HIP PROSTHESIS

MODELS AND MATERIALS

SURGICAL TECHNIQUES

APPROACHES

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IMPLANT TO BONE INTERFACE

CEMENTLESS

Grid-blasted
(Morscher Pressfit)

Threaded
(Bicon)

Porous-coated
(Pinnacle)

CEMENTED

Polished metal
(Versacem)

Polyethylene
(Müller Flachprofil)
COPING WITH BONE LOSS

Enforcement rings
(Ganz, Burch-Schneider)

Tumor prostheses
(Link)

Trabecular metal
augments
ARTICULATING SURFACES

advantage
wear ↓
reliable, forgiving
wear ↓↓↓
wear ↓↓ stability

disadvantage
breakage (head)
wear
squeaking
breakage
metal ion blood level
pseudotumor

1. Nov. 2014
MoM PROSTHESIS / MODULAR NECK

Risk of:
- osteolysis
- ALVAL\textsuperscript{1}: aseptic lymphocyte-dominated vasculitis-associated lesion
  \( \rightarrow \) pseudotumor

Investigation:
- blood serum\textsuperscript{2,3}: cobalt: > 2-7 µg/l (>119nmol/l)
  chrom: >134.5 nmol/l
- CT / MARS (metal artifact-reducing sequences) MRI

\textsuperscript{1} Watters TS, Am J Clin Pathol 134: 886, 2010
\textsuperscript{2} EFFORT, Consensus statement, April 16, 2012
\textsuperscript{3} MHRA UK. Medical device alert. Metal-on-metal total hip replacements. 2012 Apr
Table 1 - Management recommendations for patients with stemmed MoM total hip replacements – femoral head diameter ≥36mm (originally published in the MHRA’s MDA/2012/008).

<table>
<thead>
<tr>
<th>Stemmed MoM total hip replacements – femoral head diameter ≥36mm</th>
<th></th>
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</thead>
<tbody>
<tr>
<td>Symptomatic patients</td>
<td>Asymptomatic patients</td>
</tr>
<tr>
<td><strong>Patient follow-up</strong></td>
<td><strong>Imaging: MARS MRI or ultrasound</strong></td>
</tr>
<tr>
<td>Annually for life of implant</td>
<td>Recommended in all cases</td>
</tr>
<tr>
<td>Annually for life of implant</td>
<td>Recommended if blood metal ion levels rising</td>
</tr>
<tr>
<td><strong>1st blood metal ion level test</strong></td>
<td><strong>Results of 1st blood metal ion level test</strong></td>
</tr>
<tr>
<td>Yes</td>
<td>Blood metal ion level &gt; 7 ppb indicates potential for soft tissue reaction</td>
</tr>
<tr>
<td>Yes</td>
<td>If blood metal ion level &gt; 7 ppb then second blood test required 3 months later</td>
</tr>
<tr>
<td><strong>2nd blood metal ion level test</strong></td>
<td><strong>Results of 2nd blood metal ion level test</strong></td>
</tr>
<tr>
<td>Yes - 3 months after 1st blood test if result was &gt; 7 ppb</td>
<td>Blood metal ion level &gt; 7 ppb indicates potential for soft tissue reaction especially if greater than previously</td>
</tr>
<tr>
<td>Yes - 3 months after 1st blood test if result was &gt; 7 ppb</td>
<td>If blood metal ion levels rising - further investigation required including imaging</td>
</tr>
<tr>
<td><strong>Consider need for revision</strong></td>
<td><strong>If imaging is abnormal and/or blood metal ion levels rising</strong></td>
</tr>
<tr>
<td>If imaging is abnormal and/or blood metal ion levels rising</td>
<td>If imaging is abnormal and/or blood metal ion levels rising</td>
</tr>
</tbody>
</table>

Table 1 footnotes:
- Blood metal ion testing to be in whole blood.
- 7 parts per billion (ppb) equals 119 nmol/L cobalt or 134.5 nmol/L chromium.
TRENDS IN FIXATION OF PRIMARY THR

- Hybrid
- Cementless
- Cemented

Australian Joint Replacement Registry 2012
Swedish Joint Arthroplasty Registry 2010
CEMENTLESS FIXATION

Initial mechanical stability
- shape
- oversize
- strength and stiffness

Surface features relating to biocompatibility and bone attachment
- ingrowth: sintered beds, fiber mesh, porous metal
- ongrowth: grit blasting, plasma spraying

Khanuja H, JBSJ A, 93:500, 2011
Modularity allows a more accurate reconstruction

- how much accuracy is needed?
- better functional outcome?
- risk: breakage, fretting corrosion
More anatomical canal filling shape:

- less stress shielding?
- better functional outcome?
- superior survivalship?
CUSTOM-MADE STEMS

complex and unusual intra-medullary anatomy

gross extra-medullary deformity

high costs

(alternative: cemented stem)
**MATERIAL**

- Titanium-aluminium-vanadium alloy
- Cobalt-chromium-molybdenum alloy

### TABLE 7.2

<table>
<thead>
<tr>
<th>ASTM Designation</th>
<th>Common Name</th>
<th>Articular</th>
<th>Structural</th>
<th>Fixation</th>
<th>Articular</th>
<th>Structural</th>
<th>Fixation</th>
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<tbody>
<tr>
<td><strong>Metals</strong></td>
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<tr>
<td>F-67</td>
<td>CP Ti</td>
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<tr>
<td>F-75</td>
<td>Cast CoCr</td>
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<tr>
<td>F-90</td>
<td>Wrl. CoCr</td>
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<td>F-136</td>
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<td>F-560</td>
<td>Tantalum</td>
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<td>F-1314</td>
<td>High N SS</td>
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<td>F-1472</td>
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<td>F-648</td>
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<td><strong>Ceramics</strong></td>
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<tr>
<td>F-603</td>
<td>Aluminum oxide (alumina Al$_2$O$_3$)</td>
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<td>F-1185</td>
<td>Hydroxyapatite (CaHAP)</td>
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<td>F-1813</td>
<td>Zirconium oxide, yttria stabilized (Zirconia Z$_2$O$_2$, Y-TZP)</td>
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<td>F-2393</td>
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</tbody>
</table>

*Applied to a different metal alloy substrate (e.g., F-136, F-1472).
*Not in use in the United States, but in use elsewhere.
*Used as a modular component on metal alloy stem (e.g., F-90).
*Used in articulation only with UHMWPE.
SURGICAL APPROACHES

- anterior
- anterolateral
- lateral
- posterolateral
- posterior

Hoppenfeld, Surgical Exposures, LWW, 1994
..minimally invasive hip arthroplasty..

..is clearly open to interpretation.

It may reflect..
..the size of incision
..the aim to minimize trauma to muscles
..change in pain management and physical therapy protocols
..attitude concerning the length of time recovery should take.“

Wall SJ, Arthroplasty; 23 Suppl 1: 55, 2008
"...the size of incision.."

versus

< 10cm <

"minimal-invasiv"

"conventional"
Dorr LD, JBJS Am, 89:1153, 2007
"the size of incision..."

"minimal-invasive" versus "conventional"

"just cosmetics"
...the aim to minimize trauma to muscles...

- shortest way
- intermuscular
- internervous

Anterior minimal-invasive approach
MINIMAL-INVASIVER ANTERIORER ZUGANG

Hoppenfeld, Surgical Exposures, LWW, 1994
AVOID THE LAT. CUTANEOUS NERVE
DRAPING
INCISION
ENTER FASCIAL SHEAT
RETRACT TFL LATERALLY
MOBILIZE RECTUS FEMORIS
LIGATE AND COAGULATE
INSTRUMENTALIZE THE CAPSULE

SSSR

Swiss Society of Musculoskeletal Radiology

1. Nov. 2014
INTRACAPSULAR RETRACTOR
EXTRACTION OF FEMORAL HEAD
REAMER
CHECK POSITION AND RESECT POSTERIOR OSTEOPHYTES
Pull
90° OF EXTERNAL ROTATION
EXPOSURE OF FEMUR
CHECK LEG LENGTH
IMPLANT THE STEM
READAPT THE CAPSULE
CLOSE FASCIA
ANTERIOR APPROACH

standard approach primary THR
full weight bearing

advantages: less muscle damage, fast rehabilitation, low dislocation rate

Limits: stem revision

Bremer A, JBJS Br, 93:886, 2011
Alecci, J Orthop Traumatol, 12:123, 2011
TRANSGLUTEAL APPROACH

Hoppenfeld, Surgical Exposures, LWW, 2009
TRANSGLUTEAL APPROACH

THR with revision of abductor tendons

6 weeks: partial weight bearing, no deep flexion, no active abduction, no passive adduction
POSTERIOR APPROACH

Hoppenfeld, Surgical Exposures, LWW, 2009
POSTERIOR APPROACH

revision arthroplasty

6 weeks: no deep flexion, no flexion/internal rotation/adduction

advantage: very versatile

(→ repair of hip abductors)
→ diagastic trochanteric OT
→ extended trochanteric OT
DIGASTRIC TROCHANTERIC OSTEOTOMY

Femoral neck

Hoppenfeld, Surgical Exposures, LWW, 2009
EXTENDED TROCHANTERIC OSTEOTOMY
majority of THR uncemented, not yet proven to be superior to cemented

no perfect bearing surface

anterior approach widely used for primary THR
posterior approach very versatile