Ceramic Coated Metal-on-Metal
Large Head Total Hip Replacement
Surgical Technique
Introduction
The use of femoral components with large heads and matching thin acetabular components has several advantages:
- the femoral head component is placed more deeply into the acetabular component: dislocation of the hip becomes more difficult than in prostheses with smaller femoral heads: e.g.: a Charnley 22 mm head has to make a shorter up-hill movement before dislocation may occur; when a 50 mm or bigger head is used this distance is obviously much longer[8,11]. (picture on the right)
- the larger head in combination with a thin walled acetabular component enhances capsular stability[10,15]
- large femoral heads demonstrate a better range of motion: as the ratio of the head diameter to the neck diameter increases, the range of motion also increases[19]
- the risk of impingement is also reduced[16,19]
- most importantly: in metal-on-metal articulation, the bigger the head, the less the wear[3,12,23].

Large Femoral Heads
Using large heads (over 40 mm) rules out the use of polyethylene as bearing material. A polyethylene acetabular component in combination with a large metal femoral head component would simply demonstrate extensive wear shortly post-op. Based on the current experience with the metal-on-metal hip resurfacing prostheses, the metal-on-metal articulation is considered as a possible alternative also in total hip arthroplasty.
However clinical follow-up studies of metal-on-metal hip prostheses have revealed high metal ion concentrations[3,6,8,23,29] in the blood and urine of patients already shortly post-op. Further studies have demonstrated that these high serum concentrations will remain during the lifetime of the patient[20]. Although long term epidemiological follow-up studies of patients with metal-on-metal total hip implants have not been conclusive about the long term effect of the metal ion release, concern remains about the elevated metal ion levels in the blood and urine of the patients.

The ACCIS® Total Hip Prosthesis combines
- advantages of implants with large femoral heads: good range of motion[15], no impingement[11], great intrinsic stability[19]
- with the Advantages of the ceramic coating of the metal component:
  - significant less wear than in metal-on-metal prostheses[15]
  - minimal metal ion release[3,27]: normal metal ion levels in the blood!![26].

The ACCIS® System
The ACCIS® Total Hip System was designed to reduce wear in total hip replacement.
The system consists of acetabular and femoral head components for total hip replacement. The femoral head components may be placed on any femoral component with a 12/14 mm taper acc. to DIN ISO 21534, 21535 or authorized by implantcast. All components are made of the well known Cobalt-Chromium-Molybdenum alloy. A thin coating of the ceramic Titanium-Niobium-Nitride is applied at the articular surfaces of the components. This ceramic is very hard and has shown in pre-clinical tests to reduce 6-8 fold the volumetric wear of metal-on-metal articulations and to reduce metal ion release by 90%. Meanwhile these findings have been confirmed by clinical investigations.
ACCIS® Femoral Heads
- ACCIS® femoral heads for total hip replacement (*) are available in sizes 38 - 58 mm in 4 mm increments
- the modulare design with separate cone adaptors reduces weight and optimizes the stock level.
- the cone adaptor is made of a Titanium alloy and has a standard 12/14 mm cone
- cone adaptors in other dimensions and lengths are available upon request

ACCIS® Cementless Acetabular Components
- cementless cups are available with outside diameters 42 - 64 mm in 2 mm. increments
- the inner side of the acetabular cup is purely spherical, however the outer side has a three radial design with a wider circumference at the equator and a slightly smaller radius at the pole. The wider circumference at the equator provides a perfect press fit fixation
- a pure Titanium porous coating increases the primary stability and provides bone ingrowth capacity
- two additional fins add to the rotational stability

ACCIS® Cemented Acetabular Components
- Cemented cups are available in 48 - 64 mm with 2 mm increments
- the spherical design provides an even distribution of the load forces over the cement mantle
- 12 radially placed studs enhance the cement fixation and provide an even distribution of the cement mantle

ACCIS® Polaric heads
- Polaric large heads are available in outer diameters of 38 - 58 (in increments of 4mm)
- the heads consisting of high molecular weight PE may be combined with 28mm heads (38mm with 22mm head) made of CoCrMo.
- in terms of dislocation prevention this combination represents an alternative to the use of femoral and acetabular ACCIS® components.

(*) Note: In case the system is used to convert an ACCIS® resurfacing arthroplasty into an ACCIS® total hip, additional sizes of the modular femoral heads are available, matching the ACCIS® resurfacing acetabulum components.
**ACCIS® cementless acetabular components**

- the cementless ACCIS® acetabular components have three radii with three distinct areas
  - the “polar area” where there is no contact between the bone and the component
  - the “fit area” where the bone is in contact with the porous coated surface for bone ingrowth
  - the “press fit area” which provides circumferential press fit at the equator for primary implant stability
- the acetabulum is reamed to the desired depth. The depth is sufficient when the reamer, and later the cup, are completely surrounded by bone to ensure adequate press fit fixation
- the size of the last reamer is the size of the implant to select (size-for-size nomenclature)
- in case hard bone is encountered, preventing proper seating of the component, an acetabulum reamer 1 mm bigger than the last one used, may be necessary
- if the press fit fixation is not adequate, the surgeon has three options:
  - use the last reamer again and ream slightly deeper
  - use a larger component without additional reaming
  - use a component with cemented fixation

<table>
<thead>
<tr>
<th>Head Diameter</th>
<th>Acetabulum Reamer</th>
<th>Acetabulum Cup Diameter</th>
<th>Equatorial Diameter</th>
</tr>
</thead>
<tbody>
<tr>
<td>38</td>
<td>42, 44</td>
<td>42, 44</td>
<td>43, 45, 46</td>
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<tr>
<td>42</td>
<td>46, 48</td>
<td>46, 48</td>
<td>47, 49, 51</td>
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<td>46</td>
<td>50, 52</td>
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<tr>
<td>58</td>
<td>62, 64</td>
<td>62, 64</td>
<td>64, 66</td>
</tr>
</tbody>
</table>

*Note: In case the system is used to convert an ACCIS® resurfacing arthroplasty into an ACCIS® total hip additional sizes of the modular femoral heads are available, matching the ACCIS® resurfacing acetabulum components.*
**ACCIS® acetabular components with cemented fixation**

- The cemented ACCIS® acetabular components have one radius, making the cup hemispherical.
- The cement spacers have a height of 2 mm and provide an even cement mantle around the cup.
- The acetabulum is reamed until the desired depth when the reamer is completely surrounded by bone.
- Additional holes may be drilled in the actebular bone to enhance cement fixation.
- The size of the last reamer used is the size of the implant to be selected (size for size nomenclature).
- The rim is 2 mm wide, providing cement pressurization upon impaction.

<table>
<thead>
<tr>
<th>Head Diameter</th>
<th>Acetabulum Cup Diameter</th>
<th>Acetabulum Reamer</th>
<th>Cement Mantle Thickness</th>
</tr>
</thead>
<tbody>
<tr>
<td>38</td>
<td>48</td>
<td>48</td>
<td>2.0</td>
</tr>
<tr>
<td>42</td>
<td>52</td>
<td>52</td>
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<td>2.0</td>
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<tr>
<td>50</td>
<td>60</td>
<td>60</td>
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</tr>
<tr>
<td>54</td>
<td>64</td>
<td>64</td>
<td>2.0</td>
</tr>
</tbody>
</table>

**ACCIS® Femoral heads and cone adapters**

- One size of titanium adapter is suited for three head sizes.
- Each adapter is available in three different neck lengths in 4 mm increments.
- Additional neck lengths such as XL and XXL on request.
- Adapters are suited for femoral components with a 12 / 14 mm cone.

<table>
<thead>
<tr>
<th>Head Size</th>
<th>Cone</th>
<th>Neck Lengths</th>
</tr>
</thead>
<tbody>
<tr>
<td>38</td>
<td>short</td>
<td></td>
</tr>
<tr>
<td>42</td>
<td>38/44</td>
<td>medium</td>
</tr>
<tr>
<td>44</td>
<td></td>
<td>long</td>
</tr>
<tr>
<td>46</td>
<td>short</td>
<td></td>
</tr>
<tr>
<td>48</td>
<td>46/50</td>
<td>medium</td>
</tr>
<tr>
<td>50</td>
<td></td>
<td>long</td>
</tr>
<tr>
<td>52</td>
<td>short</td>
<td></td>
</tr>
<tr>
<td>54</td>
<td>52/58</td>
<td>medium</td>
</tr>
<tr>
<td>58</td>
<td></td>
<td>long</td>
</tr>
</tbody>
</table>
**Surgical Technique**
- accurate preoperative planning and templating are essential for obtaining a successful outcome
- the acetabular size is estimated using the ACCIS® X-ray templates in the A/P and the L/M view
- the surgical approach, head resection, and acetabular exposure are left to the surgeon’s preference: ACCIS® instrumentation is compatible with all routine hip exposures
- the cone of ACCIS® femoral heads fit the cone of any femoral component providing it is a 12/14 mm cone and it has been approved by implantcast
- the cemented and cementless acetabulum components use the size-for-size nomenclature: the size of the last reamer is the size of the implant to be selected
- the acetabular trials should be used to determine the accuracy of the reaming, the size and position of the final prosthesis

**Preparation of the Acetabulum**
- the acetabular component should be implanted in the anatomical position at sufficient depth with an angle of 40° - 45° relative to the longitudinal body axis and in 15° - 20° of anteversion
- it is recommended to start reaming in medial direction in order to remove any osteophytes around the fovea (“double fond”) and to reach the bottom of the fovea
- once sufficient depth has been achieved, the reaming should be directed towards the desired 40° - 45° angulation
- sequential reaming is recommended until adequate seating in the acetabulum is achieved.
- the size of the last reamer is the size of the acetabular component to be implanted

**Determining accuracy of reaming**
the open-cage trial acetabular component gives good visibility to ensure that the acetabular component can be seated properly

**Insertion of the acetabulum component without cement**
- the cup is fixed by placing the three prongs on the cup and advancing the sleeve on the impactor
- once the impactor is seated, it is locked by turning the sleeve half a turn, either way
- the two fins to secure press-fit fixation have to be implanted caudally on both sides of the original fovea.
- the cup is placed on the corresponding colour coded self-holding cup inserter
- when impacting the cup, it is recommended to use a hammer of sufficient weight to adequately seat the component and to acquire the desired equatorial press-fit
- the impaction should be performed in a gentle manner
- to loosen the inserter after placing the cup the inserter must be turned half a turn after which the sleeve is pulled back
- for final seating of the cup the non-coupled colour coded impactor can be used
Assembly of the head and neck cone
- the cone of the determined size and neck length is selected and inserted into the selected femoral head
- the assembled neck / head is placed on the cone of the femoral stem
- the cup is fixed to the femoral stem with the femoral head impactor

Determining the neck length
- the last broach for the femoral component is left in the femoral canal (or a trial femoral component is used)
- the neck trial is screwed into the trial ball of the desired diameter.
- the trial ball with the trial neck are placed on the broach (or on the femoral trial) and the joint is reduced
- if insufficient tension results, the trial neck is replaced with a longer trial neck
- when satisfactory reposition is acquired, the trial components and the broach are removed
- the femoral component is inserted and the neck and head components are selected

Insertion of the acetabular component with cement
- the cemented ACCIS® cup is a single radius design intended to achieve stable fixation with acrylic bone cement
- the size of the last reamer is the size of the acetabular component to be implanted
- the cup is placed on the inserter with rim with the corresponding color coding and inserted
- the cup is held in place with the cup pusher without rim till the cement has hardened

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Implantation of the Polaric heads

The Polaric heads will be combined with the CoCrMo head of the determined length (S to XL) using a special assembling instrument.

Attach the head implant to the clean and dry taper of the hip stem and reduce the hip joint. The Polaric implants may be combined with the cementless or the cemented ACCIS® acetabular cups.

CoCrMo head, Polaric head and cementless ACCIS® cup
ACCIS® Implants

**ACCIS® Acetabular Components cementless**

- 2912-3842  ACCIS® Acetabular Component cementless 38/42 mm
- 2912-3844  ACCIS® Acetabular Component cementless 38/44 mm
- 2912-4246  ACCIS® Acetabular Component cementless 42/46 mm
- 2912-4248  ACCIS® Acetabular Component cementless 42/48 mm
- 2912-4650  ACCIS® Acetabular Component cementless 46/50 mm
- 2912-4652  ACCIS® Acetabular Component cementless 46/52 mm
- 2912-5054  ACCIS® Acetabular Component cementless 50/54 mm
- 2912-5056  ACCIS® Acetabular Component cementless 50/56 mm
- 2912-5458  ACCIS® Acetabular Component cementless 54/58 mm
- 2912-5460  ACCIS® Acetabular Component cementless 54/60 mm
- 2912-5862  ACCIS® Acetabular Component cementless 58/62 mm
- 2912-5864  ACCIS® Acetabular Component cementless 58/64 mm

**ACCIS® Cemented Acetabular Components**

- 2923-3848  ACCIS® Acetabular Component cemented 38/48 mm
- 2923-3850  ACCIS® Acetabular Component cemented 38/50 mm
- 2923-4252  ACCIS® Acetabular Component cemented 42/52 mm
- 2923-4254  ACCIS® Acetabular Component cemented 42/54 mm
- 2923-4656  ACCIS® Acetabular Component cemented 46/56 mm
- 2923-4658  ACCIS® Acetabular Component cemented 46/58 mm
- 2923-5060  ACCIS® Acetabular Component cemented 50/60 mm
- 2923-5062  ACCIS® Acetabular Component cemented 50/62 mm
- 2923-5464  ACCIS® Acetabular Component cemented 54/64 mm

**ACCIS® Modular Femoral Heads and Necks**

- 2902-0038  ACCIS® Femoral Head (modular) Ø 38 mm
- 2902-0042  ACCIS® Femoral Head (modular) Ø 42 mm
- 2902-0046  ACCIS® Femoral Head (modular) Ø 46 mm
- 2902-0050  ACCIS® Femoral Head (modular) Ø 50 mm
- 2902-0054  ACCIS® Femoral Head (modular) Ø 54 mm
- 2902-0058  ACCIS® Femoral Head (modular) Ø 58 mm
- 2938-4400  Modular Neck Ø 38-44 mm Short
- 2938-4405  Modular Neck Ø 38-44 mm Medium
- 2938-4410  Modular Neck Ø 38-44 mm Long
- 2946-5000  Modular Neck Ø 46-50 mm Short
- 2946-5005  Modular Neck Ø 46-50 mm Medium
- 2946-5010  Modular Neck Ø 46-50 mm Long
- 2952-5800  Modular Neck Ø 52-58 mm Short
- 2952-5805  Modular Neck Ø 52-58 mm Medium
- 2952-5810  Modular Neck Ø 52-58 mm Long

**Polaric Heads**

- 2900-2238  Polaric Head Ø 22-38 mm
- 2900-2842  Polaric Head Ø 28-42 mm
- 2900-2846  Polaric Head Ø 28-46 mm
- 2900-2850  Polaric Head Ø 28-50 mm
- 2900-2854  Polaric Head Ø 28-58 mm
- 2900-2858  Polaric Head Ø 28-58 mm
**ACCIS® Instruments**

**ACCIS® Acetabular Instrument tray**
- upper tray
- lower tray
- 2950-1051

**Acetabular reamer tray**
- (includes reamers 42-64 mm of 1 mm steps)
- 2950-1048

**ACCIS® Acetabular Cup Impaction Instrument Tray**
- 2950-1052

**Polaric® trial instrument container**
- 7999-7910 available in 2010

**ACCIS® Acetabular cemented Instrument tray**
- 2950-1054
Literature about large head arthroplasty

[9] Bongaerts “Presentation about Metal Ions after Accis Resurfacing” presented at the NOV Hamburg, June 2009
[20] Luetzner, Witzleb “Serum Metal Ion Exposure after TKA” CORR 2007 Vol 00 p-p 00-000.
[27] Wear test report A068/05.1 “Tribological investigations on ceramic coated and non-coated metal-on-metal bearings during according to ISO 14242 Dr. rer. nat. Uta Kremling, IMA GmbH, 01101 Dresden.