

CeraNews

Three Big Issues

Justin P. Cobb, MD, is Professor of Orthopaedic Surgery at the Imperial College and Consultant Orthopaedic Surgeon at the Charing Cross Hospital in London and an eminent orthopaedic surgeon in the UK. His research interests focus on osteoarthritis, arthroplasty, surgical navigation and robotic systems. He will be the president of the 13th BIOLOX[®] Symposium held in Edinburgh next September. CeraNews asked him about surgical accuracy and arthroplasty trends in the UK.



Justin P. Cobb, BMBCh FRCS MCh

Can you give us a broad outline of arthroplasty in Britain today?

According to the data of the National Joint Registry of 2006 roughly 60,000 hip and the same number of knee arthroplasties were performed in England and Wales, plus around 7,000 of each in Scotland, which is not included in the registry. About ten percent of the hip and five percent of the knee operations were revisions.

And what are the major trends?

Fully cemented hip arthroplasty has recently dropped below 50 percent. Uncemented surgery has risen from around 20 to around 30 percent over the past three years. And there is a more or less stable share of 15 percent for hybrid fixation. The other big development is hip resurfacing. This particular evolution began in Birmingham and had a big impact on hip arthroplasty in Britain, with a constant share of around ten percent. Roughly a quarter of the femoral heads used in Britain today are ceramic. Unfortunately, the registry doesn't give us more detailed information about wear couples. There is also a trend towards more minimally invasive procedures but it is not dominant.

Are there still waiting lists for arthroplasty in the National Health Service?

Hospitals get fined now if their waiting times are longer than 18 weeks. Substantial investments were made and there was also a wave of overtime work to reduce the existing lists. The waiting time in England today is clearly below 18 weeks. In Wales and Northern Ireland there are still waiting lists.

Are there any restrictions on the choice of implants in the NHS?

There are issues about using ceramic bearings for instance but there are no nationally or locally agreed guidelines. There is no possibility for the patients to co-pay. They can express their preferences but there is no obligation to meet that choice. In my hospital we have ceramic-on-ceramic on the shelf and you don't have to unlock a vault or get permission to use it. The surgeon can choose and the manager of the service has to defend his surgeons' usage of more expensive devices. Right now, I am in trouble because we have overspent our prosthesis budget. But we also had to get rid of the waiting list, which means that we overperformed. And this is obviously a problem many other hospitals also have.

What are the most important aspects for the selection of a wear couple?

In my opinion, the diagnoses, and frankly, the surgical abilities should drive the choices. There are some operations that require great accuracy with a relatively unforgiving bearing, in particular the young dysplastic female hip. I do think they should have a hard-on-hard bearing and that it should be ceramic-on-ceramic

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with a big diameter. But getting the socket in the right place is extremely demanding and a crucial step during surgery. Therefore, the surgeon needs to be well audited to be capable of achieving the required accuracy. Anybody under 60, without comorbidities, is bound to live another forty years. We now have the bearing technology to last that long. But if the implantation is not done right, we have a high complication rate. You can also say that ceramic-on-ceramic will last forty years if it is done right. By the way, the fact that with BIOLOX®*delta* you can implant a 36mm femoral head in a 50mm cup is just an amazing development.

And what is your algorithm?

For a cam type hip in a young and active man I choose hip resurfacing. At the other end of the spectrum, the elderly patient with normal bone shape gives me the opportunity to use a low cost wear couple, also with a big femoral head to prevent dislocation. For the "average" total hip, the patients between 60 and 80, I have been using ceramic-on-poly if there are any contraindications to a ceramic-on-ceramic bearing. For me these are incomplete surgical accuracy and costs.

What do you consider to be the most important steps to achieve surgical accuracy?

The first and most important step is the appreciation of a three-dimensional problem. We use 3D planning for every high value hip and anybody with any worries, as well as for all private patients. This planning model tells you about the x, y and z axis translation of the hip center. Obviously you have to reach a good compromise orientation so that the hip doesn't edge load in extension or sublux in flexion. That's not such a big deal in the ceramic-on-ceramic but in the metal-on-metal, where the cup is less than a hemisphere in some devices, there are serious compromises of stability. For very experienced surgeons 3D planning means that outliers can be abolished. It is also a major contribution to avoid squeaking.

What about navigation?

Again, we use navigation for high value joints and for all joints in private practice. Navigation helps me to achieve the 3D plan that I make before surgery. If you have a plan it doesn't take more than between five and ten minutes extra time.

You will be the president of the next BIOLOX® Symposium held in Edinburgh in September. What do you expect from it?

Looking at wear couples, we live in an amazing time of variety and choice, far more than we had before, with very hard decision making. What I'm looking forward to reaching in Edinburgh as a surgeon is a strong sense of the evidence for the different options. It is unlikely that the meeting will end with a "there is only one answer" conclusion. I hope I will leave having learned what real data there is to support my decisions.

How important are wear couples in the medical discussion?

If you think back five or ten years, osteomechanical integration of shells and stems was the most important topic in arthroplasty. But this doesn't seem to be a problem any more so the focus is shifting towards the bearing couples. For me the three most important questions are diagnosis, bearing couples and accuracy.



Paul Silberer is Director International Sales of CeramTec Medical Products

Dear Reader,

The much anticipated "Asian century" is already well underway. This is evident in the very high quality of the health care available in Japan and South Korea for many years. It is also developing very rapidly in other Asian countries as their economies have experienced substantial growth.

Parallel to this growth, we are seeing an increase in the importance of arthroplasty in Asia. Implantation numbers are rising sharply in many countries. A number of years ago, CeramTec's management made the decision to make the region one of the main focuses of its corporate activity. The opening of a CeramTec office in Japan – see the Asia supplement of this issue – is just one of many steps taken in this direction.

Above all, we have placed emphasis on regular and close contact with doctors in the region. Two years ago, we conducted the first Asian BIOLOX® symposium in Seoul, Korea. As an integral part of this focus, CeramTec is represented at all of the main scientific conferences in the region, regular round table discussions and exchanges of ideas on current issues with highly reputable specialists. During the course of these discussions, we are always impressed by the high level of interest, openness and expertise shown by our partners.

Our contribution to the continuing improvement of health care for the rising number of patients in this region is to provide them with total hip replacement wear couples which are especially well suited to their specific needs. An anatomy which generally differs from that of people in the west, lifestyles and daily routines which require a particularly large range of motion, and a large proportion of young patients are significant challenges which can be addressed by the excellent solutions provided by our BIOLOX® components.

*Yours,
Paul Silberer*

THA for an Active Life

Ever more young and active individuals are undergoing hip-replacement surgery. In such cases, it is especially important to carry out extensive pre-operative planning and pay special attention in order to reduce tissue damage. Patient-specific treatment and new technologies such as navigation are increasingly discussed as trends for the future. CeraNews recently spoke about them with Professor Hartmuth Kiefer, the Medical Director of the Lukas Hospital and the head physician of its Traumatology and Orthopaedic Division in Bünde, Germany.



Hartmuth Kiefer, MD

What is your definition of a so-called “younger patient”? The deciding factor is not necessarily the patient’s age, but the patient’s activity level. For instance, although I’m 60 years old, I ran the New York Marathon last year. I would consider myself a “young” patient. And this applies to anyone who can be expected to live for a long time, who is biologically young and has good bone quality. Today, these prerequisites are often met in seventy-year-olds.

Is there a special strategy for such patients in hip arthroplasty? While the hip replacement should be geared to last for the rest of the patient’s life, the surgeon should keep options available in case revision becomes necessary. These options might include resurfacing, which I don’t favor, or a short stem.

What are your reservations about resurfacing? Ever since the Wagner Cup was introduced in the 1970s, we have seen an increased incidence of postoperative femoral neck fractures, a problem that continues to be an issue. The bone under the cap is filled with cement and more susceptible to necrosis. The main problem, however, is that we introduce a perhaps questionable advantage on the femoral side at the price of a disadvantage – a larger cup – on the more problematic acetabular side. Then there is the unresolved issue of the increased concentration of metal ions in the serum. We simply don’t know what the long-term impact is here.

Why do you prefer the short stem? It preserves a full range of options on the cup side. The force transfer in the femur is more proximal (more biological) than in the case of the standard stem. Combined with a ceramic-on-ceramic bearing couple, the short stem promises excellent longevity. If a revision becomes necessary, then one can switch over to a standard stem. The model that we use, which features a modular neck, also permits individual adjustments of the CCT angle, the anteversion and the retroversion of the stem.

What do you do on the acetabular side? In the acetabulum, we use a very stiff, press-fit cup that combines very well and reliably with a ceramic insert. Our experience with BIOLOX®*forte* was always very good. Since 2004 we’ve been using BIOLOX®*delta*. This implant combination permits us to use a bearing couple with a 36mm ball head in the case of an exterior cup diameter of 52mm. A 40mm head would even be possible for cups of 58mm and more. We have never had any problems with cup deformation when inserting our cup design.

Do you always use ceramic-on-ceramic bearing couples? For me, there is no alternative – except in the case of pronounced hip dysplasia with a very steep and flat acetabulum. Then we would only consider a ceramic inlay after clearly successful reconstruction of the acetabular roof. A ceramic-on-ceramic bearing couple would also not be indicated, for reasons of cost, in minimally active patients with low life expectancy. In all other cases, I would select the ceramic-on-ceramic bearing couple. With a large head diameter, it offers active patients, in particular, significant advantages – more stability and range of motion without increased wear.

Is wear still an issue for you? We’ve been using ceramic-on-ceramic bearing couples since 1998. Ever since then, I haven’t seen a single case of wear-related osteolysis in any of our own patients.

Why do you use navigation? Navigation allows us to detect possible departures from the optimal implant positioning at an early stage and to make any necessary adjustments. This probably enables us to reduce eccentric loading, pressure peaks, rim fracture and successive wear in the bearing, the risk of luxation and loosening as well as leg length and offset differences. We won’t know if we really achieve these reductions for another couple of years – when the long-term results are available. Navigation is an outstanding learning instrument that allows us to accelerate the learning curve tremendously. The literature shows that implant positioning accuracy increases even among experienced surgeons.

If you needed a hip replacement would you want the surgeon to use navigation? My first priority would be to find a good surgeon. And, yes, that surgeon should work with navigation and implant a short stem prosthesis with a ceramic-on-ceramic bearing couple.

You travel frequently to Asia. Do the same considerations apply to Asian patients? Dysplasia and osteonecrosis represent the most common indications for total hip replacement in Asia. The patients tend to be even younger and more active. Then there are other social habits, such as sitting with crossed legs, that require an especially large range of motion. Impingement and wear may represent more significant problems than in the west. There are also general anatomical differences. All of these variables require both a special implant concept and a very wear-resistant bearing couple with a large diameter.

The supplement to this issue is devoted to the subject of hip arthroplasty in Asia.



World Trends in THA

An overview of congresses on three continents

Recently published clinical results demonstrate that total hip arthroplasty (THA) using ceramic-on-ceramic wear couples (CoC) is extremely reliable, showing low rates of revision and dislocation as well as an absence of osteolysis. This is especially remarkable considering the young age of patients and the high incidence of previous surgery in the patient population in one study. THA in patients with developmental dysplasia of the hip (DDH) has been associated with increased rates of complications (instability, wear-induced osteolysis) and revision. Current results of CoC THA in young patients with low to middle-grade DDH are promising, with no radiographic signs of osteolysis or dislocation. The following pages give an overview of these and other results concerning wear couples in hip arthroplasty presented at some of the most prominent scientific events of the past months.

International Society for Technology in Arthroplasty (ISTA)

21st Annual Congress, 2008, Seoul, Korea, 1–4 October 2008



Ceramic-on-ceramic THA

Young-Min Kim¹ (Seoul, Korea) reported on clinical and radiological experience with 64 primary cementless alumina CoC THAs in 57 patients who had survived 10 years after primary surgery without revision and loosening. The mean age at surgery was 42 years. The mean Harris Hip Score was 94. The survival rate was 100% if aseptic loosening is taken as the endpoint. Ceramic wear was not detectable in the 28 hips where differentiation of the femoral head from the cup was possible on radiographs. A fracture of the femoral head and a peripheral chip fracture of the insert occurred in one hip following a major motor vehicle accident. In summary, Kim concluded that alumina-on-alumina bearings offer a promising option for younger and active patients.

Stephen B. Murphy² (Boston, USA) investigated 418 alumina CoC THAs performed in 360 patients. The mean age at surgery was 51.7 ± 12.3 (18–79)

years. 47 cases (11%) had had previous hip surgery. There were no cases of osteolysis or wear. Murphy reported that the results of this prospective study are promising, especially considering the young age and high incidence of previous surgery in this patient population. He concluded that the experience demonstrates that CoC THA is extremely reliable with low revision rates and an absence of osteolysis.

Nobuhiko Sugano³ (Osaka, Japan) reviewed the clinical and radiological results of 100 consecutive cementless alumina CoC THAs in 86 patients 10 years after surgery. 28 mm femoral heads were used. The average age at surgery was 55 (26–73) years. No cases of osteolysis or loosening were observed. There were no squeaking hips. He concluded that the CoC bearing provided long term stability and eliminated osteolysis.

Shaun A. Sexton⁴ (Sydney, Australia) discussed risk factors for dislocation following primary THA using the posterolateral approach with posterior capsule and external rotator repair. 3,682 consecutive THAs (28mm and 32mm head sizes) were analyzed at one institution over a 17-year period. Older age at time of surgery and decreased cup anteversion were associated with an increased risk of dislocation. Sexton reported that the CoC bearing surface was significantly associated with a decreased risk of dislocation, after controlling for age, bearing wear and time from surgery. BMI, gender, preoperative hip score and cup inclination were not related to the risk of dislocation.

Simon D. Steppacher⁵ (Boston, USA) emphasized that THA in patients with DDH has been associated with increased rates of complications and revision. 123 consecutive alumina CoC THAs in 108 patients with DDH (Crowe type I and II) were prospectively investigated. The mean age at surgery was 47.6 ± 12.7 (18–75) years. 97 cases (79%) had had no previous surgery. 28mm femoral heads were used in 61 bear-

ings and 32mm femoral heads in 62 bearings. The mean follow-up was 4.7 ± 1.9 (2–10) years. There were no cases of osteolysis or dislocations. No patient complained of squeaking. Steppacher concluded that the results of CoC THA in young patients with low to middle-grade DDH after 2 to 10-year follow-up are promising.

Atsushi Kusaba⁶ (Kanagawa, Japan) reported on results of alumina CoC THA in dysplastic hips. 1,078 hips were performed between July 1998 and October 2008. 86 hips in 79 patients were evaluated. The average age at surgery was 53 (27–60) years. The minimum follow-up was 5 years. There were no revisions, no bearing failure, no dislocation and no squeaking hips.

Ceramic-on-ceramic vs. Ceramic-on-polyethylene

Peter M. Lewis⁷ (Toronto, Canada) reported on first results of a prospective randomized long-term study comparing in vivo alumina CoC with CoP articulations. 56 hips in 55 patients received a cementless THA. 28mm femoral heads were used. The mean age at surgery was 42.2 (19–56). 30 CoC hips and 26 CoP hips were evaluated with up to 10 years (1–10) follow-up. The mean time of wear measurement was 8.3 (4.8–10.1) years for the CoC group and 8.1 (6.1–9.2) years for the CoP group. Wear was identified in 25 CoP articulations, but only in 12 CoC articulations. The mean wear was 0.14 (0–0.48) mm for the CoC group and 0.89 (0–2.43) mm for the CoP group. The annual linear wear rate was 0.02 mm for the CoC group compared to 0.11mm for the CoP group. Lewis concluded that CoC bearing is a safe and durable option avoiding the concerns of metal ions and osteolytic polyethylene debris. The patients remain under review.

Ceramic-on-ceramic in Revision THA

Laurent Sedel⁸ (Paris, France) discussed his strategy for stem revision in total hips. Cemented implants and MoP or CoP are used in old and inactive patients. A cementless acetabular fixation, cementless or cemented stem and CoC (alumina) combination are performed in young and active patients.

Yves Catonné⁹ (Paris, France) evaluated in a prospective study the revision strategy using cementless cups, BIOLOX[®] *delta* ceramic inserts and BIOLOX[®] *delta* ceramic heads (32mm) with titanium adapter sleeves when femoral revision is not required. 25 hips in 25 patients were included. The mean follow-up was 2 years. The Harris Hip Score was significantly improved (97 vs. 54). No ceramic fracture or squeaking was observed. The radiological results did not demonstrate osteolysis or acetabular loosening. As regards MoM revisions, cobalt and chromium serum levels decreased significantly.

Jun-Dong Chang¹⁰ (Seoul, Korea) analyzed 42 hips, in which revision THA was performed using cementless cups with alumina CoC bearings. Stems were revised in all hips. The mean age was 48.8 (32–59) years. The mean interval from primary surgery to revision was 9.5 ± 3.2 (3.3–16.1) years. The mean follow-up after revision was 5.4 ± 1.7 (3.2–8.0) years. There were no hips with radiolucent lines, vertical or horizontal acetabular cup migration or osteolysis during the follow-up period. Chang concluded that these data showed that clinical and radiological outcomes after revision THA using CoC (alumina) were favorable.

Metal-on-metal THA

Young-Ho Kim¹¹ (Guri, Korea) reported on clinical and radiological results of 78 cementless MoM THAs in 61 patients. The mean age at surgery was 39 years. The average follow-up period was 11.7 years. There were 2 hips with progressive osteolysis around the cup. In histopathological findings on the osteolytic region, a lot of macrophage phagocytizing metal debris and perivascular lymphocytic infiltration was found. In immunohistochemical analysis, CD4 and CD8 positive T-cells and CD68 positive macrophages were found, which suggested delayed metal hypersensitivity. Kim concluded that early osteolysis with sudden onset of pain in some hips, probably due to hypersensitivity, remains a concern.

Youn-Soo Park¹² (Seoul, Korea) reported on a consecutive series of 158 cementless MoM THAs that were performed in 154 patients. The mean follow-up was 6.5 (5–8) years. The mean age at surgery was 53 years. 13 hips (8%) had osteolysis. 5 patients who had persistent pain and osteolysis underwent revision operation for the consideration of bearing exchange to a CoC or CoP combination. The revised hips showed extensive synovial-like tissue hypertrophy and perivascular infiltration of lymphocytes on histological examination. Park concluded that the mid-term results of cementless MoM THA revealed an unexpectedly high rate of periprosthetic osteolysis possibly in association with metal hypersensitivity. For patients with persistent hip pain and osteolysis after MoM THA, he recommended considering an exchange of the wear couple to a CoC or CoP articulation.

Filippo Randelli¹³ (Milan, Italy) analyzed 5 early failures of large diameter MoM THAs. One was the result of an infection. One patient had an infected metallosis with a huge intraabdominal retroperitoneal mass. He underwent a lumbotomy to excise this mass before prosthesis removal for a two step procedure. 3 showed clear metallosis caused by incorrect positioning (cup inclination > 50°) and presented an articular noise. The blood and synovial metal ion values were high in these patients. One of these 3 patients showed allergic reactions to cobalt. One



patient with good component positioning showed an epicutaneous allergic reaction to cobalt. Randelli concluded that blood and synovial metal ion determination helps to diagnose a bad functioning of MoM prostheses. He suggested analyzing the different metals and their resistance to edge wear.

Crosslinked Polyethylene

William J. Maloney¹⁴ (Stanford, USA) discussed whether mechanical properties of the highly crosslinked PE limit its use in certain situations. He pointed out that in-vitro studies have demonstrated a relationship between radiation dose and wear reduction. As the radiation dose increases, the wear of the material decreases. But radiation negatively affects the mechanical properties of the material. However, analysis of some fractures of liners suggests that these fractures are more related to the implant's position and the loading of unsupported PE.

- ¹ Kim YM et al. Alumina-on-Alumina THA ; What we learn from more than 10-year experiences. Abstract KNA01-02, ISTA 2008
- ² Murphy SB et al. Clinical experience with the ceramic on ceramic articulation in THR in the USA. Abstract SA02-02, ISTA 2008
- ³ Sugano N et al. Long-term results of cementless THA using a third generation ceramic-on-ceramic bearing. Abstract SA02-03, ISTA 2008
- ⁴ Sexton SA et al. Risk factors for dislocation following primary total hip arthroplasty via the postero-lateral approach. Abstract OSA15-03, ISTA 2008
- ⁵ Steppacher SD et al. Outcome of ceramic-ceramic total hip arthroplasty at two to ten years in patients with developmental dysplasia of the hip. Abstract OSAA04-02, ISTA 2008
- ⁶ Kusaba A et al. Alumina on alumina bearing with uncemented implant for dysplastic hips aged sixty or below: A five years minimum follow-up study to advantage the bearing property from a viewpoint of the surgeon. Abstract OSA04-03, ISTA 2008
- ⁷ Lewis PM et al. Prospective randomized trial comparing alumina ceramic-on-ceramic with ceramic-on-conventional polyethylene bearings in total hip arthroplasty. Up to 10 years follow-up in patients under age 60. Abstract OSA04-04, ISTA 2008
- ⁸ Sedel L. Some special tools and strategy for stem revision in total hip. Abstract KNA04-02, ISTA 2008
- ⁹ Catonné Y et al. THR revisions using Delta alumina sleeved heads: a prospective study. Abstract OSA21-01, ISTA 2008
- ¹⁰ Chang JD. Third-generation ceramic-on-ceramic bearings in revision total hip arthroplasty. Abstract OSA04-05, ISTA 2008
- ¹¹ Kim YH et al. Uncemented total hip arthroplasty with second generation metal on metal articulation in young patients less than fifty years old -minimal 10 years results-. Abstract OSA03-01, ISTA 2008
- ¹² Park YS et al. Cementless total hip arthroplasty with a contemporary second generation metal-on-metal bearing. Abstract OSA03-03, ISTA 2008
- ¹³ Randelli F et al. Metal on metal big heads analysis of first failures and correlation with metal ions. Abstract OSA03-04, ISTA 2008
- ¹⁴ Maloney WJ. Highly cross-linked polyethylene in total hip replacement: pros and cons. Abstract SA03-01, ISTA 2008

In Vivo Component Noises in Total Hip Replacement

Results and Trends



The SOFCOT congress (Société Française de Chirurgie Orthopédique et de Traumatologique Congress) took place in Paris from November 10 to 13, 2008. Four presentations were dedicated to the squeaking phenomenon, highlighting it from different points of view. **Jérôme Essig** (Toulouse, France) reported in a retrospective study on 18 noisy patients out of 838 performed THRs. Although no excessive implantation angles of either stem or cup were found, the author recommended looking for impingement in case of squeaking. **Christophe Chevillotte** (Lyon, France) presented in-vitro investigations of ceramic hard-on-hard bearings in a hip simulator where squeaking occurred every time the lubricating fluid film between the two ceramic surfaces had broken down, and particularly when particles were placed between such surfaces, which are likely to cause wear, surface contact phenomena or impingement. **Laurent Sedel** (Paris, France) explained that over several thousand implanted CoC bearings, he has observed only 7 squeakers which have been mostly transient. **Elhadi Sariali** (Leeds, England) reported on the influence of the cup angle and edge loading on in-vitro squeaking of ceramic implants, concluding that under high inclination angles (75°) the squeaking could also be reproduced in lubricated conditions.

The American Association of Hip and Knee Surgeons annual meeting in Dallas, Texas, brought together highly specialized total joint replacement surgeons from all over the world. Membership is limited to surgeons performing more than 25 total hip and/or total knee operations per year. This annual meeting provided CeramTec with a unique opportunity to present the participants with scientific and clinical data as well as surgical hints from key scientists and orthopaedic surgeons implanting these components, in order to help them better understand the issue of "In Vivo Noises in Total Hip Replacement".

Scientific Overview

The presentations of **Michael M. Morlock** (Hamburg, Germany) and **William L. Walter** (Sydney, Australia) identified the causes of squeaking and the main factors that lead to its development. The focus of their investigations is friction-induced vibration as the mechanism that causes squeaking arising in connection with sliding motions or in connection with the friction transition objects undergo from a sticking to a sliding state (stick-slip phenomenon). The so-called self-generating vibrations produced in this manner may then lead to an acoustic epiphenomenon that is perceived as squeaking and can be clearly

differentiated from other phenomena such as clicking, popping or grating sounds. The frequency associated with squeaking is directly related to the stiffness and damping behavior of all components that make up the THA system, including the surrounding bone and soft tissue.

Clinical Overview

To evaluate the clinical significance of squeaking, one must look at the clinical incidence related to this condition and its relationship to implant design. Walter reported on personal experience of implantation of 2,397 primary and 319 revision ceramic THRs. Squeaking was observed in only 13 of their cases for an incidence of 0.48% (13 of 2,716). Furthermore, only one of the 2,716 ceramic THAs (0.037%) has required revision THA for this occurrence. Reviews of numerous other series of ceramic THA similarly report a very low incidence of squeaking (<1%) following ceramic THA with the exception of Ranawat and Rothman who reported an incidence of 7% and 2.7% in a study in which the majority involved a specific design in which the ceramic liner is recessed into a titanium liner with an extended rim designed to protect the ceramic liner from impingement. **Stephen B. Murphy** (Boston, USA) provided further insight into this area by presenting data from his institution involving more than 1,275 cases which were analyzed and divided into distinct groups based on the type of shell and stem system used. His data for the three patient groups was as follows:

1. **Group one:** taper locked with a flush-mounted ceramic insert: had a reported incidence of squeaking of 0.4%.
2. **Group two:** used a shell with a ceramic insert encased in a metal shell and with an extended protective rim and a heavy stem: had a reported rate of squeaking of 3.1%.
3. **The third group:** used the same shell as group two but with a lighter femoral stem and reported a rate of squeaking of 7.6%.

Murphy presented his hypothesis that the extended titanium rim reduces range of motion until impingement of the femoral neck on the rim occurs, probably producing microseparation of the femoral head and increased stresses on the opposite side of the liner. This may result in the generation of metal debris as well as ceramic grain loss and stripe wear which may interrupt the normal fluid film lubrication regime typically present in ceramic THA.

In addition to implant design, **Walter** has demonstrated that acetabular component position appears to contribute to the incidence of squeaking after ceramic THA. Acetabular component position was



critically evaluated in 17 ceramic THAs that demonstrated squeaking and compared with a control group without squeaking. Acetabular component position within the recommended range of $45 \pm 10^\circ$ of abduction inclination and $25 \pm 10^\circ$ of anteversion was present in 94% of the control group vs. only 35% of ceramic THAs that demonstrated squeaking. Hips that squeaked with walking had acetabular components that were more anteverted (40°) than hips that squeaked with deep bending (18° ; $p = 0.020$), suggesting the role that impingement may play in this phenomenon.

Lastly, **Jonathan P. Garino** (Philadelphia, USA) and **Peter F. Sharkey** (Philadelphia, USA) presented a review of results of ceramic THA which demonstrated the excellent short, medium and long-term (18.5– 20.5 years) survivorship with cementless acetabular components (85.6%) with extremely low wear ($<0.025\text{mm/yr.}$), and minimal osteolysis, supporting the concept that squeaking is both uncommon and not associated with clinical failure.

Recommendations

All of the speakers emphasized the fact that avoidance of impingement in ceramic on ceramic or metal on metal articulation THA systems is paramount.

A second point that was emphasized was the fact that squeaking usually indicates a condition that is not normal and may require a closer look from the surgeon. However there is no data indicating that squeaking is a precursor to a clinical failure.

A third point mentioned was the fact that there are several patients who were confirmed as squeaking that no longer squeak, opening up the possibility that this condition may be temporary.

Finally, the point was made that the lessons learned from these investigations need to be taken into account when designing the systems of the future.



SICOT 2008

XXIV Triennial World Congress, Hong Kong, China, 24–28 August 2008

Ceramic-on-polyethylene vs. metal-on-polyethylene

Hiroyuki Oonishi¹ (Osaka, Japan) reported excellent long-term clinical and radiological results of ceramic-on-polyethylene (CoP) THAs. 285 hips were performed in 212 patients using a 28mm diameter alumina ceramic head. 192 patients (265 hips) could be followed. The mean age at surgery was 64 (29–81) years. He demonstrated that 19–21 years after surgery osteolysis was only observed in 1 case (0.5%) on the acetabulum and in 2 cases (0.9%) on the femur. He pointed out that with reduction of wear debris by ceramic heads, osteolysis could be significantly reduced. Oonishi noted that in a previous study he reported the wear rate of CoP to be 20% lower than that of metal-on-polyethylene (MoP).

Ceramic-on-ceramic vs. ceramic-on-polyethylene

Philippe Hernigou² (Créteil, France) reported on clinical and radiological results with cemented bilateral THA in 21 patients who had survived more than 20 years after primary surgery without revision and without loosening. All hips were performed between 1981 and 1985. The patients received an alumina CoC THA and an alumina CoP THA contralaterally. 32mm heads were used. The mean age at surgery was 57 (38–64) years. On the CoC hips no osteolysis was detected on X-ray. 3 acetabular lesions and 1 calcar lesion were detected on the CT scan. On the CoP hips 5 acetabular lesions and 17 calcar lesions were detected on X-ray. 21 acetabular lesions and 21 calcar lesions were detected on the CT scan. The CoC hips showed significantly less osteolysis on X-ray (average 25mm² for CoC versus 98mm² for CoP) and on the CT scans (170mm³ for CoC versus 1290mm³ for CoP). Wear was undetectable on CoC hips compared to CoP (mean of 1.6mm) using the Livermore technique and digital calipers. Hernigou concluded that CoC THAs showed lower wear rates and less osteolysis compared to CoP.

Ceramic-on-ceramic

Laurent Sedel³ (Paris, France) presented clinical and radiological results in 74 patients with 82 alumina CoC hips (hybrid, cemented stem). The mean age at surgery was 43 (21–50) years. 32mm heads were used. 65 patients (68 hips) were examined. The median follow-up was 8.6 (6–14) years. 2 dislocations occurred in the early postoperative period. The survival rate was 98% at 14 years if aseptic loosening is taken as the endpoint. In summary, Sedel concluded that alumina CoC THA showed excellent clinical results in patients under 50 at 14 years.

Metal-on-metal

Wing Keung Wong⁴ (Hong Kong, China) reported on a consecutive series of 106 MoM hybrid THAs in 98 patients using 28mm diameter heads. The patients' average age at surgery was 56 (18–82) years. After a follow-up period of 7.2 years 5 cases were revised due to aseptic loosening. Osteolysis was found in all the aseptic loosening cases. Metallosis was noted in 4 cases. After an average follow-up of 11 years osteolysis has been observed in 6 of the remaining 62 patients. The implants are still stable in radiological assessment. Wong concluded that aseptic loosening and osteolysis still occurred in some young patients with MoM articulation.

Hip Resurfacing

David Langton, Simon Jameson, Tom Joyce, Antoni Nargol⁵ (Stockton, Newcastle, UK) showed a poster with clinical and histological findings, operative management and explant analysis for a 36-year-old female patient with metallosis following MoMhip resurfacing HR. She developed groin pain 12 months postoperatively. The authors noted at revision surgery that "the acetabular cup was loose and surrounded by a large green-grey colored joint effusion." The histological analysis showed necrotic tissue, vasculitis and large numbers of black-stained particulate matter contained within histiocytes. All these symptoms improved after revision to a CoC THA. The authors explained that metallosis is still a poorly understood condition. They suggested patients with persisting groin pain should be investigated with this condition in mind.

Simon Jameson⁶ (Stockton, UK) reported on the functional outcome following MoM HR, the importance of component size and acetabular orientation. He pointed out that implant position guidance for MoM HR is only based on historical reports, wear analysis and in vitro studies. An optimal cup orientation for MoM HR has yet to be established. Reducing the failure rate and the metal ion concentration in HR has driven the need to find a "safe zone." A consecutive series of 200 HR were examined 1 year after surgery. Cup inclination and anteversion angles were measured using EBRA. Patients with anteversion $\geq 20^\circ$ had a significantly lower HHS compared with cups anteverted $< 20^\circ$. 96% of patients with an HHS < 90 had malaligned cups. Jameson concluded that restoring preoperative cup inclination, anteverting the cup $< 20^\circ$ and using large femoral heads improves early clinical outcome.

Crosslinked Polyethylene

Moussa Hamadouche⁷ (Paris, France) discussed whether polyethylene (PE) is still a solution in young patients. He pointed out that the different manufacturing processes of highly crosslinked polyethylenes show great variations. This has important conse-



quences for the tribological and mechanical properties of the materials produced. Hamadouche reported that hip simulator studies and early clinical studies have shown decreased wear rates and lower femoral head penetration as compared to conventional PE. Therefore crosslinked PE could be an effective bearing material in young and active patients. However, some studies indicate that the negative impact of crosslinking on the mechanical properties can lead to catastrophic failures (e.g. rim cracking, surface damage). Case reports of fractures along the rim of highly crosslinked PE liners have been attributed to implant malposition and thin PE. Hamadouche concluded that more studies and a longer follow-up are needed to find out if the lower wear will result in a decreased incidence of osteolysis.

Wear Debris: Biological Responses

William J. Maloney⁸ (Stanford, USA) discussed foreign body reactions after THA. He pointed out that the impact of foreign body wear debris on the periprosthetic bone is related to the particle load, the access of the particles to the implant-bone interface and periprosthetic bone, and the biologic response to wear debris. The relationship between the volumetric wear of PE and the development of osteolysis has been well documented in clinical studies. He noted that there are also concerns regarding different MoM bearings (hypersensitivity reactions). The problems are possibly greater than previously expected. Maloney concluded that the long-term survivorship of total hip implants depends on limiting the particle load as well as limiting access to periprosthetic bone. He suggested that "modern implant designs as well as new bearing surfaces should have a marked impact on both the problem of osteolysis and long term implant failure".

¹ Oonishi H et al. *Clinical results of total hip prostheses with alumina ceramic head combined with UHMWPE socket for 19–21 years by radiographical study. Abstract 19755, SICOT 2008*

² Hernigou P et al. *Ceramic-ceramic versus ceramic-polyethylene bearing on the contralateral hip: A 20-years study of 21 patients with osteonecrosis. Abstract 19040, SICOT 2008*

³ Sedel L. *All alumina bearings THR in patients under 50. Abstract 19041, SICOT 2008*

⁴ Wong WK et al. *Primary total hip arthroplasty with metal-on-metal articulation. Abstract 17669 SICOT*

⁵ Langton D et al. *A patient with metallosis following metal on metal hip resurfacing: Metal ion levels, histology and explant analysis. Poster 18371, SICOT 2008*

⁶ Jameson S et al. *Functional outcome following hip resurfacing: The importance of component size and acetabular orientation. Abstract 18404, SICOT 2008*

⁷ Hamadouche M. *Is polyethylene still a solution in young patients? Abstract 19049, SICOT 2008*

⁸ Maloney WJ. *Foreign body reaction after total hip arthroplasty. Abstract 19057, SICOT 2008*

Internet Produces Misinformed Patients:

Managing the Confusion

"The Internet is a wonderful thing, but unfortunately it is creating problems for us orthopaedic surgeons," said David S. Hungerford to attendees at the **Current Concepts in Joint Replacement** Annual Winter Meeting in Orlando (USA), 10–13 December 2008. He cited data published in 2003 that found that of 1,050 surveyed U.S. physicians, 85% said they had experienced patients bringing information they had collected from the internet to the consultation.

Hungerford noted that 38% of the physicians said it decreased the efficiency of the patient visit because physicians had to spend time correcting information that is patently false, inaccurate, misleading or irrelevant. It was damaging to the doctor-patient relationship. He also cited data published in 2007 that investigated the impact of direct-to-consumer advertising. It had a negative impact on the patient relationship for 74% of responding surgeons, and 77% believed it produced patients who were misinformed and confused. Internet searches produce information but not understanding, Hungerford concluded.

A solution is to fight the misinformation on the Internet with viable information. One way to do this is to present patients with specific, easily comprehensible written information which they may use in their discussion with the surgeon. Such information is available for total hip patients.

The Bone and Joint Decade Network has published a patient brochure entitled "In Spite of Arthritis: Be Active Again with Modern High Tech Joint Replacement". The brochure provides easy-to-understand information about joint disease and deals with the important aspects of arthroplasty from a patient's perspective.

The brochure can be downloaded at www.boneandjointdecade.org





British Orthopaedic Association

Annual Congress, Liverpool, UK, 16–19 September 2008

Metal-on-metal Hip Resurfacing

Hena Ziaee¹ (Birmingham, UK) presented the first 6-year report of a prospective longitudinal study of cobalt and chromium levels in urine and blood following metal-on-metal (MoM) hip resurfacing in 26 male patients. The mean age at surgery was 52.9 years. The results of 22 patients were presented. Urine and whole blood specimens were collected pre-operatively and at post-operative follow up intervals after hip resurfacing surgery. The specimens were analyzed using High-Resolution Inductively-Coupled Plasma Mass Spectrometry. Urine chromium and cobalt at 6 years were 3.8 and 8 µg/l and blood levels were 1.1 and 1.1 µg/l respectively. Both urine and blood levels showed a statistically significant early increase up to one year postoperatively followed by a decreasing trend over the following 5 years. The reductions were not statistically significant for blood cobalt. The 4 and 6-year chromium levels were significantly lower than the 1-year level. Ziaee concluded that the elevated systemic metal exposure following MoM bearing arthroplasty remains a concern and the need for continued vigilance persists.

David J. Langton et al.² (Newcastle, UK) measured the whole blood metal ion concentrations following MoM hip resurfacing in a consecutive series of 76 patients at 1 year after surgery. Postoperative radiographic measurements of cup inclination and anteversion were obtained using EBRA. Mean whole blood chromium and cobalt levels were higher in patients receiving the smallest implants than in those with the largest prostheses by a factor of 3 and 9 respectively. Ion concentrations in the small femoral groups were significantly related to acetabular inclination and anteversion. Mean chromium and cobalt concentrations in patients with accurately oriented cups were 3.7 µg/l and 1.8 µg/l compared to 9.1 µg/l and 17.5 µg/l in malaligned cups. The authors' recommendation is an accurate acetabular component positioning in order to reduce metal ion concentrations.

Langton et al.³ documented the clinical and histological findings in patients with early aseptic failure of large MoM bearing joints. 6 female patients of 350 patients with a hip resurfacing prosthesis were revised due to aseptic loosening. The failures were associated with malpositioned cups and high whole blood metal ion levels. The patients complained of severe groin pain. Large amounts of sterile, highly viscous green fluid and a gross swelling of the pseudocapsule were found surrounding the implant. Histological examination of periprosthetic tissue showed changes consistent with ALVAL/metallosis. Analysis of the fluid revealed dense numbers of inflammatory cells. Symptoms in patients revised to CoC THAs improved postoperatively. This was not the case with those reimplanted with MoM joints.

Mohamed El-Meligy et al.⁴ (Liverpool, UK) discussed the results of a cementless THA using anatomically-sized MoM bearings in 101 males and 89 females. The mean age was 62 (20–89) years. 28% of the patients developed groin pain and increasing stiffness at 3 years postoperatively. 12.5% of the symptomatic patients had an effusion. 11 patients showed histological evidence of metal allergy; chrome and cobalt levels in the synovial fluid were very high. There were signs of toxicity on histology. The authors suggest that the use of metal bearings should be further scrutinized.

¹ Ziaee H et al. Six-year results of prospective cobalt and chromium monitoring in patients with a modern hip resurfacing arthroplasty. Abstract, BOA 2008

² Langton D et al. Reducing exposure to metal ions following hip resurfacing: the importance of acetabular orientation. Abstract, BOA 2008

³ Langton D et al. Early aseptic failure of large metal-on-metal hip arthroplasty – Is metal sensitivity a consequence of excess wear? Abstract, BOA 2008

⁴ El-Meligy M et al. Uncemented total hip arthroplasty using anatomic-sized metal on metal bearings. Abstract, BOA 2008

CoC: Ceramic on Ceramic / CoP: Ceramic on Polyethylene / DDH: Developmental Dysplasia of the Hip / EBRA: Single-image radiographic analysis / MoM: Metal on Metal / MoP: Metal on Polyethylene / HHS: Harris Hip Score / HR: Hip Resurfacing / THA: Total Hip Arthroplasty / XPE: crosslinked polyethylene

German Congress of Orthopaedics and Traumatology

Berlin, Germany, 22–25 October, 2008

Jozef Zustin¹ (Hamburg, Germany) reported on hypersensitivity-induced hip pain and non-fracture failure following MoM hip resurfacing. 157 retrieval femoral head specimens of failed cemented MoM resurfacing cups were histologically analyzed. The histological examination showed that extensive intraosseous lymphocytic infiltrates underneath the bone-implant interface in 10 (6.6%) cases. Zustin concluded that these findings are in agreement with those in recent publications. He suggested that hip pain and metallosis-induced aseptic loosening in cemented MoM articulations are possibly associated with hypersensitivity to cement or metal.

Daniel Neumann² (Salzburg, Austria) reported on the occurrence of metallosis subsequent to implantation of 100 MoM THAs in 99 patients. This prospective study was conducted over a minimum follow-up period of 10 years. 6 THAs were revised due to aseptic loosening, mechanical implant failure or periprosthetic fracture. In histopathologic findings metallosis and intensive lymphocytic and plasmacellular infiltrations were found. The survival rate was 98% for the stem and 96% for the cup if aseptic loosening is taken as the endpoint. In analogy with the conclusions drawn by recent publications, Neumann postulated that osteolysis and aseptic loosening in connection with MoM bearings are probably associated with hypersensitivity induced by metal debris.

At its Berlin congress in October the Heinz Mittelmeier Research Award of the German Association for Orthopaedics and Orthopaedic Surgery (DGOOC) was awarded to Saverio Affattato (Bologna, Italy) for his scientific work on "Advanced nanocomposite materials for orthopaedic applications. A long-term in vitro wear study of zirconia-toughened alumina".³ The 5000 Euro award is funded by CeramTec. Our picture shows Saverio Affattato (right) and Fritz Niethard, the General Secretary of the Association, at the event.



¹ Zustin J et al. Intraosseous lymphocytic infiltrates underneath the cemented resurfacing metal-on-metal arthroplasty suggestive of hypersensitivity reaction: A study of 157 retrieval femoral head specimen. Poster 13–802, DKOU, 2008

² Neumann D et al. Metallose nach Implantation einer Metall-Metall-Gleitpaarung in der Hüftendoprothetik – eine prospektive Studie mit einem Nachuntersuchungszeitraum von mindestens 10 Jahren. Abstract WI4060, DKOU, Berlin 2008

³ Journal of Biomedical Materials Research Part B: Applied Biomaterials. See also: Journal of Biomedical Materials Research Volume 78B Issue 1, Pages 76–82, Published Online: 16 Nov 2005, Copyright © 2008 Wiley Periodicals, Inc., A Wiley Company



Scotland calling

BIOLOX[®] Symposium and BIOLOX[®] Award in Edinburgh

The 13th BIOLOX[®] Symposium will take place on 4th and 5th of September 2009 in the Scottish capital of Edinburgh and will be presided by Professor Justin Cobb, Consultant Orthopaedic Surgeon at Charing Cross Hospital and Full Professor for Orthopaedics at the Imperial College in London (see also the interview on pages 1–2). The latest clinical results and experiences with alternative bearings will be presented, with the subject of ceramic components naturally playing an important role. The use of wear couples in hip arthroplasty will again be the focus of the Symposium as a result of the fact that aseptic loosening remains the most common complication in total hip replacement. All experts in joint replacement and tribology in the clinical and scientific community are welcomed to attend the event in Edinburgh.

The BIOLOX[®] Award UK 2009 will be granted to a physician, engineer or other scientist not older than 35, without regard to nationality or residence. The winner will be selected by a scientific committee. The award in the amount of GBP 2000 will be given to the winner during the Symposium. Scientific work featuring important contributions in research and development relating to "The use of ceramic wear couples for joint replacement" may be submitted. Theses, post-doctoral theses, dissertations and other previously published scientific works will also be considered. Previously published scientific works that have received an award will not be considered for the BIOLOX[®] Award. The deadline for submission is 15th June 2009. Please submit 5 copies in English to:

CeramTec AG
Medical Products Division
Florence Petkow
Fabrikstr. 23–29
D-73207 Plochingen

More information about the Symposium, speakers and participant registration is available at: www.bioloxx-symposium.com

Current Knowledge

Bearing support in the UK

Before Steve French joined CeramTec in September 2008, he held various positions in both sales and marketing for major orthopaedic manufacturers in the United Kingdom. He is excited by the challenge of his new role as Product Manager UK and Ireland with CeramTec: "Over the years, the main issues of scientific discussion in arthroplasty have been changing. At the moment the one issue dominating the news is bearing surfaces," he says. "They were extensively discussed at the 2008 BOA Congress and the profile of hard-on-hard wear couples has never been higher. The amount of time dedicated to the subject there, at the recent meeting at the Institution of Mechanical Engineers and at the third annual Great Debate meeting, held on 23 and 24 of January 2009 at the IMAX Theatre in London, is testimony to this."

The use of ceramic components for arthroplasty in the UK has not been as widespread as in continental Europe but recent figures from the National Joint Registry suggest a new trend. The implantation numbers of ceramic acetabular inserts and femoral ball heads are steadily rising. "This reflects a growing awareness of the problems of wear-related aseptic loosening and osteolysis as more and more younger patients are receiving arthroplasty," French concludes. A major part of his job will be to offer support to the implant manufacturers in informing about the use of ceramics in THA and to keep in touch with the orthopaedic community. "I hope I am able to work at different levels in this new role in assisting with the training of sales and hospital staff. The ultimate aim, of course, is to create additional benefit for the surgeon and ensure he is kept abreast of current knowledge about bearing couples and ceramics."



Steve French

■ **March 13–14**
Endoprothetik Forum Münster
Münster, Germany

■ **March 19–21**
China Med
Beijing, China

■ **March 23–27**
Journées d'Orthopédie de Fort de France
Fort de France, France

■ **March 27–28**
Unfallmedizinische Tagung der DGUV
Düsseldorf, Germany

■ **April 18**
Internationales Symposium Hüfte
Hannover, Germany

■ **April 22–26**
Mid America Association Annual Meeting
Amelia Island, USA

■ **April 23–25**
Master Series
Pasadena, USA

■ **April 28–May 1**
126th Kongress der Deutschen Gesellschaft
für Chirurgie
Munich, Germany

■ **April 30–May 3**
57th Jahrestagung der VSO 2009
Baden-Baden, Germany

■ **May 14–17**
82nd Annual meeting of the Japanese
Orthopaedic Association
Fukuoka, Japan

■ **May 17–20**
Current Concept in Joint Replacement
Las Vegas, USA

■ **May 20–23**
DVOST/AE/DVES-Symposium
Pichlarn, Austria

■ **May 28–30**
40th OTODI
Palermo, Italy

■ **June 3–6**
10th EFORT Congress
Vienna, Austria

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