

# Failure analysis: practice and future challenges



**Material failure**

Michael M. Morlock and co-workers

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Institute of Biomechanics  
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**TUHH**  
Hamburg University of Technology

# Failure analysis: practice and future challenges

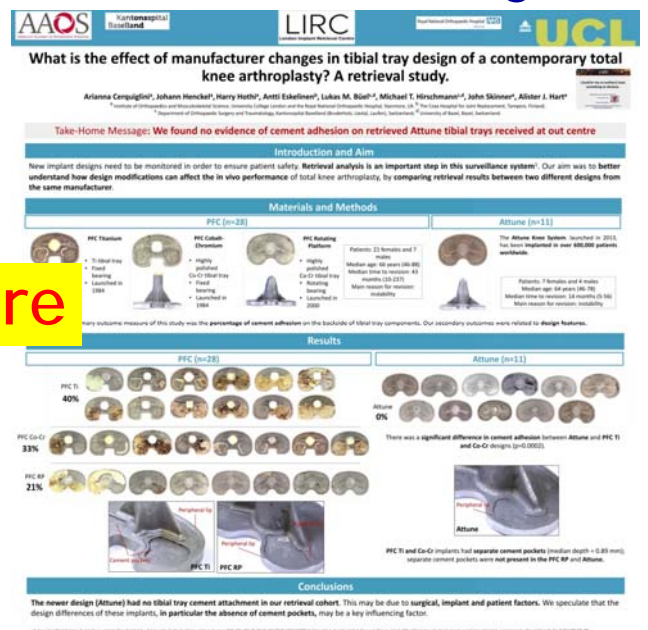


**Clinical failure**

Michael M. Morlock and co-workers

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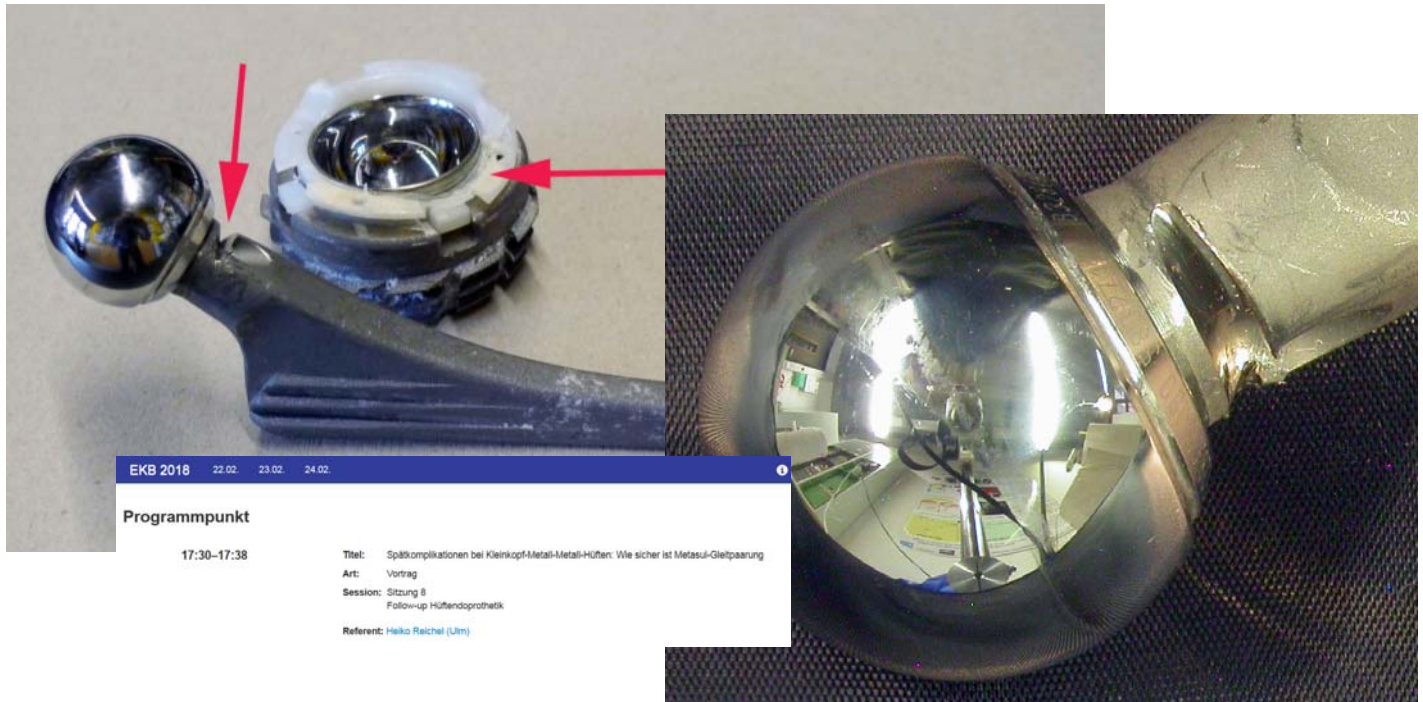
**TUHH**  
Hamburg University of Technology

- It didn't work and had to be replaced
- Main question: material failure or clinical failure?
- Best case scenario: failure can directly be related to observations made from the implant

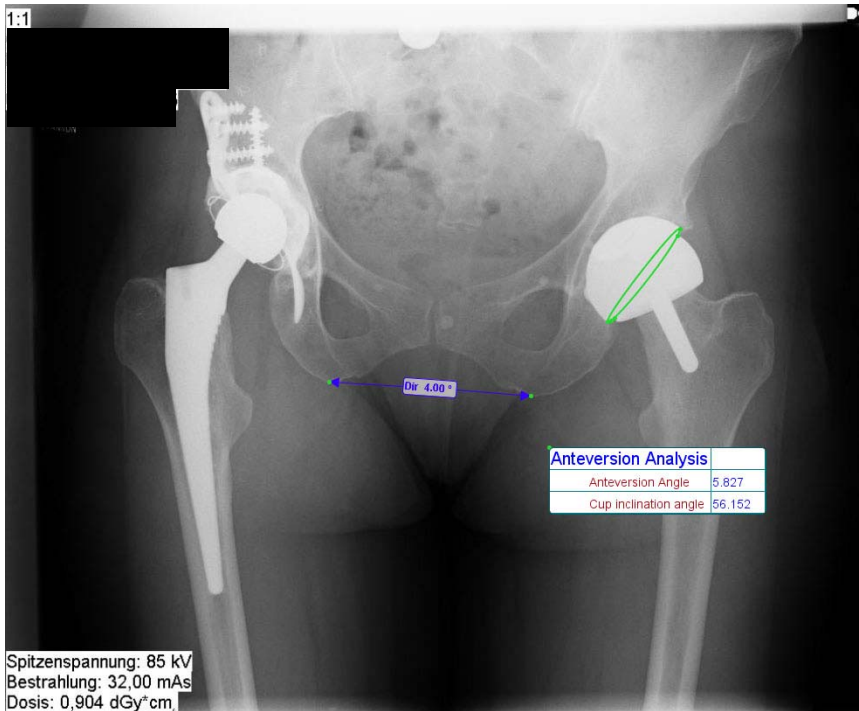
## Example 1



# Example 1



# Example 2

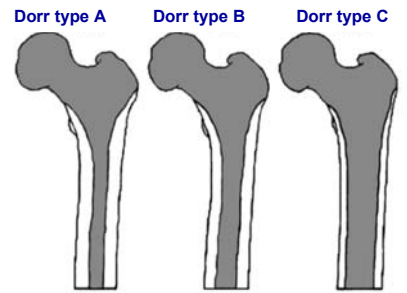


Co 93.1 µg/l

# Example 3



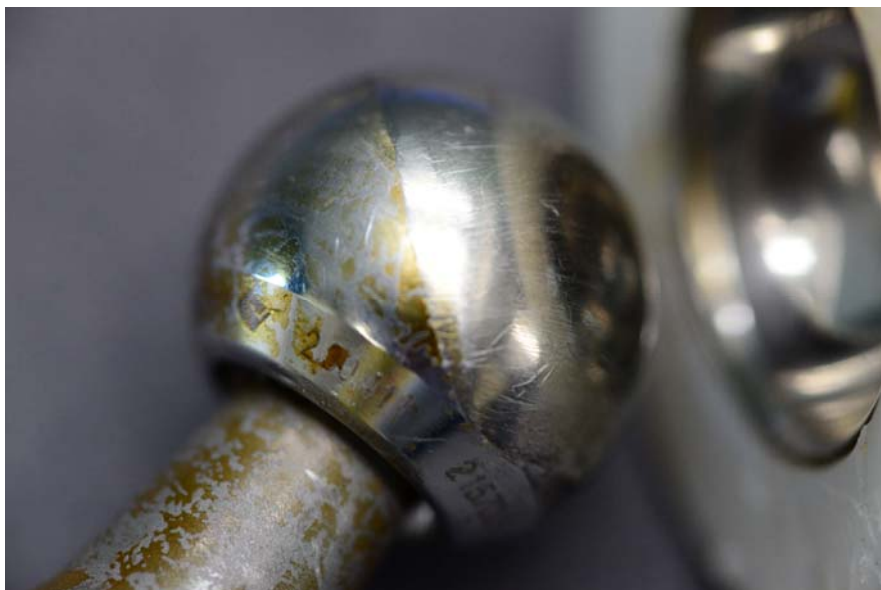
2.8 years



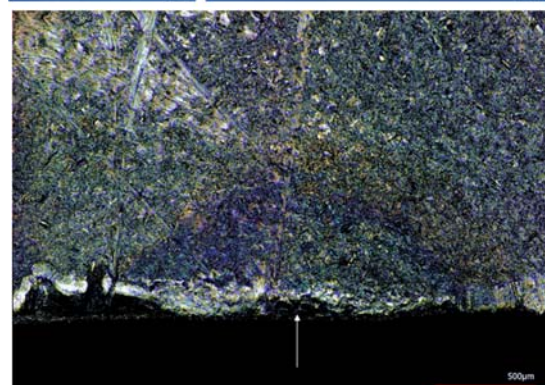
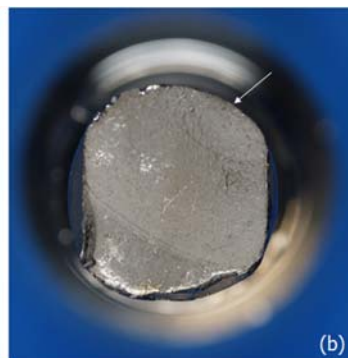
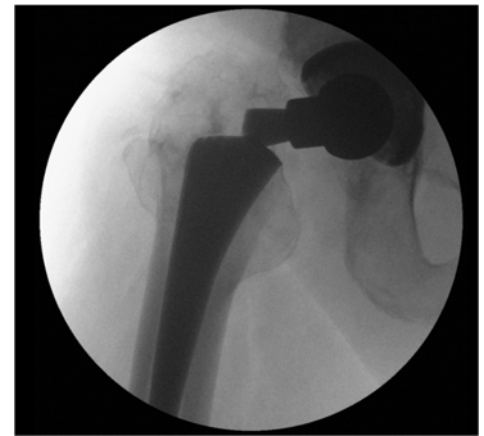
[Abdul Kadir 2013]

# Example 3

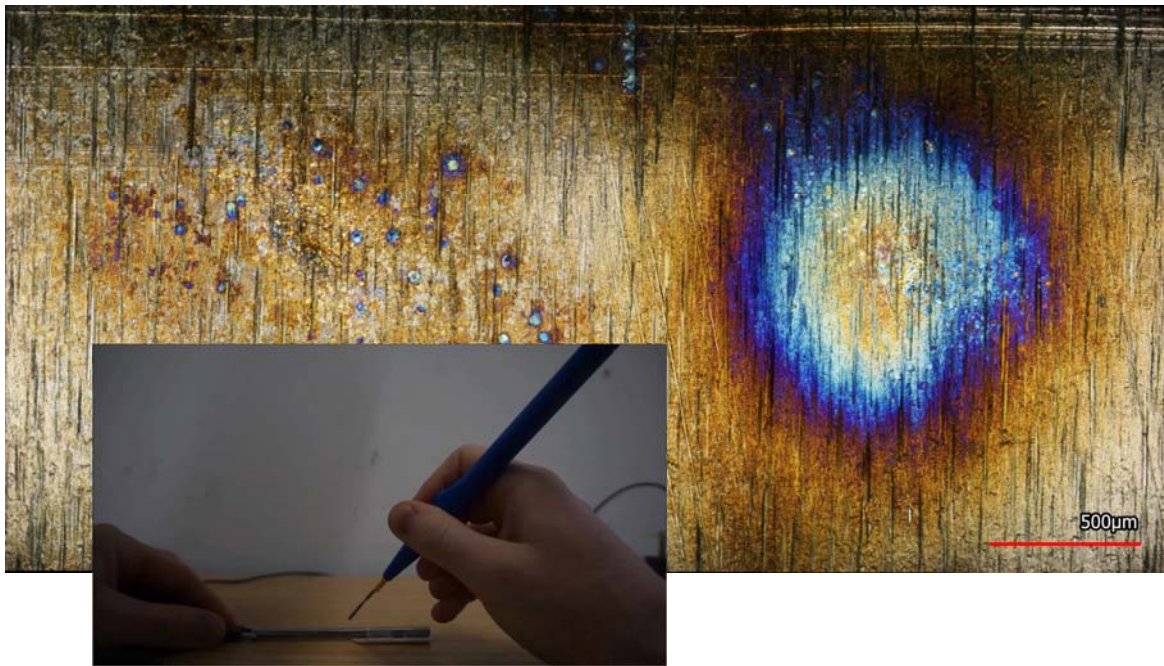
6.5 years



Primary 08.10.2006  
+8mm head



..... the combination of a CLS stem and a DePuy head with a neck length of **more than 8 mm** is an unauthorized combination, which is not released by Zimmer (see [www.product-compatibility.zimmer.com](http://www.product-compatibility.zimmer.com)).....



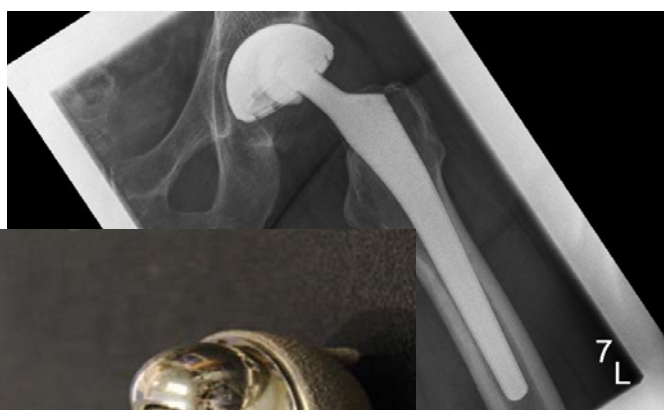
## What does retrieval analysis tell us?

- It didn't work and had to be replaced
- Best case scenario: failure can directly be related to observations made from the implant

All examples (also previous talk) from court cases in which manufacturer was accused

- It didn't work and had to be replaced
- Best case scenario: failure can directly be related to observations made from the implant
- Normal situation

## Example 7 - Liner dislocation



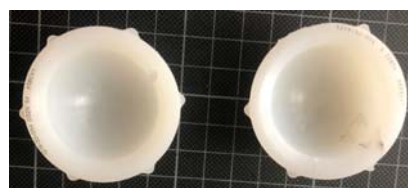
This damage has been documented before:

NJR 0.1% (Jameson et al., 2013)

DePuy 0.06%

Peer reviewed studies

0.17%, 0.32%, 0.77%, 0.82%  
(in total 12 publications)



## Example 8 - Ceramic Inlay fracture



## Example 11 - Stem taper failure



Courtesy Robert Hube







He crashed twice...

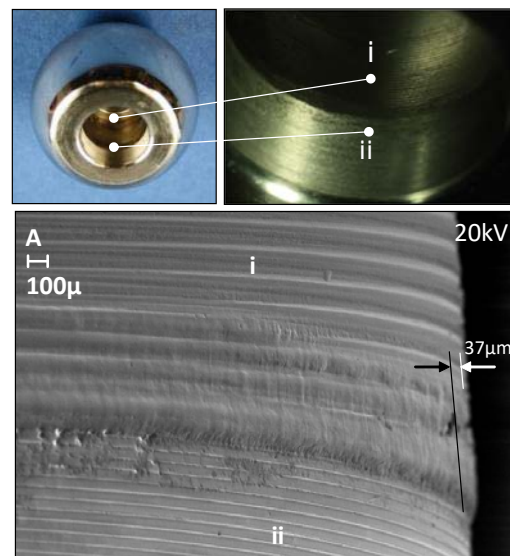
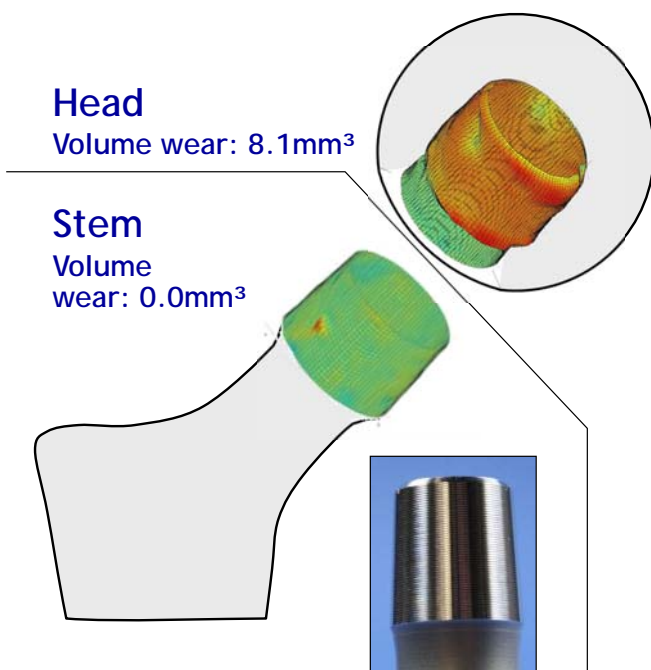
**“What are the factors to make an implant successful in some but fail in other patients?”**

## What do we know?

- Implant: CE-certified, fullfills all specifications required by the notified body (most controlled factor....)
- Surgeon: Trained (University, Hospital, Training courses). Not standardized, transfer of knowledge after training courses not assured (CME credit for physical presence)
- Patient: .....

*Predominantly the implant is "identified" as the reason for revision, since we only look at the implant (predominantly)*

- Multiple quantitative methods to document condition



- Imprint of Ti stem taper profile in CoCr head taper

- Multiple quantitative methods to document condition
- Very difficult to conclude, what exactly caused the condition (in most cases), especially if only single retrievals are available
- Gross product failure vs. Interface failure

-> look for frequency of occurrence in registries!

## *Failure analysis: practice and future challenges*

### Practice

- Sophisticated descriptive methods to document situation
- Little gain of knowledge, what differentiates between failure and success
- Difficult to establish causality (missing info - flight recorder?)
- Material problems vs. (tiness)



## *Failure analysis: practice and future challenges*

### Future challenges

- Obtain „complete“ data: Manufacturer (technical data)  
Surgeon (procedure)  
Patient (loading)  
Registry (single - many)
- Report to authorities, manufacturer, original surgeon, laboratory - do not throw away!
- Design a simple process of reporting and providing explants together with the additional information without scaring the surgeons away by too much paper.
- Most important: dare to address all „real“ problems!