The evidence base
MiniHip™

3A ODEP rating, demonstrating 99.5% survivorship at 3 years for aseptic loosening

Total number of patients 175 (89 male; 86 female)
Mean age 59.15 (33-72)
Mean follow-up 3.2 years (0.01-4.5)
Survival rate 99.5% (95% CI 100-98.1) (aseptic loosening)
1. MiniHip™ 5 year data

<table>
<thead>
<tr>
<th>Score</th>
<th>Pre-op</th>
<th>Year 1</th>
<th>Year 2</th>
<th>Year 3</th>
<th>Year 4</th>
<th>Year 5</th>
</tr>
</thead>
<tbody>
<tr>
<td>OHS</td>
<td>17.7</td>
<td>44.8</td>
<td>45.6</td>
<td>45.9</td>
<td>46.3</td>
<td>46.4</td>
</tr>
<tr>
<td>HOOS</td>
<td>30.1</td>
<td>92.3</td>
<td>93.7</td>
<td>94.4</td>
<td>94.9</td>
<td>95.2</td>
</tr>
</tbody>
</table>

**Methods**

This was a retrospective study with 172 patients (191 hips) with MiniHip™ implantation carried out at 2 centres. Average age of the patients was 59.5 years (± 10.6 years). Follow-up period was 3.7 years (± 0.7 years) HOOS and OHS questionnaires were completed preoperatively, in 2011, 2012 and 2013 there was also a EQ 5D quality of life questionnaire and radiographic evaluation sheets.

**Results**

The table below shows the 5 yr OHS and HOOS score. The survivorship at 5 yrs is 97.38% with revision for any reason.

**Conclusion**

MiniHip™ is showing good mid term results compared to other hip stems, longer term data is needed.
2. Physiological bone loading

Title: Load transfer into the proximal femur: are short stems more advantageous with respect to the mechanical environment?

Authors: Simpson D, Yeoman M, Lowry C, Cizinauskas A, Vincent G, Jerosch J, Collins S

Publication: AAOS 2011 poster presentation

Methods: Finite element models of two implants, MiniHip™ and a conventionally loaded HA coated hip stem, were used to simulate bone remodelling under physiological load condition (45% gait).

Results: The correctly sized MiniHip™ transferred considerably more load into the proximal femur, and resulted in nearly twice the medial cortical strain, compared to the long stem.

Conclusion: The short stem implant may offer less mechanical disturbance on the femur, causing less bone loss in most zones and even inducing bone ingrowth in the lateral/distal region. Short stem implants may have the potential to be more bone conserving compared to conventional stems, and to minimise periprosthetic bone loss when correctly sized and implanted.
### 3. Good short-term results for bone conservation

<table>
<thead>
<tr>
<th>Title</th>
<th>A report on the short-term outcomes of 101 MiniHip™ short femoral stems</th>
</tr>
</thead>
<tbody>
<tr>
<td>Authors</td>
<td>Woodnutt D</td>
</tr>
<tr>
<td>Publication</td>
<td>Presented at AOA and NZ combined, Rotorua New Zealand 2011</td>
</tr>
</tbody>
</table>

**Methods**

This poster represents the units experience and results with the first 101 implantations with maximum follow up of 30 months.

**Results**

100% follow-up.

One revision at 3 months for failure to integrate, this was attributed to surgical error.

Four asymptomatic subsidences all arrested by 6 months.

No significant leg length discrepancies.

Offset reproduced to less than 2mm in 85% of stems.

**Conclusion**

These short term results suggest MiniHip™ is a useful adjunct to other bone conserving THRs. It is also a useful stem in unusual cases such as obstruction, Fractured Neck of Femur and revision from a resurfacing.
4. Lower risk of increasing CCD angle and reducing offset

<table>
<thead>
<tr>
<th>Title</th>
<th>Reproduction of the anatomy (offset, CCD and leg length) with a modern short stem hip design - a radiological study</th>
</tr>
</thead>
<tbody>
<tr>
<td>Authors</td>
<td>Jerosch J, Grasselli C, Kothny PC, Litzkow D, Hennecke T</td>
</tr>
<tr>
<td>Publication</td>
<td>Published in Deutscher Arzte-varlag, OUP, 2012</td>
</tr>
</tbody>
</table>

Methods

In this prospective radiological study, 250 consecutive hips with osteoarthritis were included, 129 females and 117 males. The patients were operated on by five different surgeons with MiniHip™. Different anatomic parameters of the hip were documented using pre-operative and post-operative X-rays. All measurements were performed by an independent examiner.

Results

Offset changed by +0.28cm after surgery, small decrease of -0.51 degree of the CCD angle and leg length increased by an average of 0.09cm. No difference between male and female patients.

Conclusion

The results showed that with MiniHip™ it was possible to reconstruct the individual geometry of the hip. The tendency of increasing the CCD and decreasing the offset seems not to be existent in this prosthesis.
5. Good survival rates and ability to recreate patient biomechanics

<table>
<thead>
<tr>
<th>Title</th>
<th>Revision rates after short stem total hip arthroplasty – a systematic review of 49 clinical studies</th>
</tr>
</thead>
<tbody>
<tr>
<td>Authors</td>
<td>Van Oldenriik J, Molleman J, Klaver M, Poolman RW, Haverkamp D.</td>
</tr>
<tr>
<td>Publication</td>
<td>Published in Acta orthopaedica 2014</td>
</tr>
</tbody>
</table>

**Methods**
This paper evaluated 49 studies involving 19 different stems and discussed the large number of studies on neck preserving stems, partial neck preserving stems and neck sacrificing stems.

**Results**
In 6,495 patients the different types of short stems showed various survival rates with neck preserving stems showing an unsatisfactory survival rate.

<table>
<thead>
<tr>
<th>Stem</th>
<th>Type of stem</th>
<th>Revisions/100 component years</th>
</tr>
</thead>
<tbody>
<tr>
<td>MiniHip™</td>
<td>Partial neck preserving</td>
<td>0.55</td>
</tr>
<tr>
<td>Metha</td>
<td>Partial neck preserving</td>
<td>1.20</td>
</tr>
<tr>
<td>Optimys</td>
<td>Partial neck preserving</td>
<td>3.17</td>
</tr>
<tr>
<td>Spiron</td>
<td>Neck preserving</td>
<td>1.50</td>
</tr>
<tr>
<td>TaperLoc Microplasty</td>
<td>Neck sacrificing</td>
<td>0.80</td>
</tr>
</tbody>
</table>

The paper also assessed ability to recreate biomechanics and found only five stems able to do this, MiniHip™ was one of those stems.

**Conclusion**
This paper demonstrates the survival rates for MiniHip™ compared to other ‘short stems’ and also demonstrates independently that MiniHip™ can recreate a patient’s biomechanics.
6. Suitability for treating avascular necrosis

**Title**
Is there an indication for a partial neck preserving short stem (MiniHip™) in patients with avascular necrosis of the femoral head?

**Authors**
Jerosch J, Graselli C, Kothny C

**Publication**
Published in Deutscher Arzte-varlag, OUP, 2014

**Methods**
In a prospective study design a total of 186 patients with a partial neck preserving stem (MiniHip™) were evaluated. There was a sub group of 18 patients who suffered from secondary osteoarthritis due to avascular necrosis (AVN).

**Results**
Oxford Hip Scores (OHS) and Hip dysfunction Osteoarthritis and Outcome Score (HOOS) showed significant improvement comparing pre-operative and post-operative values. Patients in the AVN group showed a trend for better improvement in both these scores. There was no early aseptic loosening in the AVN group, no radiological abnormalities, especially no bone loss in Gruen zones 6 and 7 and no cortical reaction on the lateral femur.

**Conclusions**
MiniHip™ seems to be a suitable stem for patients with secondary osteoarthritis due to AVN.
7. DEXA results for MiniHip™ at 12 months

Title: Short stems promote positive bone remodelling: A DEXA study
Authors: Ercan A, Filler TJ, Jerosch J
Publication: Presented at ICJR Vienna 2015

Methods: 62 patients aged 25-78 Yrs (34 women, 28 men) were implanted with MiniHip™ through an antrolateral approach. Periprosthetic bone mineral density (BMD) in each of the 7 gruen zones was measured with DEXA at 2 weeks, 3, 6 and 12 months post op.

Results: The largest change was seen at 3 months with decease in zones 1, 2, 4 & 7. At 12 months compared to the 6 months results there is an increase in BMD in gruen zone 1 (5.09%) and 7 (2.82%) This is consistent with other studies however unlike other studies MiniHip™ shows an increase in BMD up to 12 months post op.

Conclusion: The theory of proximal load transfer is supported by the DEXA. The MiniHip™ shows loss of BMD immediately post-op. After initial decrease there is an increase especially in the proximal gruen zones 1 and 7.
8. Ability to restore femoral head centre in extreme cases of anteversion

**Title**
High anteversion in the Japanese population and the ability to restore femoral head centre

**Authors**
Lowry C, Traynor A, Kreuzer S, Collins S

**Publication**
Presented at ORS 2015

**Methods**
76 Japanese scans were analysed. Results of the CT data analysis indicated a tendency for higher anteversion associated with Japanese patients. Scans exhibiting the ninetieth percentile of version (extreme anteversion) were segmented using Materialise software and implanted with a contemporary long stem then with MiniHip™. The ability of each to restore pre-operative femoral head centre (FHC) was evaluated in terms of mediolateral and anteroposterior horizontal and vertical displacement.

**Results**

<table>
<thead>
<tr>
<th>Average deviation</th>
<th>MiniHip™ (mm)</th>
<th>MetaFix™ (mm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>x</td>
<td>1.71</td>
<td>4.43</td>
</tr>
<tr>
<td>y</td>
<td>0.87</td>
<td>3.19</td>
</tr>
<tr>
<td>z</td>
<td>1.81</td>
<td>3.44</td>
</tr>
</tbody>
</table>

**Conclusion**
Results of this study have indicated the suitability of bone conserving short stem devices, provided with a single CCD and offset, for the restoration of FHC for extreme examples of anteverted femurs.
9. How MiniHip™ compares to Accolade in early outcomes

**Title**
Short stem hip replacement compared with conventional hip replacement; difference in early outcomes?

**Authors**
Daivjna S, Agnello L, Bajwa A, Villar R

**Publication**
Presented at ISTA, Kyoto Japan 2014

**Method**
This study was a retrospective evaluation of 249 consecutive patients. 125 received MiniHip™ and 124 an accolade stem. Mean follow up is 3.5 years (1-7) average age was 66 (31-88) for the accolade patients and 54.4 (29-79) for the MiniHip™ patients.

**Results**
Evaluation was carried out on plain X-rays at 6 months, 1 year and 2 years post-operatively. Clinical status was assessed using Harris Hip Score (HHS) pre-operatively and post-operatively, 6 weeks, 6 months, 1 and 2 years.

<table>
<thead>
<tr>
<th>Variables</th>
<th>Accolade (Mean HHS)</th>
<th>MiniHip™ (Mean HHS)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pre-operative HHS + pain function</td>
<td>15+26</td>
<td>15+29</td>
</tr>
<tr>
<td>6 weeks</td>
<td>39+40</td>
<td>40+44</td>
</tr>
<tr>
<td>6 months</td>
<td>39+40</td>
<td>40+44</td>
</tr>
<tr>
<td>1 year</td>
<td>38+40</td>
<td>41+44</td>
</tr>
<tr>
<td>2 years</td>
<td>39+40</td>
<td>40+45</td>
</tr>
</tbody>
</table>

There was 1 revision of an accolade and none of a MiniHip™ in this time period.

**Conclusion**
This study suggests MiniHip™ is comparable to conventional stems. MiniHip™ shows adequate osteointegration. The functional scores seem to be better for the MiniHip™ group.
10. MiniHip™ through a direct anterior approach

**Title**
Total hip arthroplasty by the direct anterior approach using a neck preserving prosthesis – a learning curve

**Authors**

**Publication**
Poster at ICJR World Arthroplasty congress Paris April 2015

**Method**
150 cases implanted in a single surgeon series with MiniHip™ Trinity. The cohort was further sub divided into 2 groups, 75 patients in each based on recruitment order. OHS and SF36 were collected post op radiological review and operative evaluation.

**Results**
Improvement in OHS and SF36 of 26+29 points respectively

<table>
<thead>
<tr>
<th></th>
<th>Group 1 (First 75 Cases)</th>
<th>Group 2 (second 75 cases)</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intra-operative fracture</td>
<td>5</td>
<td>1</td>
<td>6</td>
</tr>
<tr>
<td>Peri-prosthetic fracture</td>
<td>1</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>Subsidence</td>
<td>1</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>Dislocation</td>
<td>1</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>Trochanteric bursitis</td>
<td>1</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>Anterior thigh numbness</td>
<td>8</td>
<td>4</td>
<td>12</td>
</tr>
</tbody>
</table>

**Conclusion**
We propose that using MiniHip™ utilizing the direct anterior approach is safe, reproducible and a reliable treatment for active patients but with a learning curve interrelated with familiarity of implant design and approach.
## MiniHip™ compared to conventional hip and resurfacing

### Title
Which prosthetic system restores hip biomechanics more effectively?

### Authors
Buttaro M, Nally F, Diaz F, Stagnaro J, Rossi L, Comba F, Zanotti G, Piccaluga F

### Publication
Poster at ICJR World Arthroplasty congress Paris April 2015

### Method
124 patients with a mean age of 52 years (range: 26-65 years) operated through a posterolateral approach, with either MiniHip™, Corail or Resurfacing.

### Results
Offset and leg length were measured compared to controlateral leg in the 3 groups.

<table>
<thead>
<tr>
<th></th>
<th>Group 1</th>
<th>Group 2</th>
<th>Group 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Stem</td>
<td>MiniHip™</td>
<td>Corail</td>
<td>Resurfacing</td>
</tr>
<tr>
<td>Number of patients</td>
<td>36</td>
<td>46</td>
<td>42</td>
</tr>
<tr>
<td>Offset</td>
<td>3.5mm</td>
<td>1.7mm</td>
<td>-3.9mm</td>
</tr>
<tr>
<td>Leg length</td>
<td>1.2mm (-4.7 to 7)</td>
<td>2.3mm (-6 to 7.4)</td>
<td>-2.1mm (-15 to 8)</td>
</tr>
</tbody>
</table>

### Conclusion
MiniHip™ procedures restored leg length with more precision than Corail or resurfacing. The leg shortening in the resurfacing group can be attributed to the inability to increase leg length. Whilst statistical differences in offset were seen it is unclear if this has any clinical significance.
12. **MiniHip™ versus resurfacing in surgery time and outcomes**

**Title**
Comparison of patient-reported outcome from partial neck preserving, short-stem arthroplasty and resurfacing arthroplasty in younger osteoarthritis patients: a matched-cohort study.

**Authors**
Dettmer M, Pourmoghaddam A, Kreuzer S

**Publication**
Poster at ICJR World Arthroplasty congress Paris April 2015

**Method**
125 patients received either MiniHip™ (n=73) or Resurfacing (n=52). Surgery times were monitored and HOOS scores.

**Results**
Both groups showed a significant increase in HOOS.

<table>
<thead>
<tr>
<th></th>
<th><strong>MiniHip™</strong></th>
<th><strong>Resurfacing</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>Surgery time</td>
<td>62.5 +- 14.8</td>
<td>104.4 +- 17.8</td>
</tr>
<tr>
<td>Length of follow up</td>
<td>495 days +- 281</td>
<td>1422 days +- 739</td>
</tr>
</tbody>
</table>

**Conclusion**
The neck-preserving, MiniHip™ may be preferable to Resurfacing, due to the less challenging surgery and similar outcomes. More research is needed to investigate longer-term outcomes.
Ceramic liners and ceramic on ceramic articulations are available in the USA only for use in an approved investigational device exemption clinical study.