Monthly **CeraNews**

The Orthopaedic Landscape Information Newsletter, Issue November 2016

Ceramic fracture very rare

As demonstrated by current registry and official data, the fracture of a mixed-ceramic ball head like BIOLOX®*delta* is an extremely rare event in total hip arthroplasty. For 10,000 procedures with mixed-ceramic femoral heads the Australian Joint Replacement Registry 2014 lists a fracture rate of only 0.17. The evidence from this registry confirms the CeramTec database which shows a fracture rate of just 0.001% for the 4.08 million implants worldwide.

READ MORE >

Metal wear damages bone

A study by the University Hospital Charité and the DRK Klinikum Westend (Berlin, Germany) has demonstrated that the chromium and cobalt release in metal-on-metal bearings contributes to the loss of bone lining the implant. Once the dissolved constituents reach the bone marrow, they will damage the mesenchymal stem cells there. In patients exposed to metal wear they had lost all potential of osteogenesis.

READ MORE >

Ceramic-on-ceramic: 99.7% survival rate

A retrospective South Korean study by **Kim** et al. investigated 1,131 hip arthroplasties with ceramic-on-ceramic bearings (BIOLOX®*forte*, 28 mm) over a period of 15–20 years (mean 18.8 years). No osteolysis, aseptic loosening or ceramic fracture was seen. The twenty-year Kaplan-Meier survival rate was 100% for the femoral stem and 99.7% for the cup.

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.

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Editorial board:
- *Hartmuth Kiefer*
- *Steven Kurtz*
- *Rocco Pitto*
- *Robert Streicher*

Ceramic against fretting corrosion

One of the hottest topics of the EFORT Congress in Geneva was fretting corrosion of the taper fixation in cobalt-chromium femoral heads on titanium stems. The symptoms noted by the patients resemble those seen in metal-on-metal bearings. While at present the scope of the problem has been somewhat exaggerated, a detailed discussion is rather important because of the severe consequences for the patients, emphasized **Prof. Michael M. Morlock, PhD** in his comprehensive presentation and described the multifactorial genesis of fretting corrosion.

In particular, the head size and fitting of the taper fixation play an important role, as Prof. Morlock said. He described the failure mechanisms and pointed out the danger of increased metal ion release with its potential of initiating biological reactions. In certain material pairings this corrosion may result in fracture of the stem's neck. He pointed out that with the use of ceramic femoral ball heads, the risk of fretting corrosion is almost nonexistent. This conclusion is in line with the evidence presented by other speakers and published in the current literature.

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

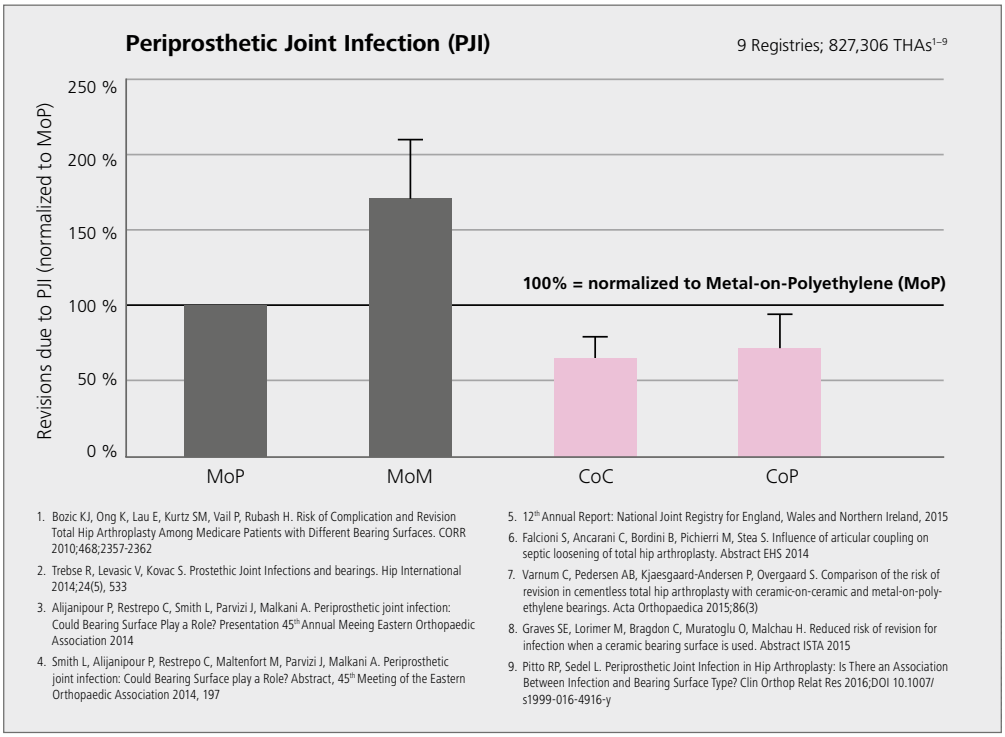
READ MORE >

Infection related revision risk reduced with ceramic bearing components

An analysis of the New Zealand registry by **Pitto** et al. suggests a correlation between the infection-induced risk for revision surgery and the bearing surface type. This retrospective study comprised 84,894 hip arthroplasties covering a period of 15 years. The lowest hazard ratio (HR) was seen with ceramic-on-ceramic bearings (HR 1), followed by ceramic-on-polyethylene articulations with an HR of 1.3. The hazard ratio of 2.12 for metal-on-polyethylene bearings, on the other hand, was more than twice as high. Metal-on-metal bearings have an HR of 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
** The investigators did not stratify the analysis according to polyethylene quality.*

READ MORE >



1. Bozic KJ, Ong K, Lau E, Kurtz SM, Vail P, Rubash H. Risk of Complication and Revision Total Hip Arthroplasty Among Medicare Patients with Different Bearing Surfaces. CORR 2010;468;2357-2362
2. Trebse R, Levasic V, Kovac S. Prostethic Joint Infections and bearings. Hip International 2014;24(5), 533
3. Alijanipour P, Restrepo C, Smith L, Parvizi J, Malkani A. Periprosthetic joint infection: Could Bearing Surface Play a Role? Presentation 45th Annual Meeing Eastern Orthopaedic Association 2014
4. Smith L, Alijanipour P, Restrepo C, Maltenfort M, Parvizi J, Malkani A. Periprosthetic joint infection: Could Bearing Surface play a Role? Abstract, 45th Meeting of the Eastern Orthopaedic Association 2014, 197
5. 12th Annual Report: National Joint Registry for England, Wales and Northern Ireland, 2015
6. Falcioni S, Ancarani C, Bordini B, Pichierri M, Stea S. Influence of articular coupling on septic loosening of total hip arthroplasty. Abstract EHS 2014
7. Varnum C, Pedersen AB, Kjaesgaard-Andersen P, Overgaard S. Comparison of the risk of revision in cementless total hip arthroplasty with ceramic-on-ceramic and metal-on-polyethylene bearings. Acta Orthopaedica 2015;86(3)
8. Graves SE, Lorimer M, Bragdon C, Muratoglu O, Malchau H. Reduced risk of revision for infection when a ceramic bearing surface is used. Abstract ISTA 2015
9. Pitto RP, Sedel L. Periprosthetic Joint Infection in Hip Arthroplasty: Is There an Association Between Infection and Bearing Surface Type? Clin Orthop Relat Res 2016;DOI 10.1007/s1999-016-4916-y

The analysis of nine arthroplasty registries suggests a statistical correlation between the bearing surface type and the rate of revision surgery due to infection. If there are metal components in the bearing, the rate is higher than without. The lowest infection-related revision rates are seen with ceramic-on-ceramic bearings.

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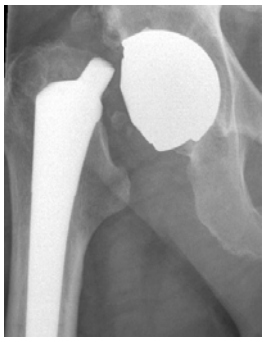
The end of the taper disaster



Michael M. Morlock
Dennis Bünte, Julian Gührs, Annika Krull, Henning Haschke

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Disclosures

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

Which disaster?

- **Disaster 1**

HIP
ISSN 1120-7000

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

REVIEW

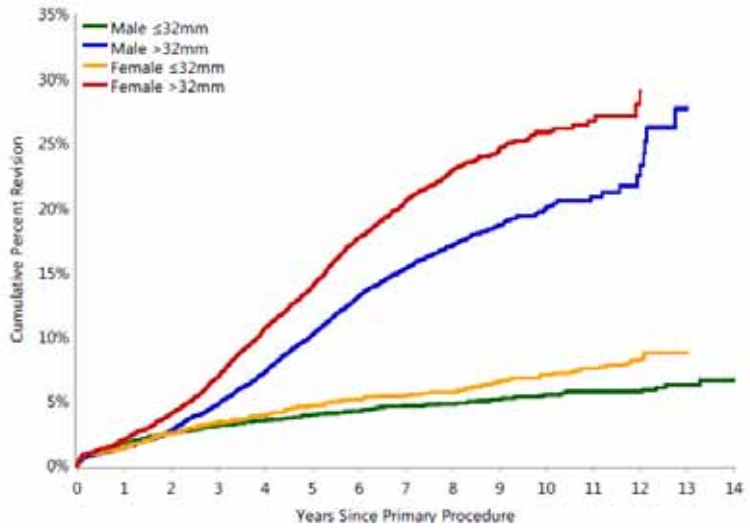
The taper disaster - how could it happen?

Michael M. Morlock

Institute of Biomechanics, TUHH Hamburg University of Technology, Hamburg - Germany

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

Disaster 1

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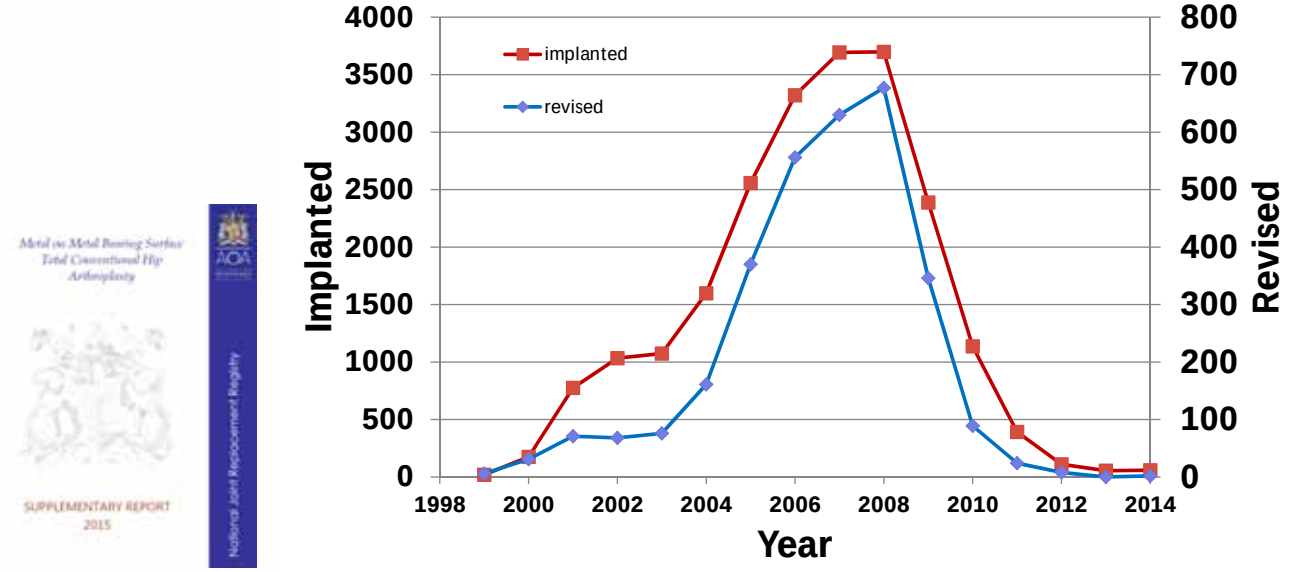
Table MM1 Number of Revisions of Metal/Metal Primary Total Conventional Hip Replacement by Year of Implant

Year of Implant	Number Revised	Total Number
TOTAL	3115	22088



Disaster 1

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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	Cormet	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.

Disaster 1

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JOURNAL OF MATERIALS SCIENCE: MATERIALS IN MEDICINE 9 (1998) 687–690

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

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Laboratoire National d'Essais, 5, Avenue Enrico Fermi, F-78197 Trappes, France

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.

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Disaster 1

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Orthopaedics & Traumatology: Surgery & Research (2013) xxx, xxx–xxx

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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

F. Hannemann[a,b], A. Hartmann[a], J. Schmitt[b,c], J. Lützner[a], A. Seidler[c], P. Campbell[d], C.P. Delaunay[e], H. Drexler[f], H.B. Ettema[g], E. García-Cimbrelo[h], H. Huberti[i], K. Knahr[j], J. Kunze[k], D.J. Langton[l], W. Lauer[m], I. Learmonth[n], C.H. Lohmann[o], M. Morlock[p], M.A. Wimmer[q], L. Zagra[r], K.P. Günther[a,*]

2016

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Which disaster?

- **Disaster 1**
- **Disaster 2**

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%)

History 1

- **It has always been there**

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.†, AND GUDMUND BLOMGREN, M.D., PH.D.†, HUDDINGE, SWEDEN

From the Departments of Orthopaedic Surgery and Pathology and the Research Center, Karolinska Institute, Huddinge University Hospital, Huddinge

no head size specified

Introduction

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

History Taper Disease

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

Revision Reasons AOA 2015

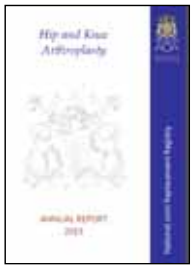


Table HT10 Primary Total Conventional Hip Replacement by Reason for Revision

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

History Taper Disease

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

Hip replacement survival

Modular primary THA is unbelievable successfull!

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

History Taper Disease

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

History Taper Disease

CLINICAL ORTHOPAEDICS AND RELATED RESEARCH
Number 401, pp. 149–161

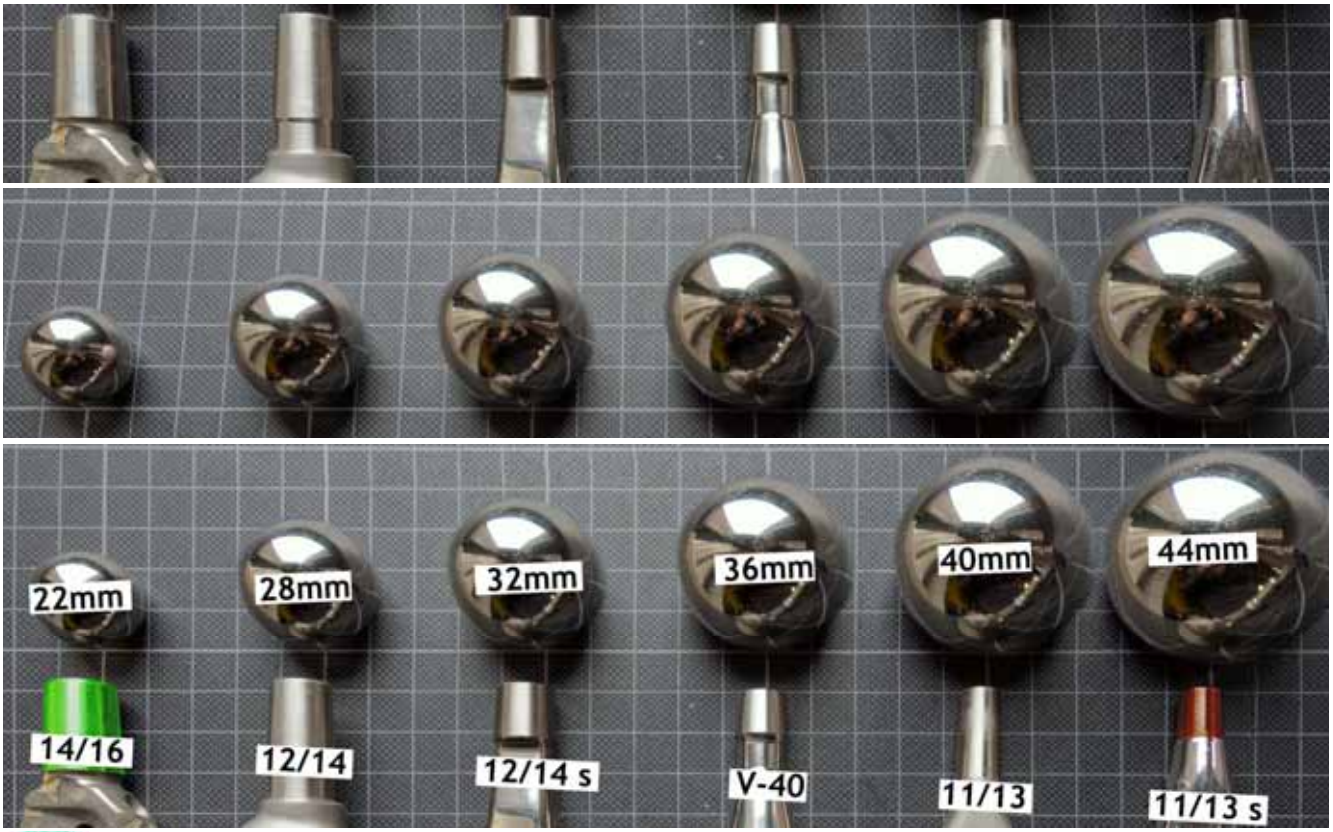
A Multicenter Retrieval Study of the Taper Interfaces of Modular Hip Prostheses

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

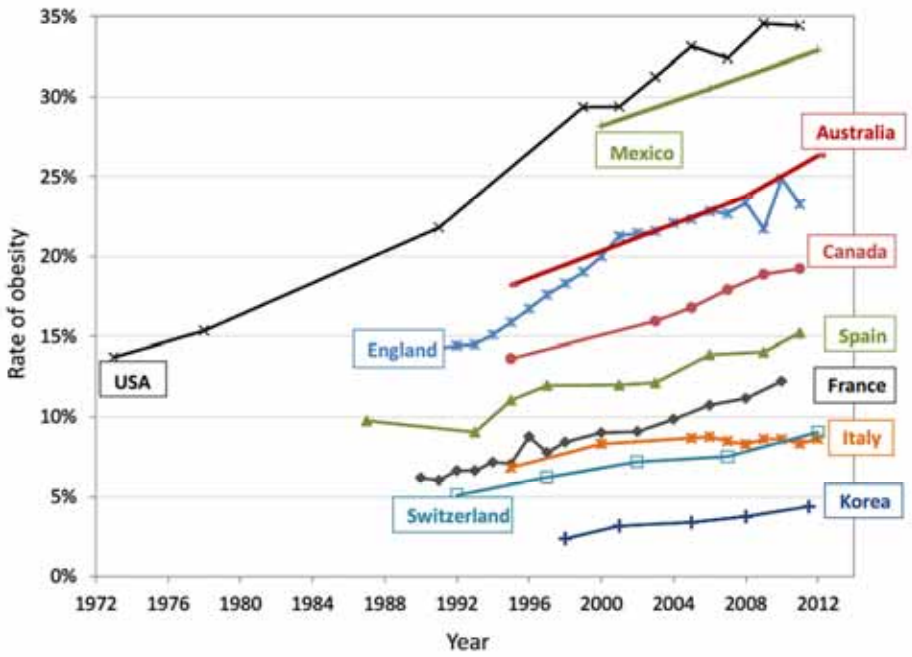
- Flexural rigidity of the neck predictor
- Larger diameter necks have higher increased stiffness and may reduce fretting corrosion
- Mechanically assisted crevice corrosion
- Corrosion and fretting more obeserved inside the head

Taper and head size development



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.

Why is anybody surprised?

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……)

Taper Corrosion

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

There is no single one...

Taper Corrosion

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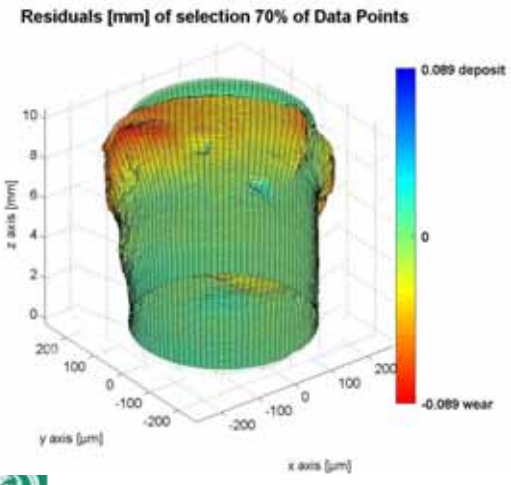
Movement / separation at the taper interface is a prerequisite for the start of mechanically induced tribocorrosion (fretting).



Taper Corrosion

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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.

Example

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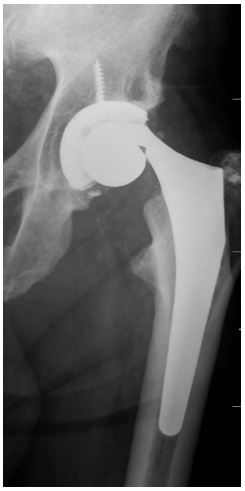
- **Active patient**
- **9 years in situ**

Example

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


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?

Taper corrosion

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Factors:

- Design
- Assembly
- Load

Taper corrosion

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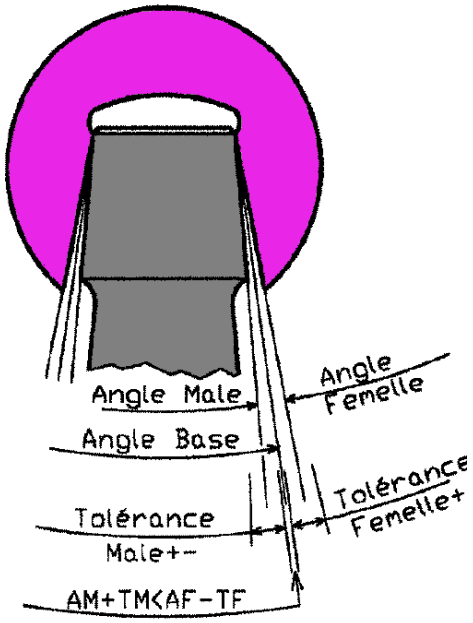
Factors:

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

What is best?



Factor Design

- 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

Taper corrosion

Factors:

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

Factor assembly

- **Prevent major mismatch**

Major mismatch

76 y female
16 years in situ

Little biological reactions since little Co or Cr

JBJS Case Connect 2014;4:e25

Major mismatch

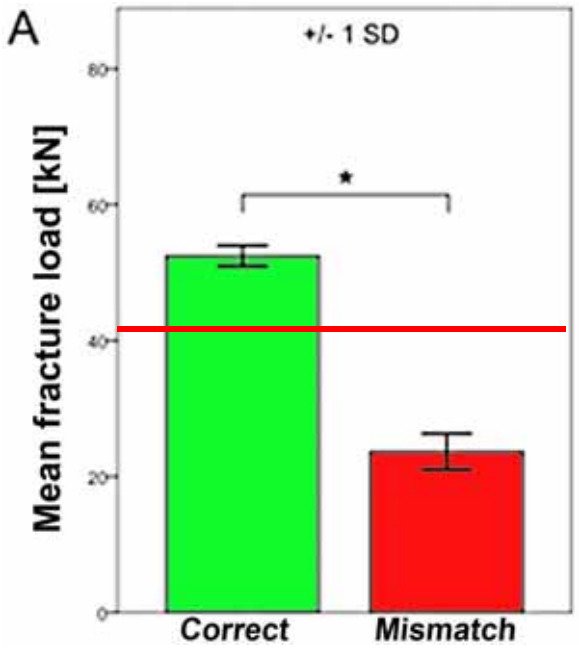
76 y female
16 years in situ

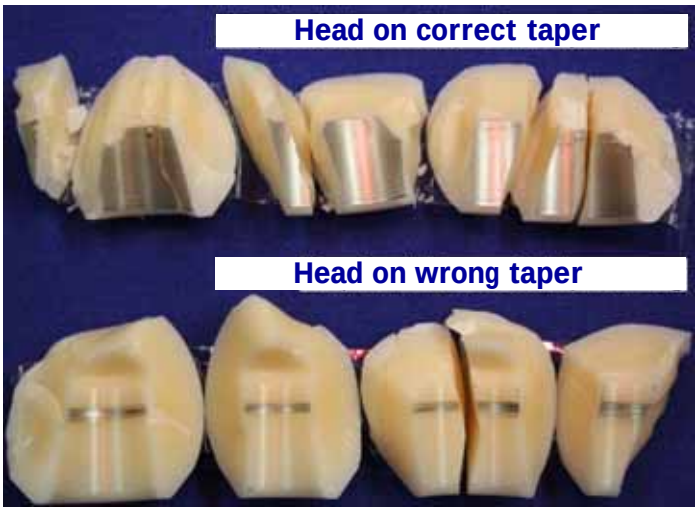
Little biological reactions since little Co or Cr

14/16 head on a 12/14 taper

JBJS Case Connect 2014;4:e25

Major mismatch

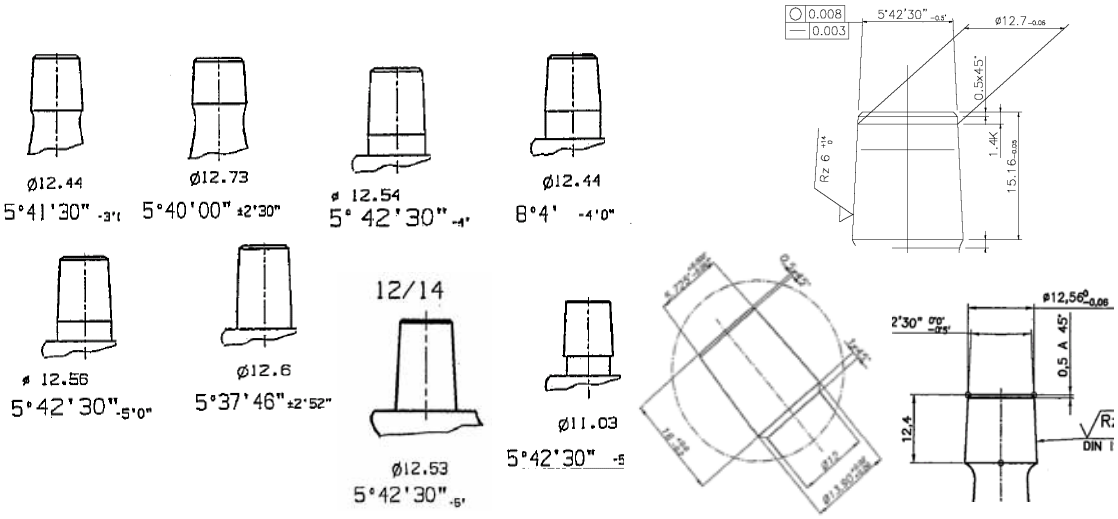




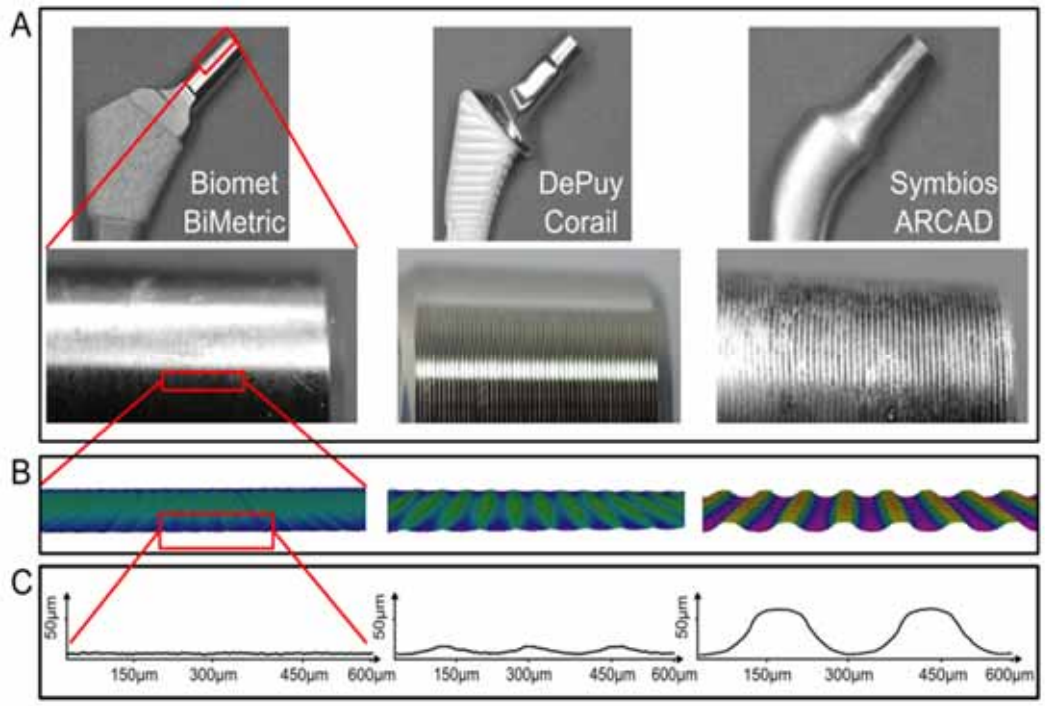
"Type I" instead of V40 taper, (Gührs et al, 2015 in press)

Taper corrosion

- **Prevent major mismatch**
- **Prevent „minor“ mismatch**



Taper geometry



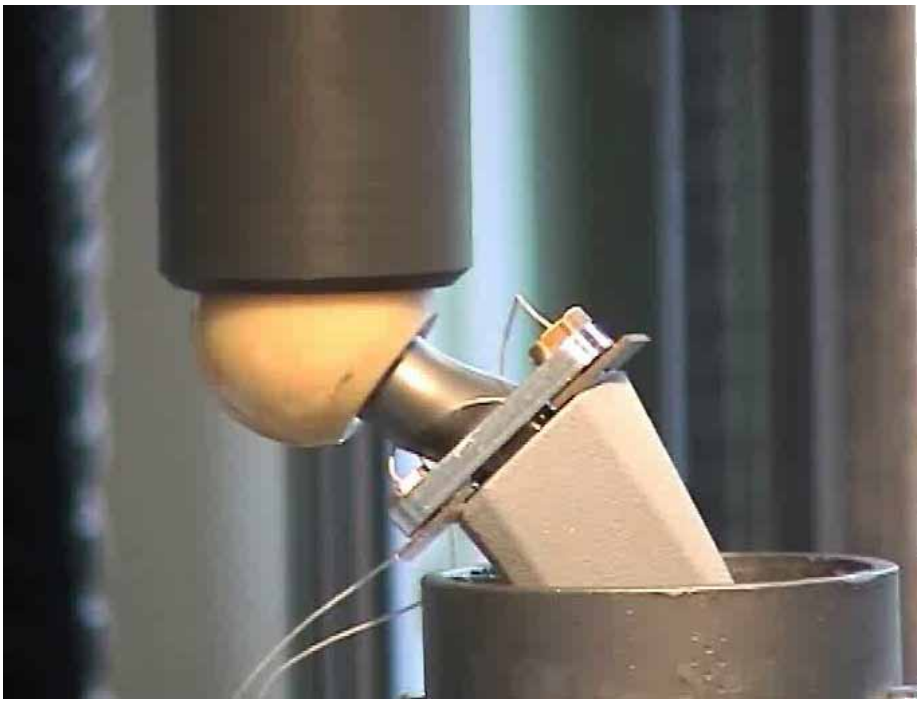
Factor assembly

- Prevent major mismatch
- Prevent „minor“ mismatch
  - no idea whether it is important
  - don‘t take any risk..

Factor assembly

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

Taper contamination



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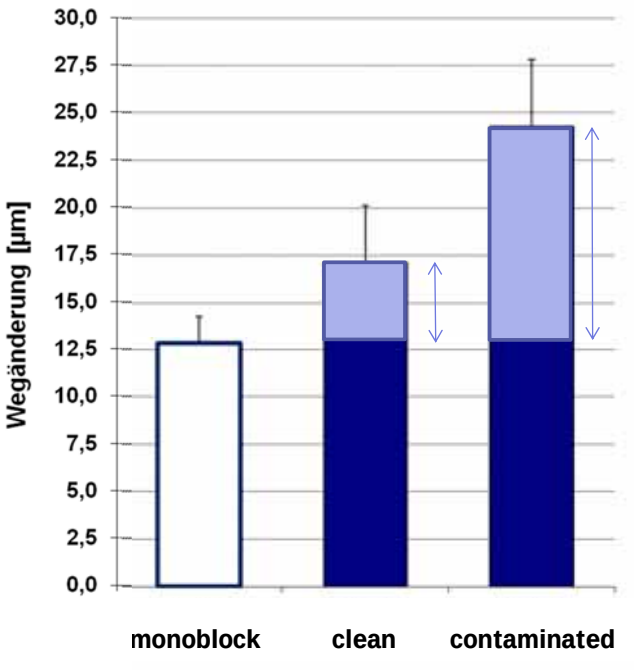
Taper contamination

Micromotion + Deformation



Jauch JoR 2013

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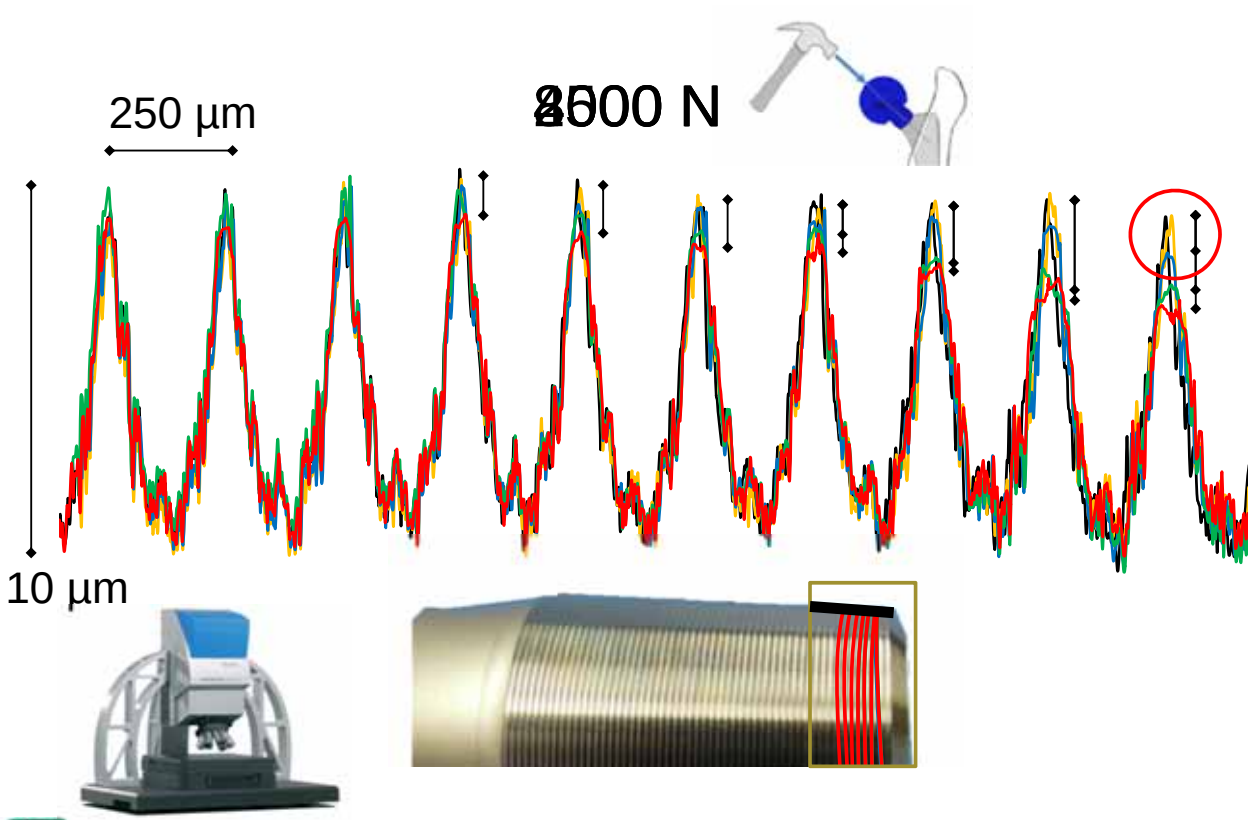
Factor assembly

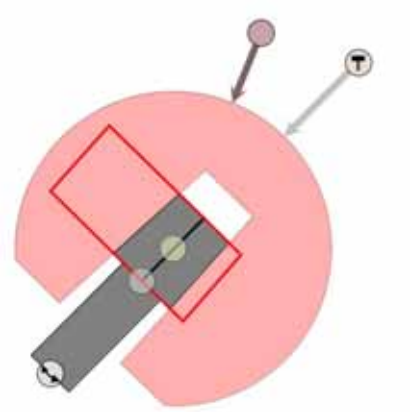
- **Prevent major mismatch**
- **Prevent „minor“ mismatch**
- **Prevent contamination**
- **Sufficient assembly force**

Plastic deformation for higher strength

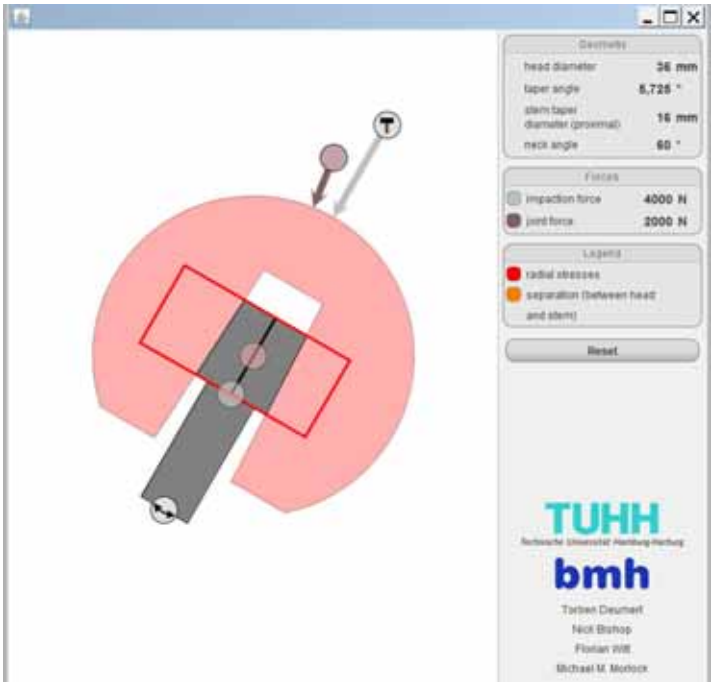


Factors:

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



Taper interface loading



Head length

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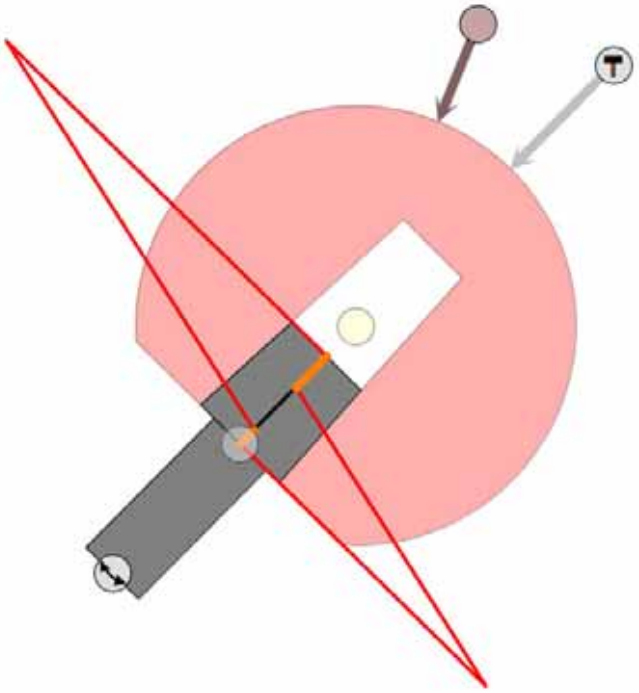
Taper interface loading



Taper corrosion

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

Offset of taper from joint load

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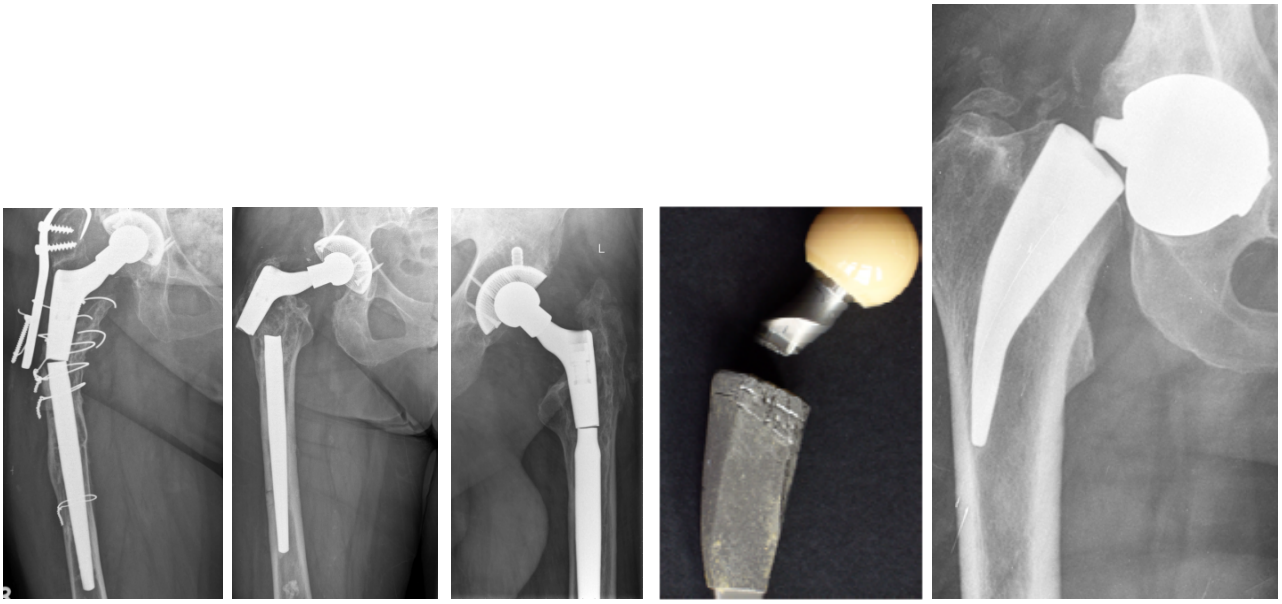
Fractures in Revision stems and bi-modular primary stems



Taper corrosion

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

THE BONE & JOINT JOURNAL

■ HIP

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

P. Craig,
G. Bancroft,
A. Burton,
S. Collier,
P. Shaylor,
A. Sinha

From Cannock Chase Hospital, Mid Staffordshire NHS Foundation Trust, Cannock, United Kingdom

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Oswestry/Stoke Orthopaedic Training Programme, Postgraduate Office, Institute of Orthopaedics, The Robert Jones & Agnes Hunt Orthopaedic Hospital NHS Foundation Trust, Oswestry, Shropshire SY10 7AG, UK.

G. Bancroft, MSc, PhD, Lecturer
Staffordshire University, Faculty of Computing, Engineering & Technology, College Road, Stoke-on-Trent, Staffordshire ST4 2DE, UK.

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.

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Taper corrosion

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Factors:

- Design
- Assembly
- Load

All factors have to be addressed!

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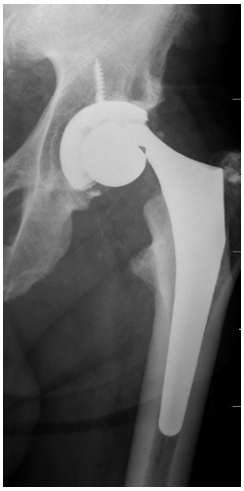
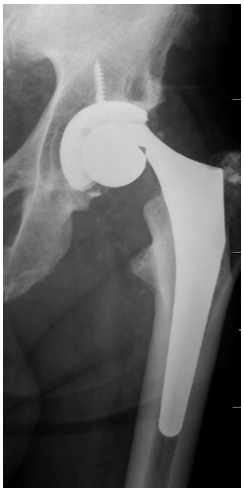
Example

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


Example – what caused it (n=4)

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


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

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. Rimnac PhD

The Journal of Arthroplasty xxx (2016) 1–6

Contents lists available at ScienceDirect

The Journal of Arthroplasty

journal homepage: www.arthroplastyjournal.org

ELSEVIER

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

Hospital for Special Surgery, New York, New York

Disaster 2

The Journal of Arthroplasty xxx (2016) 1–8

Contents lists available at ScienceDirect

The Journal of Arthroplasty

journal homepage: www.arthroplastyjournal.org

Original Article

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

Sok Chuen Tan, MBBS, FRCS (Edin) [a,*], Adrian C.K. Lau, MBBS, FRCS (Edin) [a], Christopher Del Balso, BSc (Hons), MSc, MBBS [a], James L. Howard, MD, MSc, FRCSC [a], Brent A. Lanting, MD, MSc, FRCSC [a], Matthew G. Teeter, PhD [a, b, c]

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

Discussion

Many things have to be done right SIMULTANEOUSLY..

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**
- **Laywers and patients and surgeons „like“ problems, which can be directly linked to the product**

Discussion

Discussion

Take home

- 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 -

Take home

- 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

2016

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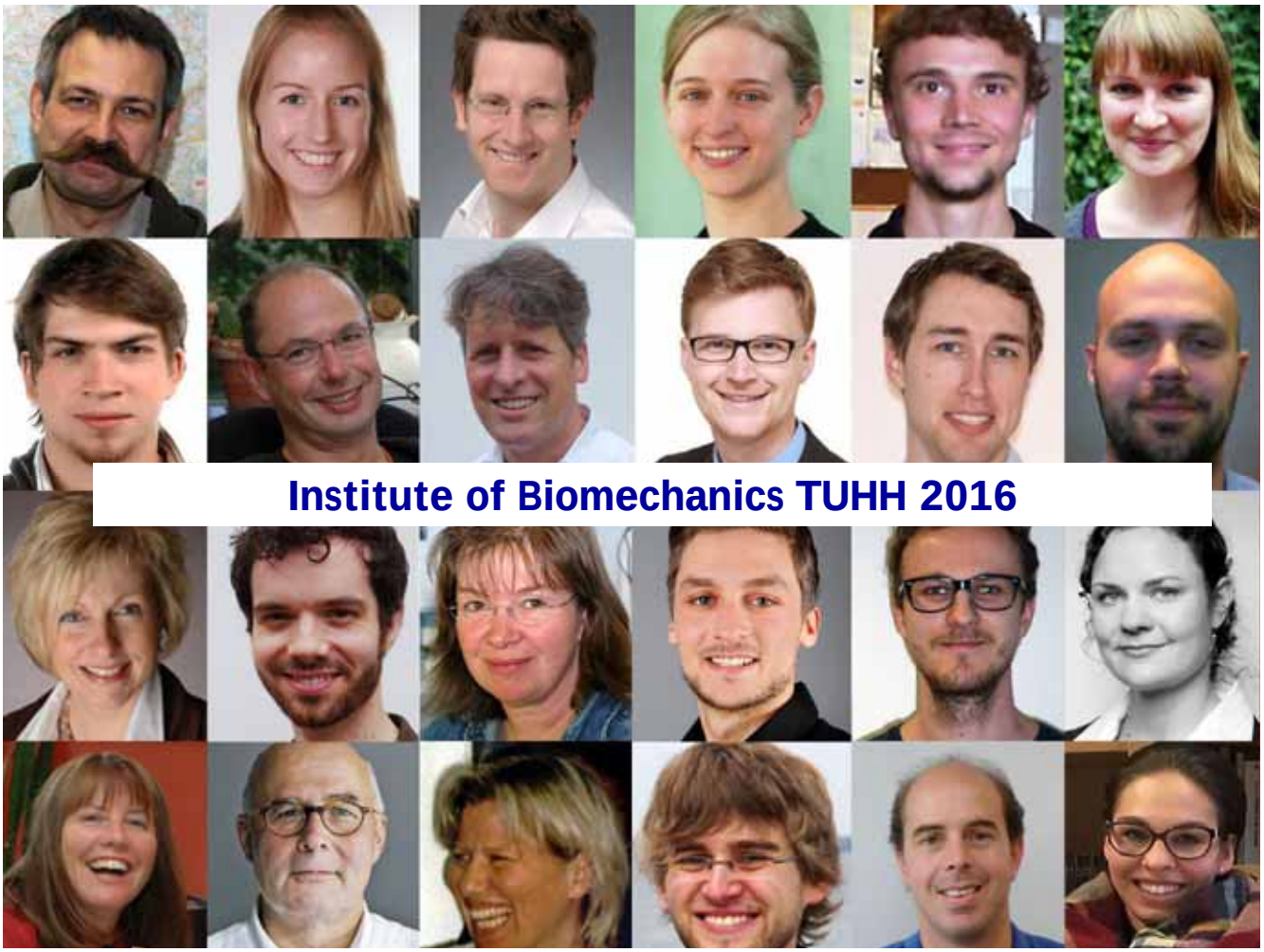
Take home

- 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)



Thank you for your attention!

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2016

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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	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 obrservation 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. 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. 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.
Key Research Findings	**There was no difference in the rate of early (<6 months) risk of revision for infection between the bearing surfaces**
	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
	Study results have to be considered preliminary due to the exclusion of several confounding factors
Study limitations	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
	Early rate of infection did not include surgical procedure for PJI that did not require exchange of components
	Retrospective study
	No information of causative microorganism

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

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MT-MM 0045 1609 ENG

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

Manufacturer Database	**BIOLOX®*delta* / Mixed Ceramic Heads**	**BIOLOX®*delta* / Mixed Ceramic Inserts**
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
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

MT-MM 00622 1611 EN

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	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). 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. 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
Key Research Findings	**Cementless THA with CoC bearings show excellent long-term survivorship at 20 years**
	No osteolysis and no ceramic fracture
	0.4% squeaking hips, none revised
	CoC bearings can be used successfully without fractures if placed correctly and handled appropriately
Study limitations	Single surgeon, single center
	Retrospective, observational case series, no control arm
	No information of causative microorganism

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