, direction)



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- Prevent major mismatch



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Major mismatch



76 y female
16 years in situ

Little biological
reactions since
little Co or Cr



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JBJS Case Connect 2014;4:e25

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Major mismatch



76 y female
16 years in situ

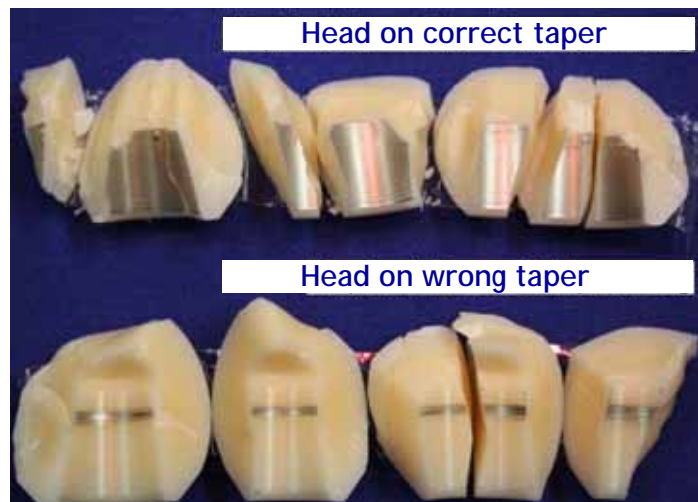
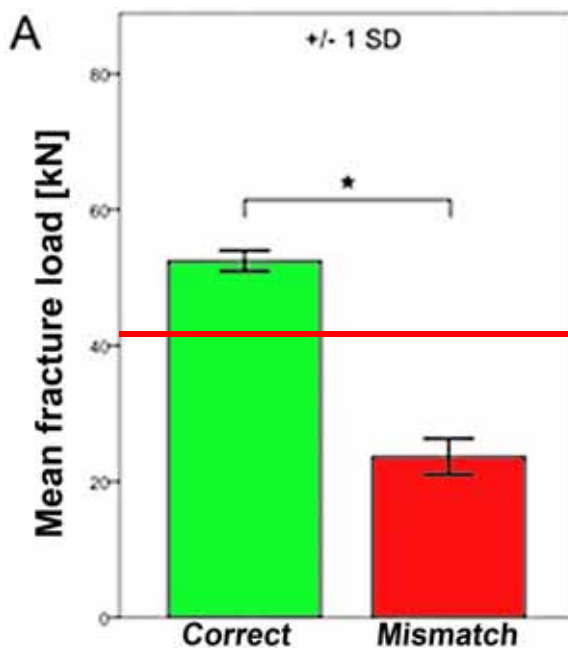
Little biological
reactions since
little Co or Cr

14/16 head
on a
12/14 taper

JBJS Case Connect 2014;4:e25



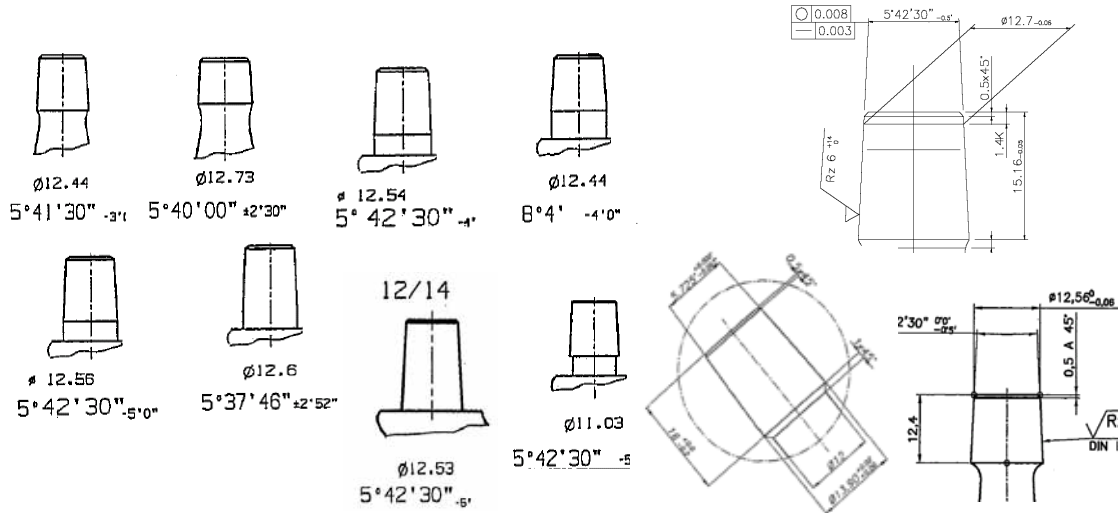
Major mismatch



“Type I” instead of V40 taper, (Gührs et al, 2015 in press)

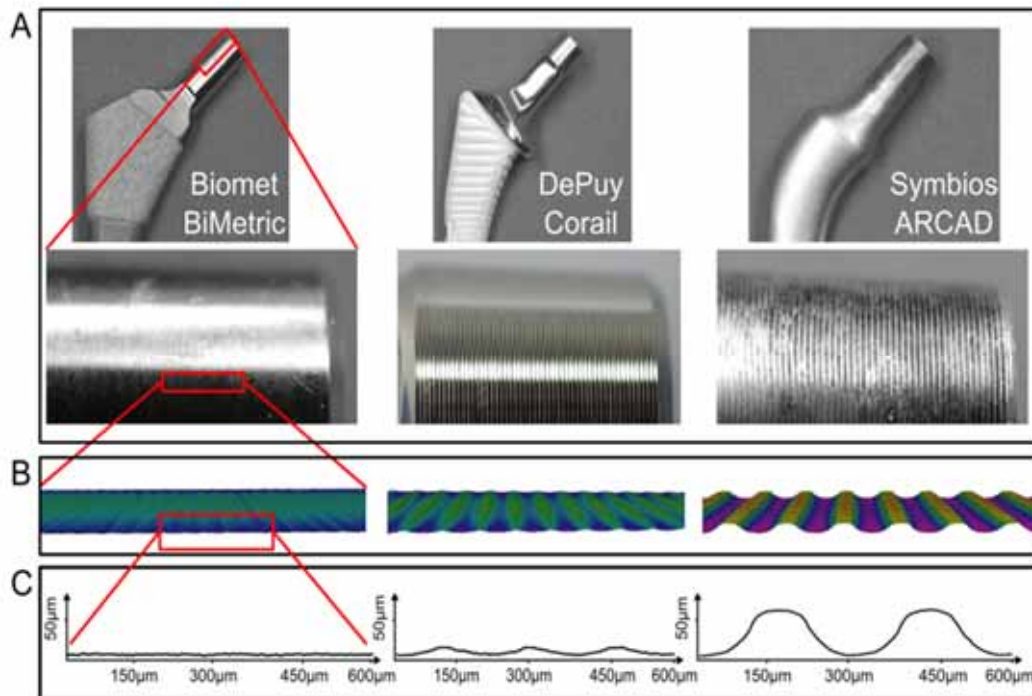


- Prevent major mismatch
- Prevent „minor“ mismatch



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- Prevent major mismatch
- Prevent „minor“ mismatch
 - no idea whether it is important
 - don't take any risk..



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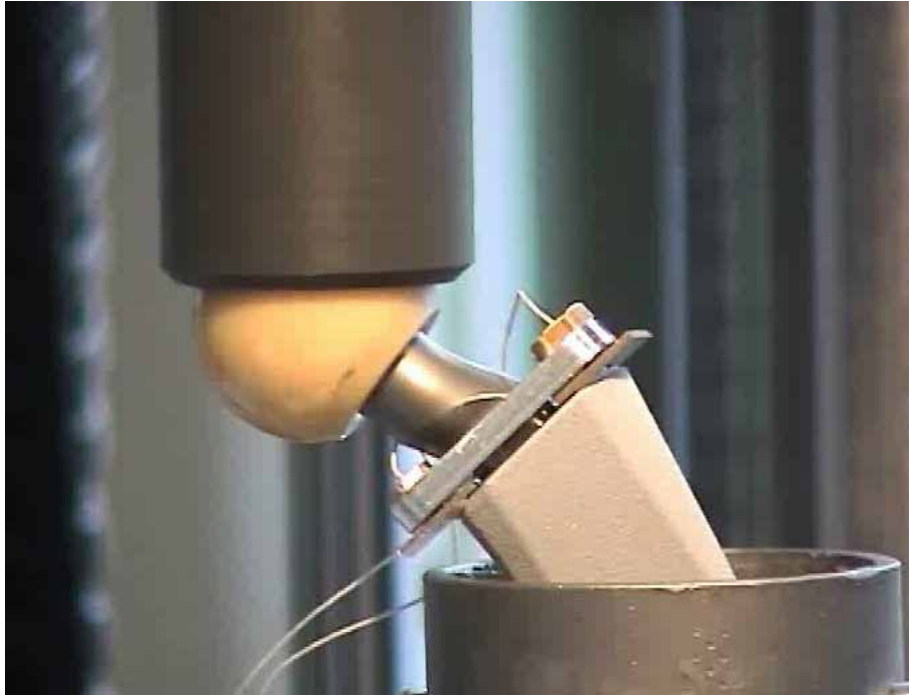
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- Prevent major mismatch
- Prevent „minor“ mismatch
- Prevent contamination



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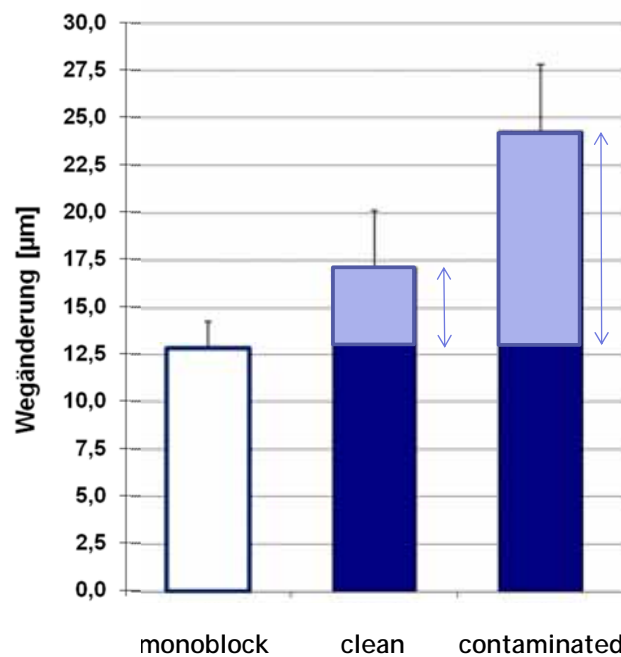
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Micromotion + Deformation



Jauch JoR 2013



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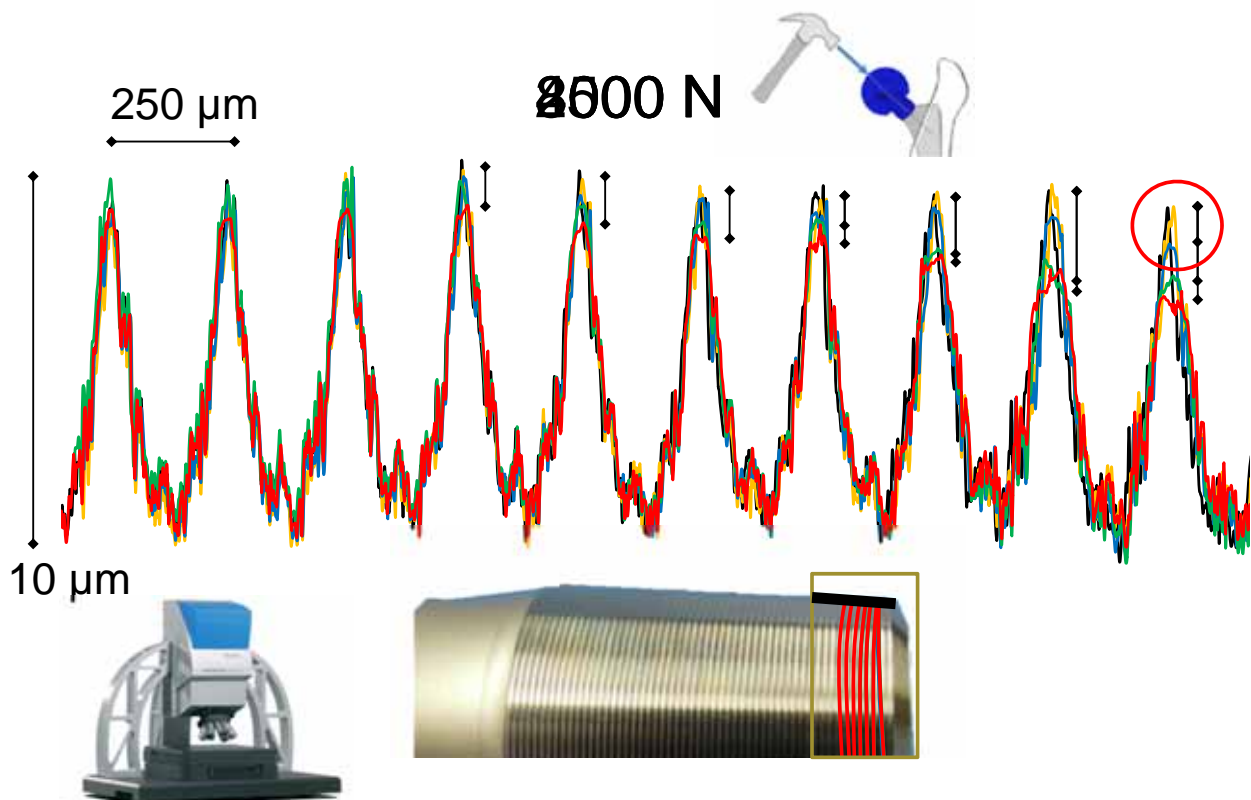
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- Prevent major mismatch
- Prevent „minor“ mismatch
- Prevent contamination
- Sufficient assembly force



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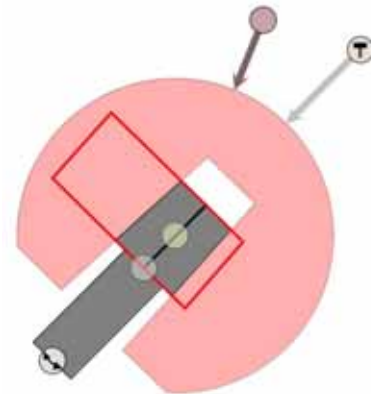
Plastic deformation for higher strength



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Factors:

- Design
- Assembly
- Loading (magnitude, direction, lever arm)

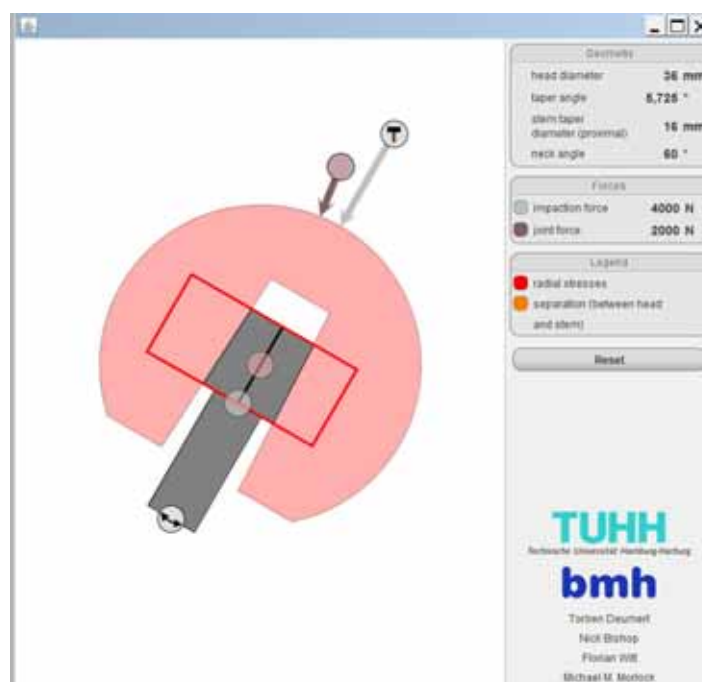


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Head length

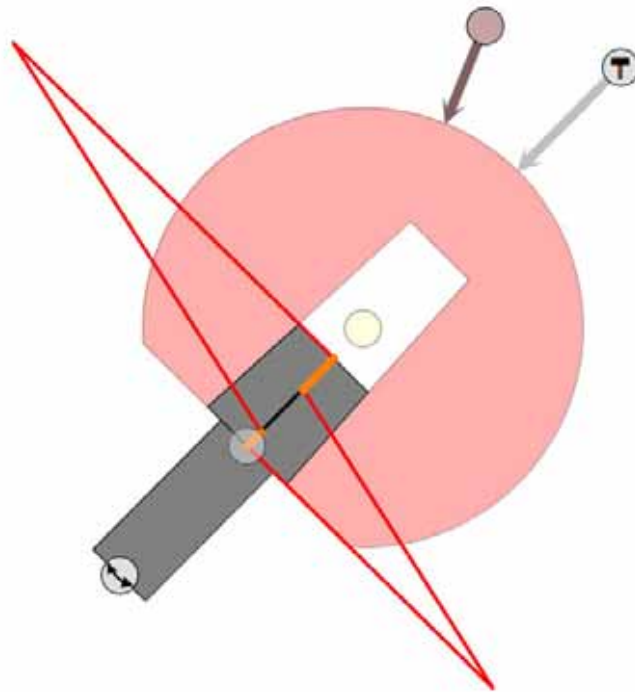
Taper interface loading



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Taper interface loading



Geometry	
head diameter	36 mm
taper angle	5,725 °
stem taper diameter (proximal)	16 mm
neck angle	45 °

Forces	
impact force	4000 N
joint force	2900 N

Legend	
●	radial stresses
●	separation (between head and stem)

Reset

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Technische Universität Hamburg-Harburg
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Taper corrosion

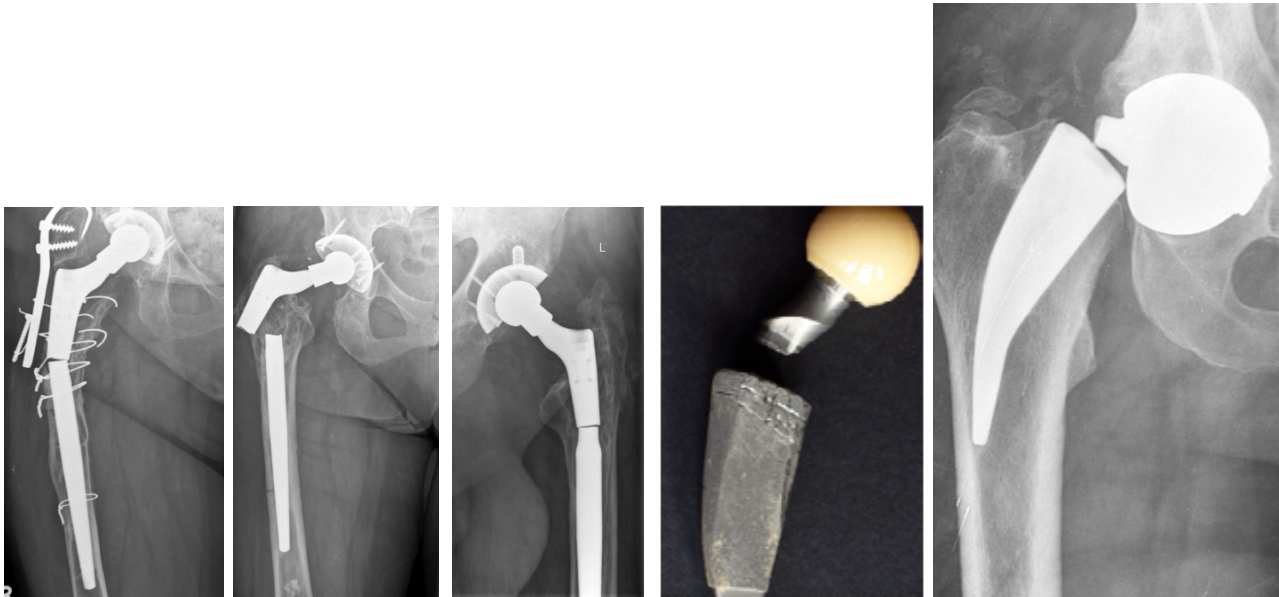
- Prevent major mismatch
- Prevent „minor“ mismatch
- Prevent contamination
- Sufficient assembly force
- Offset / Length



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Fractures in Revision stems and bi-modular primary stems



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Taper corrosion

- Prevent major mismatch
- Prevent „minor“ mismatch
- Prevent contamination
- Sufficient assembly force
- Offset / Length
- Head size



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Raised levels of metal ions in the blood in patients who have undergone uncemented metal-on-polyethylene Trident–Accolade total hip replacement

P. Craig,
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The issues surrounding raised levels of metal ions in the blood following large head metal-on-metal total hip replacement (THR), such as cobalt and chromium, have been well documented. Despite the national popularity of uncemented metal-on-polyethylene (MoP) THR using a large-diameter femoral head, few papers have reported the levels of metal ions in the blood following this combination. Following an isolated failure of a 44 mm Trident–Accolade uncemented THR associated with severe wear between the femoral head and the trunnion in the presence of markedly elevated levels of cobalt ions in the blood, we investigated the relationship between modular femoral head diameter and the levels of cobalt and chromium ions in the blood following this THR.

A total of 69 patients received an uncemented Trident–Accolade MoP THR in 2009. Of these, 43 patients (23 men and 20 women, mean age 67.0 years) were recruited and had levels of cobalt and chromium ions in the blood measured between May and June 2012. The patients were then divided into three groups according to the diameter of the femoral head used: 12 patients in the 28 mm group (controls), 18 patients in the 36 mm group and 13 patients in the 40 mm group. A total of four patients had identical bilateral prostheses in situ at phlebotomy: one each in the 28 mm and 36 mm groups and two in the 40 mm group.

There was a significant increase in the mean levels of cobalt ions in the blood in those with a 36 mm diameter femoral head compared with those with a 28 mm diameter head ($p = 0.013$). The levels of cobalt ions in the blood were raised in those with a 40 mm diameter head but there was no statistically significant difference between this group and the control group ($p = 0.152$). The levels of chromium ions in the blood were normal in all patients.

The clinical significance of this finding is unclear, but we have stopped using femoral heads with a diameter of ≥ 36 mm, and await further larger studies to clarify whether, for instance, this issue particularly affects this combination of components.

Cite this article: *Bone Joint J* 2014;96-B:43–7.

Taper corrosion

Factors:

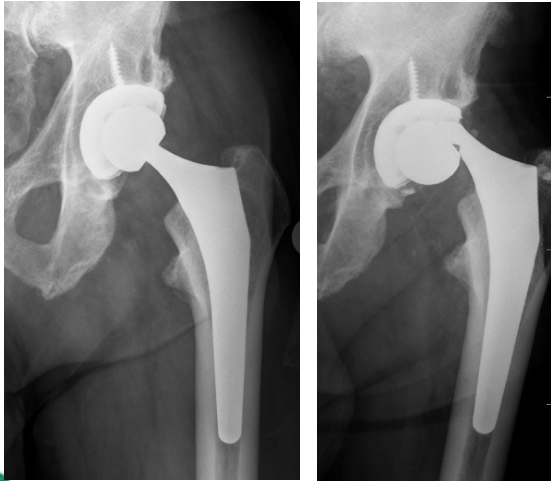
- Design
- Assembly
- Load



All factors have to be addressed!



- Active patient
- 9 years in situ
- Dislocated without warning
- Taper „problem“ - what caused it?

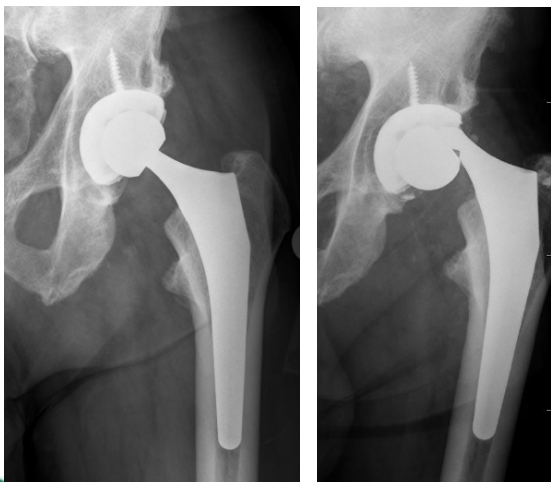


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Example - what caused it (n=4)

- Soft Ti?
- Small Taper?
- Large Head (36mm is large!)?
- Contamination? Assembly?
- High loading?



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- Corrosion has been, is, and will always be there if metals are put in a physiological environment
- Taper corrosion is a problem - but not as big as it is currently made, if large heads and high friction and large levers are omitted
- Ceramic heads minimize the problem



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Disaster 2

Clin Orthop Relat Res
DOI 10.1007/s11999-013-3096-2

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BASIC RESEARCH

Do Ceramic Femoral Heads Reduce Taper Fretting Corrosion in Hip Arthroplasty? A Retrieval Study

Steven M. Kurtz PhD, Sevi B. Kocagöz BS, Josa A. Hanzlik MS, Richard J. Underwood PhD, Jeremy L. Gilbert PhD, Daniel W. MacDonald MS, Gwo-Chin Lee MD, Michael A. Mont MD, Matthew J. Kraay MD, Gregg R. Klein MD, Javad Parvizi MD, Clare M. Rinnac PhD

The Journal of Arthroplasty xxx (2016) 1–6



ELSEVIER

Contents lists available at ScienceDirect

The Journal of Arthroplasty

journal homepage: www.arthroplastyjournal.org



Original Article

A Comparison of Blood Metal Ions in Total Hip Arthroplasty Using Metal and Ceramic Heads

Peter B. White, BA^{*}, Morteza Meftah, MD, Amar S. Ranawat, MD, Chitranjan S. Ranawat, MD

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Original Article

Tribocorrosion: Ceramic and Oxidized Zirconium vs Cobalt-Chromium Heads in Total Hip Arthroplasty

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Christopher Del Balso, BSc (Hons), MSc, MBBS^a, James L. Howard, MD, MSc, FRCSC^a,
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Discussion

- Corrosion has been, is, and will always be there if metals are put in a physiological environment
- Taper corrosion is a problem - but not as big as it is currently made, if large heads and high friction and large levers are omitted
- Ceramic heads minimize the problem
- No single root cause for failure



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Many things have to be done right **SIMULTANEOUSLY..**



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- Corrosion has been, is, and will always be there if metals are put in a physiological environment
- Taper corrosion is a problem - but not as big as it is currently made, if large heads and high friction and large levers are omitted
- Ceramic heads minimize the problem
- **No single root cause for failure**
- Lawyers and patients and surgeons „like“ problems, which can be directly linked to the product



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- The taper issue is not going to be solved by a magic idiot proove design - the whole process has to be improved!
- The currently used tapers are designed for 28mm and 32mm heads and work very well (but can also fail if something is wrong)
- They do work for larger heads - BUT -



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- The taper issue is not going to be solved by a magic idiot proove design - the whole process has to be improved!
- The currently used tapers are designed for 28mm and 32mm heads and work very well (but can also fail if something is wrong)
- They do work for larger heads - BUT - are less forgiving against errors with high loading



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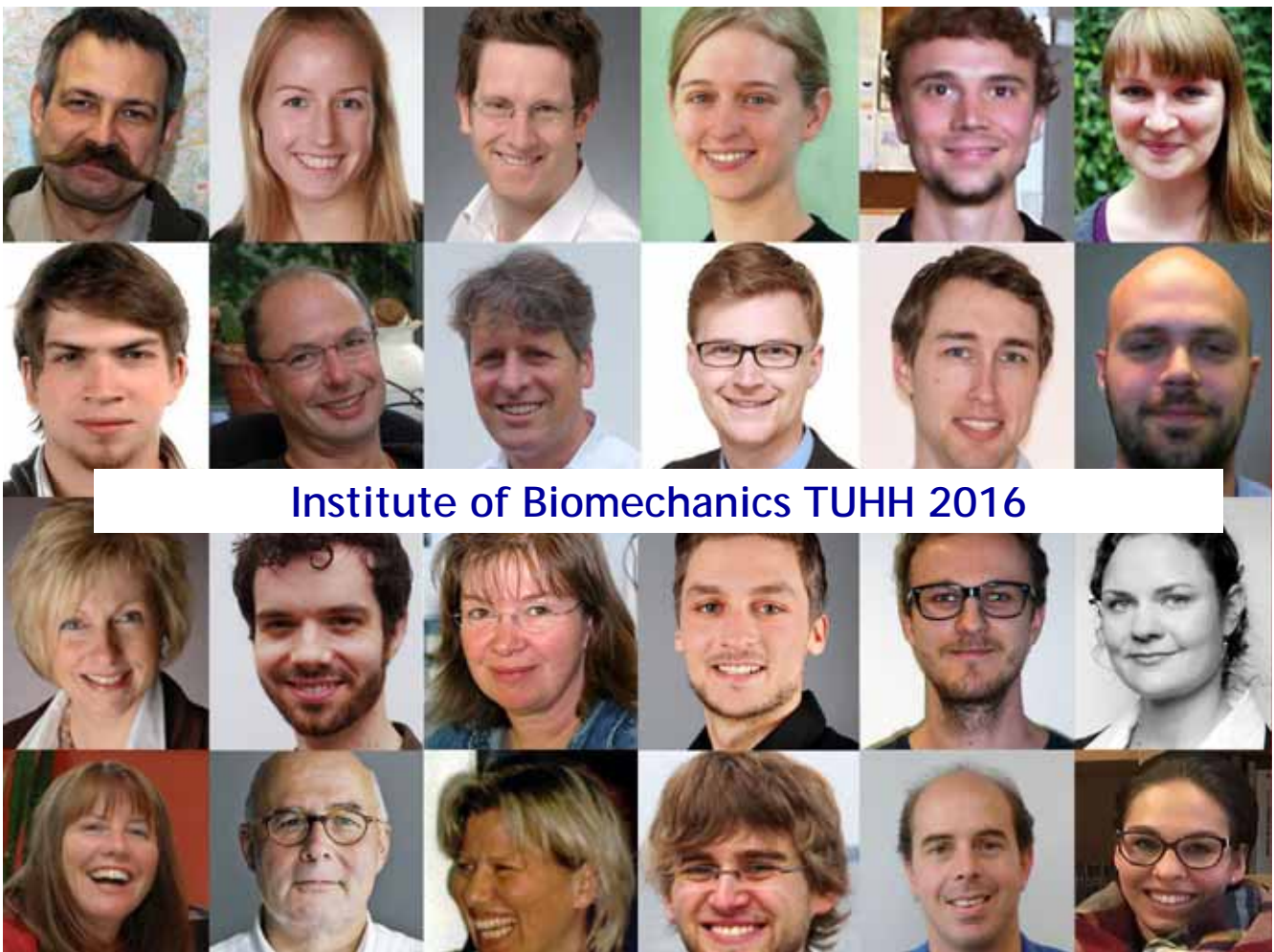
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- Wear is a „minor“ issue with modern materials, friction related issues comprise the bigger problem (back to Charnley....)
- 36mm is rather large for Me heads, for CE heads it's probably o.k.
- Disaster 1 is over (MoM is gone)
- Disaster 2 - is no disaster, can be prevented
- **Technique, head size & material** (orientation, offset, length, CCD, contamination, assembly)



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Thank you for your attention!



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Hamburg Harbour 2015

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Executive Summary

Issue November 2016

Title	Periprosthetic joint infection in hip arthroplasty: is there an association between infection and bearing surface type
Authors	Pitto RP., Sedel L.
Journal	Clin Orthop Relat Res 2016; online June 2016. DOI 10.1007/s11999-016-4916-y
Level of Evidence	Level III. Therapeutic study.
Summary	<p>Pitto and Sedel aimed to assess whether the type of bearing surface (CoC, CoP, MoP, MoM) is associated with differences in risk of revision for early (<6 months) or late (>6 months) deep infection by using the national arthroplasty registry of New Zealand. In all they included 84,894 primary THA with a median observation period of 9 years. Included were only patients with degenerative joint disease without previous surgeries or trauma. There were 54,409 MoP, 16,503 CoP, 9,051 CoC and 4,931 MoM bearings. The following risk factors were included in the multivariate analysis: age, gender, operating room type, use of body exhaust suits, fixation mode, and surgeon volume.</p> <p>During the first 6 months 0.07% CoC bearings, 0.09% CoP bearings, 0.15% MoP, and 0.14% MoM bearings were revised for infection. After controlling for certain confounding variables (see above), the authors did not find significant (<0.05) differences in risk of revision for deep infection within the first 6 months after surgery for the various bearing surfaces. The early rate of infection did not include surgical procedure for PJI that did not require exchange of components.</p> <p>The overall revision rate for PJI of all bearings was 0.5% over the entire observation period (median 9 years). When the entire observation period was considered, CoC bearings were associated with a statistical significant lower risk of revision for infection (p=0.013) compared to CoP (HR, 1.3; CI, 0.78-2.18), MoP (HR, 2.21; CI, 1.23-3.65) and MoM (HR,1.75; CI,1.07-2.86) bearings. Kaplan-Meier survival analysis after 10 years showed no revisions for PJI in the CoC group but a constantly increasing revision rate for the other bearings.</p>
Key Research Findings	<p>There was no difference in the rate of early (<6 months) risk of revision for infection between the bearing surfaces</p> <p>CoC Bearings were associated with a lower risk of revision for infection compared to CoP, MoP and MoM, when the whole observation period was considered</p> <p>Study results have to be considered preliminary due to the exclusion of several confounding factors</p>
Study limitations	<p>Many patient factors known to influence infection risk, such as comorbidities, malnutrition, smoking, alcohol consumption or BMI could not be included in the multivariate analysis</p> <p>Early rate of infection did not include surgical procedure for PJI that did not require exchange of components</p> <p>Retrospective study</p> <p>No information of causative microorganism</p>

The investigators did not stratify the analysis according to polyethylene quality.

Reliability of Mixed Ceramic / BIOLOX®*delta*: Fracture Rates



**BIOLOX®*delta* /
Mixed Ceramic Heads**

**BIOLOX®*delta* /
Mixed Ceramic Inserts**

Manufacturer Database

Manufacturer database (1/2003–12/2015) In total: 5'730'000 components (2016)*	0.001% 44 fractures 4'080'000 ball heads	0.021% 351 fractures 1'650'000 inserts
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Registries and Health Authorities

Australian Joint Replacement Registry AOA NJRR (2014) ¹	0.0017% 0.17/10'000 procedures	–
Evaluation based on Massin et al. referring to French health authorities ANSM In total: 342'769 components (2014) ²	0.001% 3 fractures 230'769 ball heads	0.025% 28 fractures 112'000 inserts
Evaluation based on figures from Regional Registry of Emilia Romagna (Italy) 2000–2014 In total: 36'996 components (2016) ³	0.005% 1 fracture 20'960 ball heads	0.050% 8 fractures 16'036 inserts

* Based on CeramTec sold components data

¹ Australian Orthopaedic Association National Joint Replacement Registry (AOANJRR). Hip and Knee Arthroplasty Annual Report 2014. Adelaide: Australian Orthopaedic Association (AOA), 2014, p.108.

² P. Massin et al. Does BIOLOX®*delta* ceramic reduce the rate of component fractures in total hip replacement? Orthop Traumatol Surg Res 2014; 100(6 Suppl):S317-21; doi: 10.1016/j.otsr.2014.05.010; Epub 2014 Aug 12

³ Report of R.I.P.O. Regional Register of Orthopaedic Prosthetic Implantology, 1st Jan. 2000 – 31st Dec. 2014

Executive Summary

Issue November 2016

Title	Long-term results of third-generation ceramic-on-ceramic bearing cementless total hip arthroplasty in young patients
Authors	Young-Hoo Kim, MD, Jang-Won Park, MD, Jun-Shik Kim, MD
Journal	The Journal of Arthroplasty (2016), doi: 10.1016/j.arth.2016.03.058. accepted manuscript.
Level of Evidence	Level IV. Retrospective observational study. (Patients treated one way with no comparison group of patients treated in another way.)
Summary	<p>Kim et al reviewed 871 patients 65 years of age or younger who had a cementless THA (DePuy: IPS stem, Duraloc shell) with a 28mm CoC bearing (B. Forte) implanted between 1995 and 2000. Primary diagnosis was mostly osteonecrosis of the femoral head (53%), followed by primary osteoarthritis, or secondary osteoarthritis due to dysplasia or childhood pyogenic arthritis (40%). Mean follow up was 18.8 years (range 15-20 years).</p> <p>Harris Hip Score increased from 40 points before surgery to 95±2.9 points at 1 year, 93±5.9 at 5 years, 92±6.8 at 10 years, and 91±11.1 at 15 years and 90±9.9 at 20 years. No patient reported thigh pain at final follow-up. Fifty-seven hips (5%) had clicking sounds and 4 hips (0.4%) showed squeaking sounds. The 4 squeaking patients were not satisfied with their outcome, even though there were no other symptoms than the sound. There was no aseptic loosening of any component and no osteolysis. Dislocations occurred in 10 hips (0.9%), 7 of which were treated by closed reduction. Three patients had recurrent dislocations and the acetabular component was revised. Infections developed in 2 hips (0.2%), the femoral heads and inserts were exchanged, and intravenous antibiotics were given for 6 weeks. There was no recurrence of infection. Kaplan-Meier survivorship at 20 years for the femoral component was 100% with revision as endpoint and 99.7% for the acetabular component with revision as the endpoint.</p> <p>The authors conclude that their cementless THA utilizing CoC bearings in patients younger than 65 years provides outstanding long-term fixation and provides a high rate of survivorship without evidence of osteolysis. Kim et al emphasized the importance of carefully following their patients, and concluded that ceramics were an excellent bearing option to address the limitations of other bearing surfaces</p>
Key Research Findings	<p>Cementless THA with CoC bearings show excellent long-term survivorship at 20 years</p> <p>No osteolysis and no ceramic fracture</p> <p>0.4% squeaking hips, none revised</p> <p>CoC bearings can be used successfully without fractures if placed correctly and handled appropriately</p>
Study limitations	<p>Single surgeon, single center</p> <p>Retrospective, observational case series, no control arm</p> <p>No information of causative microorganism</p>