TOTAL HIP REPLACEMENT
THE BEARING SURFACE

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Bearing surface ?

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Bits that rub together

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Study of bearing surfaces

- Tribology
- Greek
- Ology = study of
- Tribos = to rub

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Options

- **Femoral head**
- **Metal**
  - **Chromium Cobalt**
  - **Titanium**
- **Ceramic**
  - **Alumina**
  - **Zirconia**

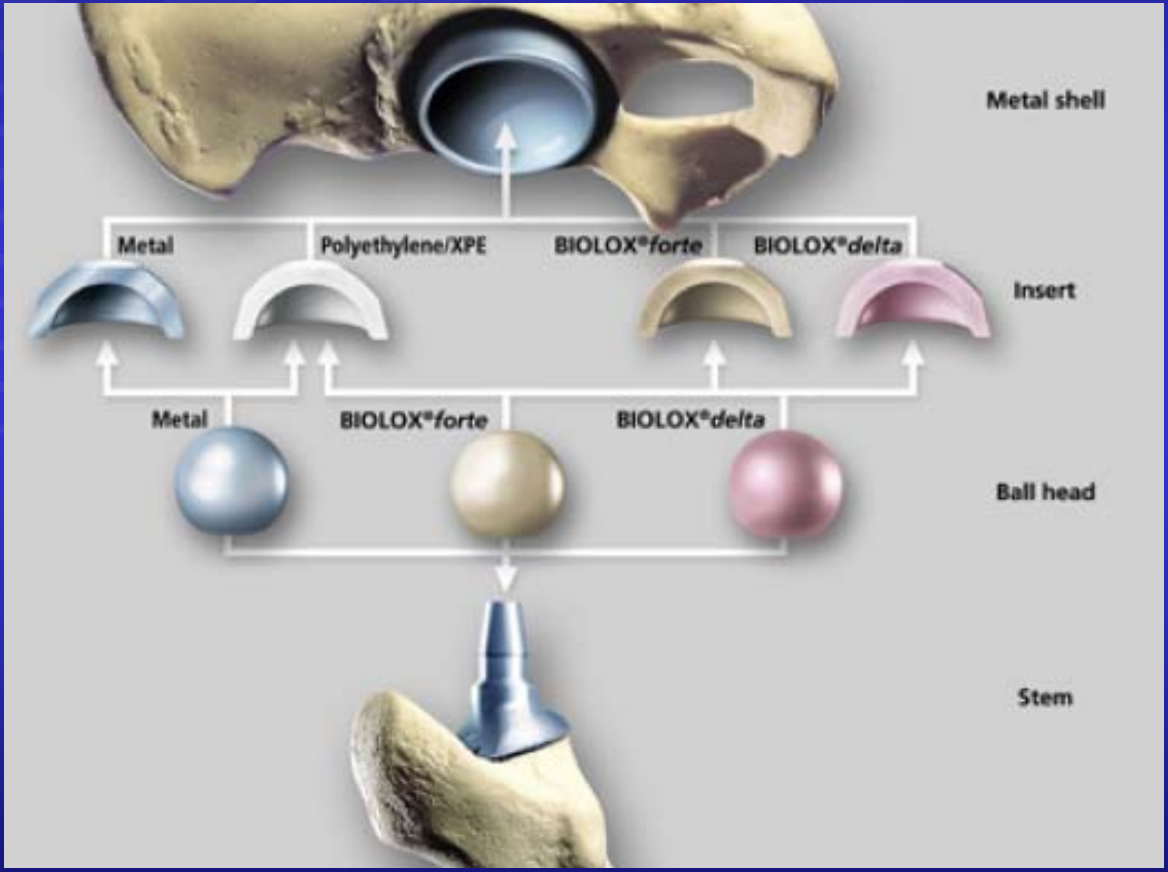
Acetabular liner

- **Polyethelene**
  - **Standard UHMW**
  - **Highly cross linked**
- **Ceramic**
  - **Alumina**
  - **Zirconia**
- **Metal**
- **Chromium cobalt**

Combinations

- Metal on poly
- Ceramic on poly
- Ceramic on ceramic COC
- Metal on metal MOM
- Metal on ceramic

Hard on hard



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In reality

- Chrome cobalt heads
- Ceramic heads
- Poly liners >>> Highly X linked
- Ceramic liners

How do we choose ?

- Age
- Activity
- Head size option
- Neck size option
- Cost
- Past performance

Does what we choose alter post op rehab ?

No

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History

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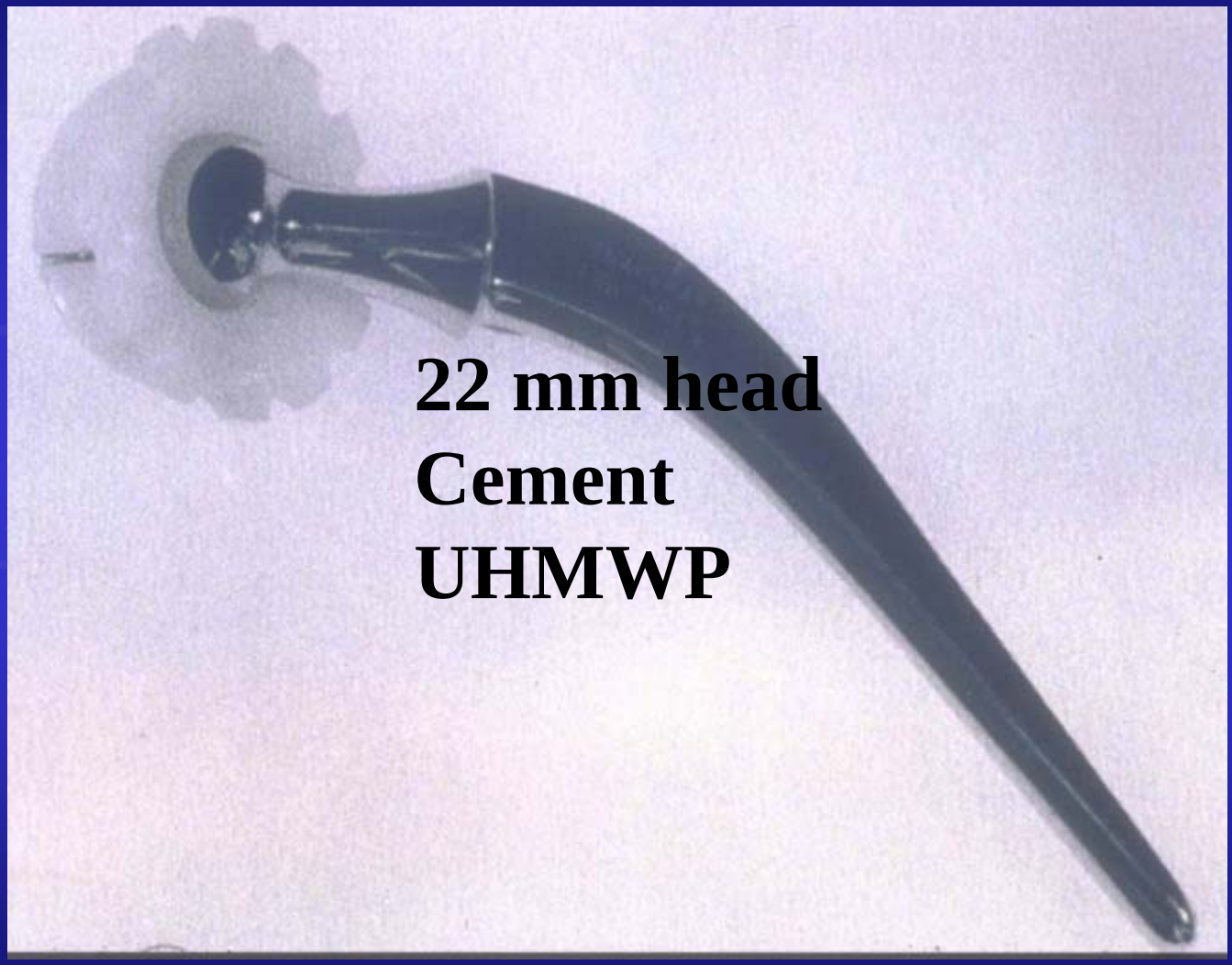

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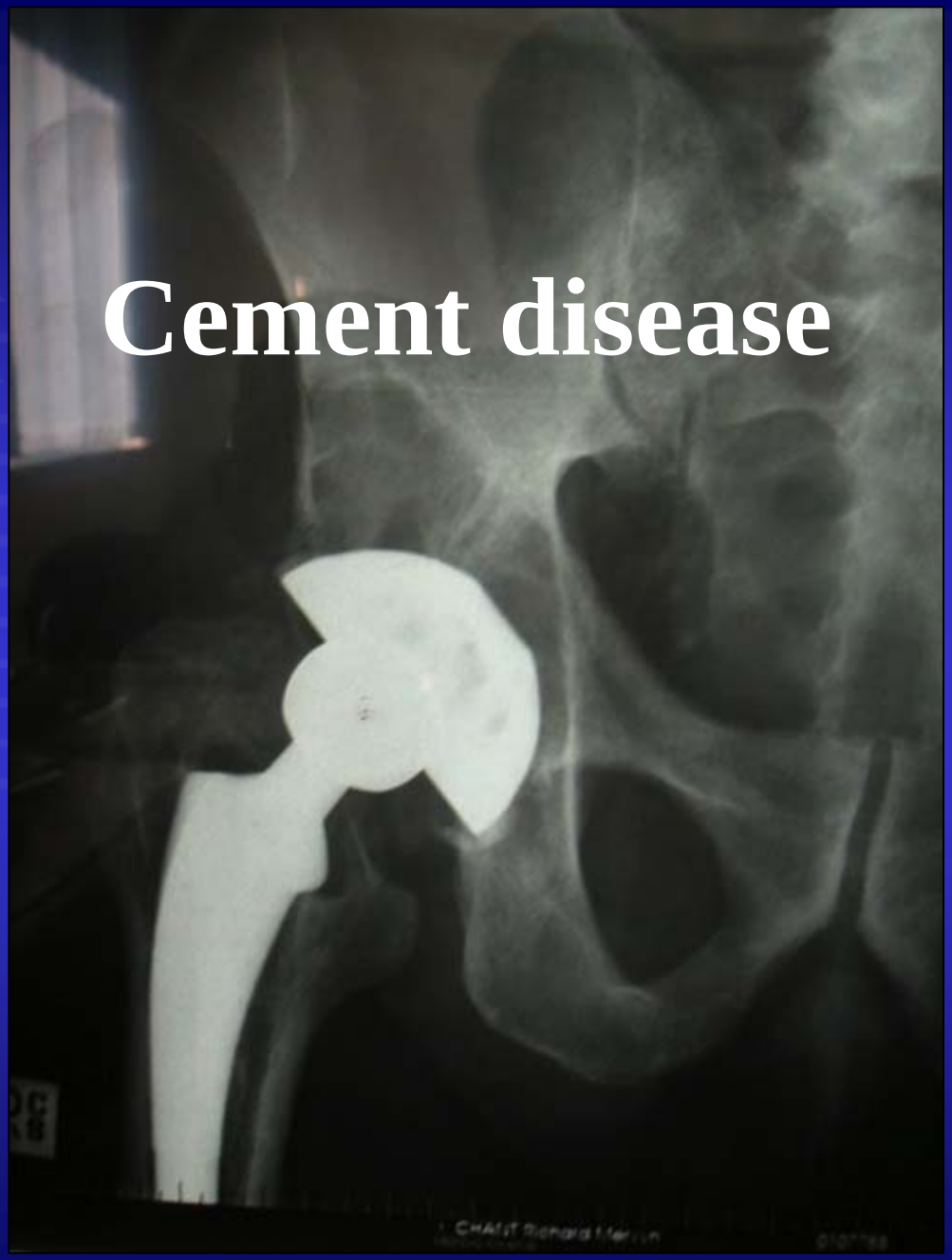
Cement disease



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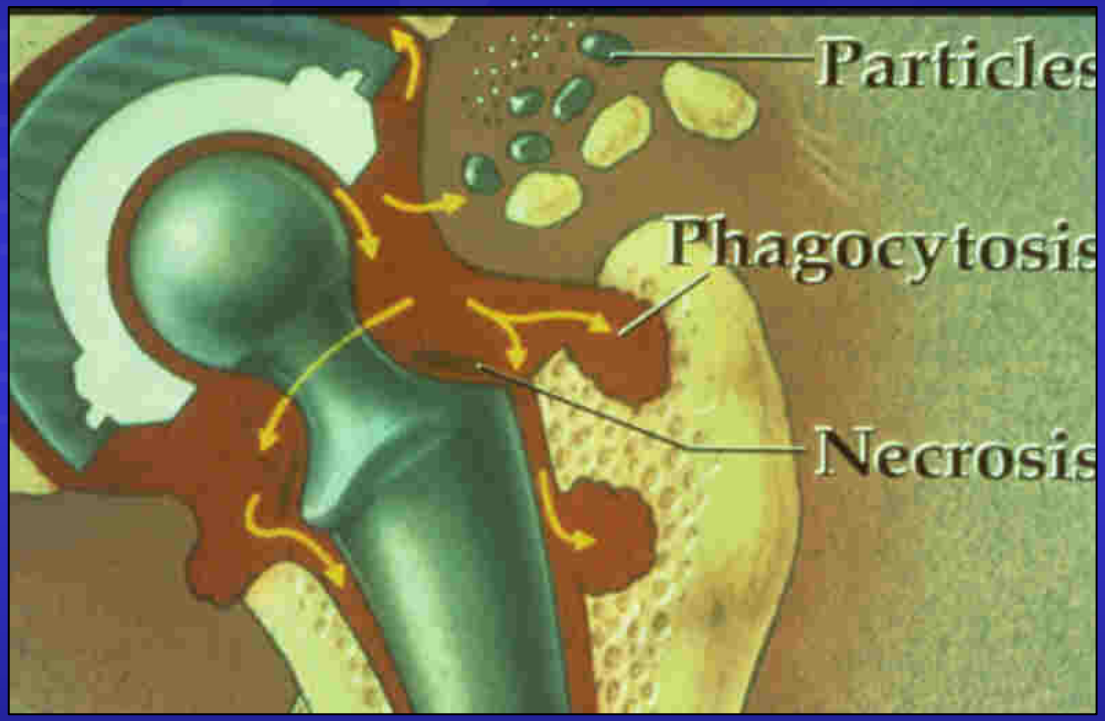

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Granuloma seen again

- Cement disease

Eliminate cement

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Not just cement disease

- Any submicron particle

Particle disease

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In an uncemented THA the major source of particles in the bearing surface

The major research focus in hip arthroplasty is the bearing surface

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Poly debris became the major culprit

Alternate bearing surfaces

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Ceramics

- Low wear rates
  - 2-3 microns per yr
  - 200 microns standard poly
- Particles less biologically active

Sounds like the solution

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But

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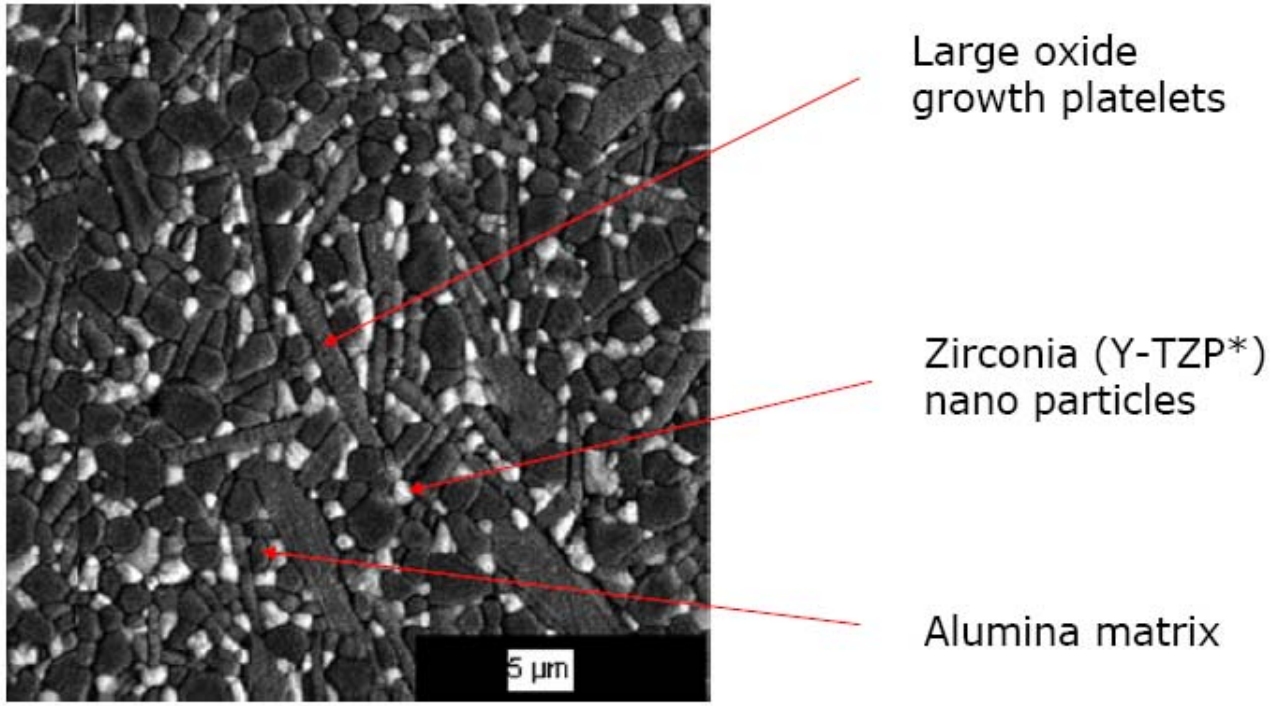
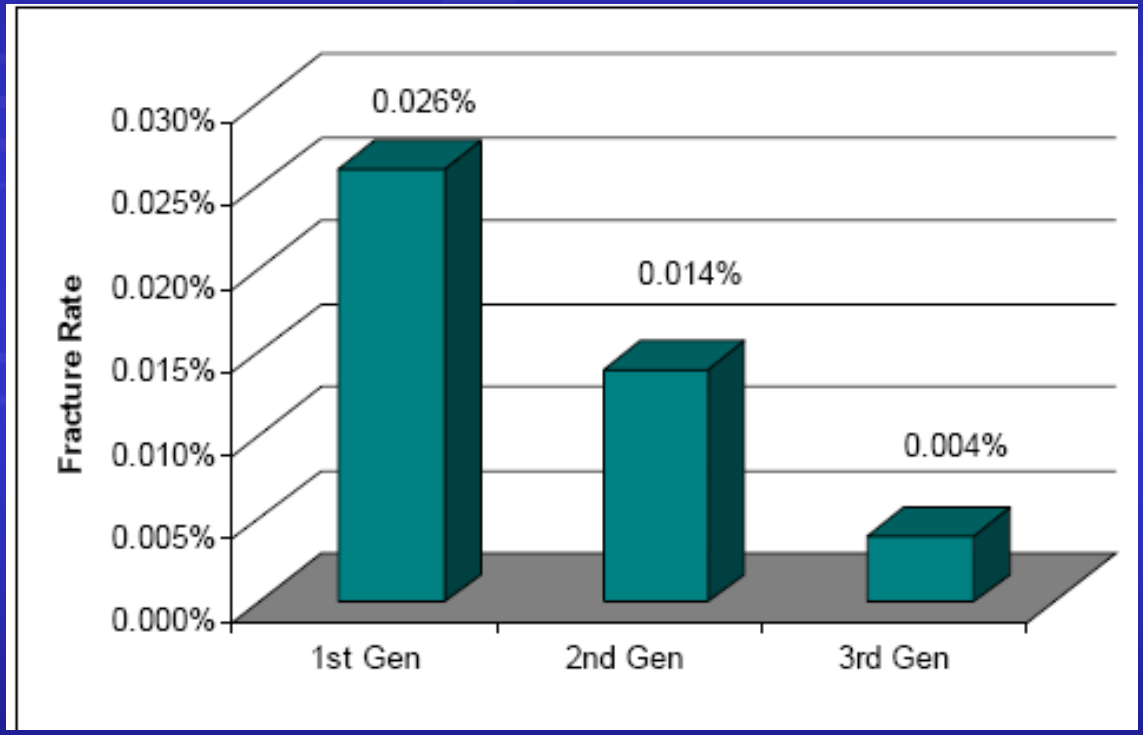


Property	Biolox® *forte*	Biolox® *delta*
Density (g/cm³)	3.98	≥ 4.36
Grain Size of Alumina matrix (µm)	< 1.8	≤ 1.5
4-Point Bend Strength (MPa)	580	1000
Fracture Toughness (MPam½)	2.78	5.7
Young's Modulus (GPa)	380	350



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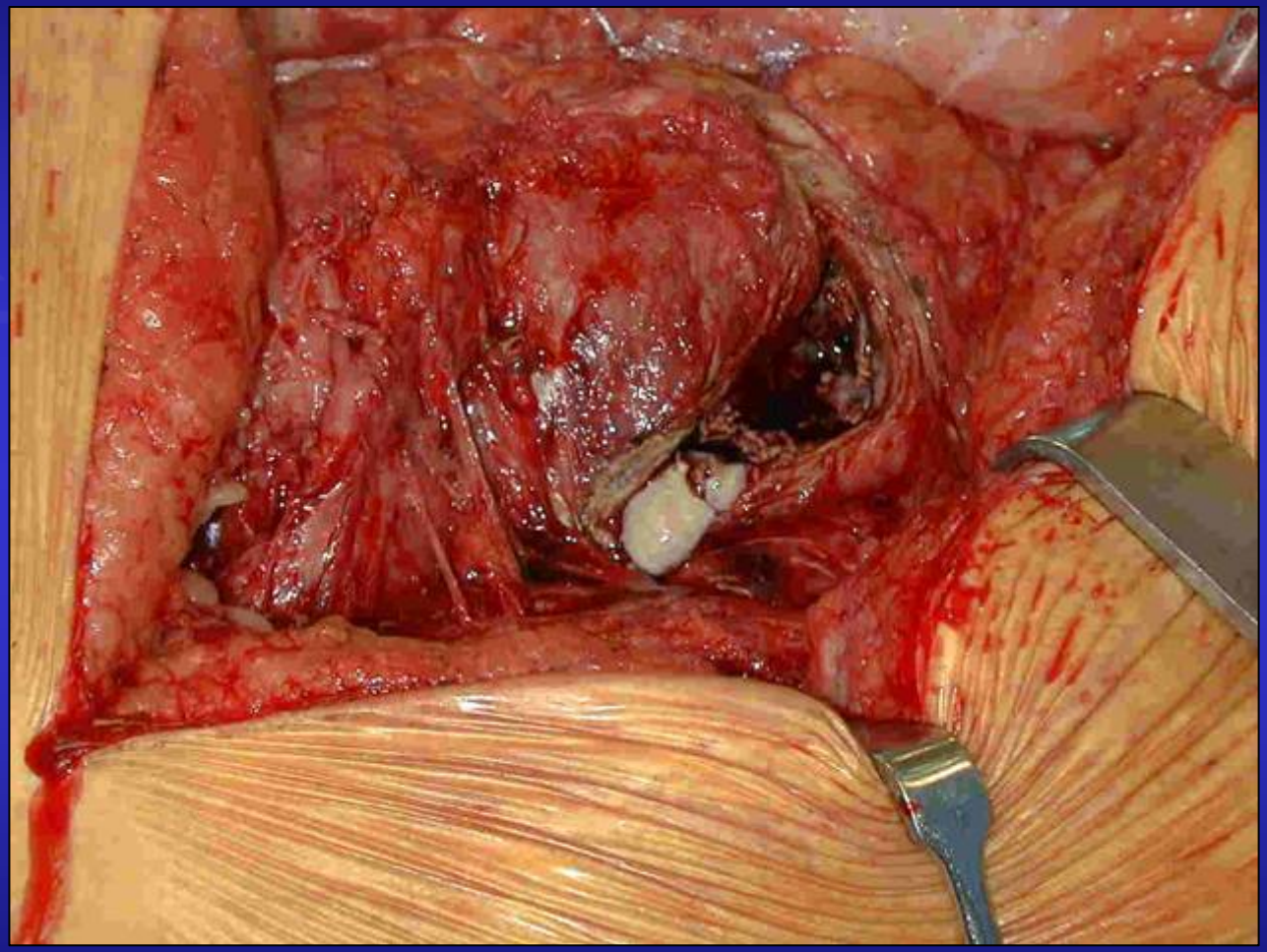

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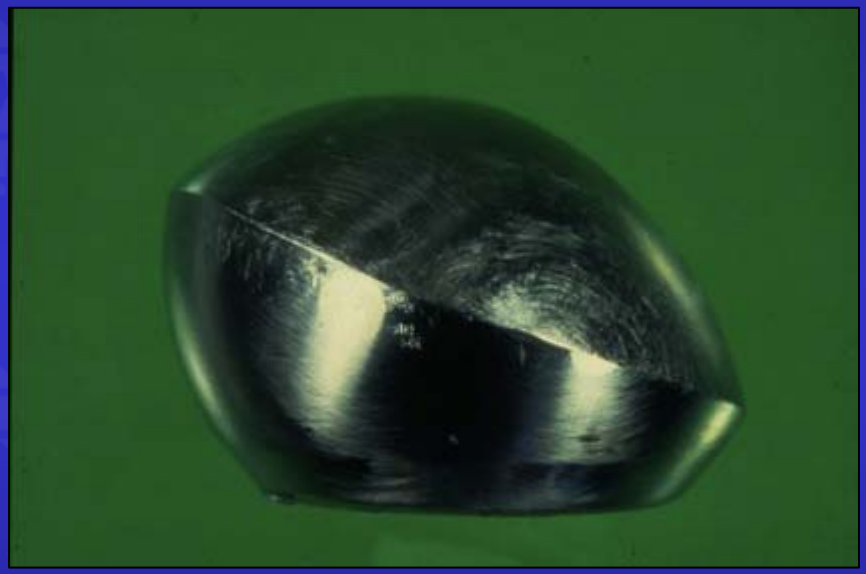

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Also

Squeaking

- Edge loading
- Beware instability

Metal on metal

- Low wear rates
- Cant fracture
- Vary neck length
- Can be thinner than ceramic
- Use big head sizes
- Greater ROM without risk of dislocation

Very attractive

But

- High failure rates in past
- Due to manufacture rather than wear

Manufacturing problems overcome

- New metals
- Better machining

Great enthusiasm

- Media
- Surgeon promotion
- Everybody wanted one
- Patients insisting

Until

- Higher than expected failure rates reported

Issues

- Loosening
- Elevated chromium cobalt ions
- Metallosis
- Synovitis
- Bone lysis
- Necrosis
- Pseudo tumours

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Now

- No body wants one
- No one wants to put them in

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Highly crossed linked poly

- Low wear rates
- Implies less granuloma
- More forgiving
  - Position
  - Impingement
- No fracture
- No ions

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But

- X linking require radiation
- Produces free radicals
- Participate in x linking
- Any free radical left over oxidises
- Oxidation weakens poly

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So

- Solution is to eliminate any free radical not involved in x linking

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Done by

- **Heating**
  - **Melting or annealing**

But this

- Alters crystalline structure of poly
- Poly weakened

???

- Annealing
- Vit D

Big heads ??

- Reduce dislocation
- Improve ROM

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Reality

- Head sizes above 36 mm
- Don’t reduce dislocation
- Don’t increase ROM

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And

- **Almost all modes of failure increase with head sizes over 36 mm**

Thank you

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