
Abstracts

Abstracts from the EUROPEAN HIP SOCIETY 2004 Domestic Meeting

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I. ABSTRACTS - ORAL PRESENTATIONS

PAEDIATRIC HIP

O001**THE GANZ APPROACH TO SEVERELY SLIPPED SCFE**

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In the period 2001-2002, 3 male patients with a mean age of 15 years with severely (> 60°) slipped capital femoral epiphysiolysis (SCFE) underwent an open reduction, callus resection and subcapital osteotomy using the approach of "surgical dislocation" described by GANZ: this approach includes a trochanter "flip" osteotomy with osteosynthesis and provides the preservation of vascularity because it preserves the *pars reflecta* branches of the medial circumflex artery. The contralateral side was routinely fixed *in situ* with one screw. After a follow-up of 20-36 months all patients had an excellent clinical and radiological outcome with free internal rotation and no evidence/suspicion for femoro-acetabular impingement or avascular necrosis or chondrolysis. Our preliminary results suggest the GANZ approach to be powerful and safe, if a severely slipped capital femoral epiphysis needs anatomical restoration. Vascularity can be preserved if the surgical exposure is performed according to the guidelines described by GANZ.

O002**PELVIC OSTEOTOMY IN THE JUVENILE UNSTABLE HIP**

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INTRODUCTION. The aim of the presentation is to introduce the different types of pelvic osteotomies in different pediatric hip conditions, excluding of DDH, MCLP and teratological dislocations.

MATERIAL AND METHODS. From 1996 to 2002, 57 patients underwent 76 pelvic osteotomies for unstable hip in: cerebral palsy (18 patients), sequels of coxitis (19 patients), MMC (7 patients), PFFD (10 patients) and ischiadicus paresis, extrophy of the bladder and enchondromatosis. In the unstable, but reduced hips (59 hips), the redirection osteotomy of innominate bone (1.5-11 years) or triple pelvic osteotomy (acc. Steel) were performed. Pemberton acetabuloplasty was used in 6 hips. The Chiari osteotomy was indicated in 5 cases, mostly in paralytic hips.

RESULTS. Because of different pathological conditions, only simple radiological and functional criteria for evaluation were used (reduction, subluxation, dislocation, satisfactory - unsatisfactory). In cerebral palsy (32 hips), only 2 subluxations were present. The function was mostly satisfactory. In the patients with coxitis (19), painful subluxation occurred in 6 patients and they need the next procedures. In the group of PFFD (10 hips), the subluxations occurred in 2 patients. Subluxation was also obvious by patient with ischiadicus paresis after Pemberton acetabuloplasty.

CONCLUSIONS. The role of different pelvic osteotomies is to achieve the stability of the hip and to reduce the pain. The best results were achieved when congruen-

cy of the hip is present before the surgery. In incongruent hips, the pelvic osteotomy helps to cover the period to adult age, when other procedures are available.

O003

CRUENT REPOSITION AND SALTER OSTEOTOMY IN TREATMENT OF CONGENITAL LUXATED HIP

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INTRODUCTION. Luxatio coxae congenita is a significant problem in Bosnia and Herzegovina, and practically a daily pathology at the children's ward of the Clinic for Orthopedic and Traumatology (University Clinical Center Sarajevo). Our wish is to elaborate and start a debate on question of selection of cruent reposition and Salter osteotomy but without intervention on femur as method of choice in carefully selected group of patients with proximal femur epiphysis in alignment with triradiate cartilage.

PATIENTS AND METHODS. In our paper we present 35 female patients aged between 24 and 28 months with verified congenital luxation of the hip. Radiological position of growth cartilage at proximal part of femur was at level of triradiate cartilage. To all patients we performed cruent reposition (open reduction), capsuloraphy, release of m. iliopsoas tendon and Salter osteotomy. Duration of follow-up was 4 years.

RESULTS. We did not have any case of early and late infection nor any case of re-luxation. Acetabular index was increased by 17-20 degrees respectively. In 2 cases we had 2nd-degree osteochondritis and 4 cases of 1st-degree osteochondritis.

CONCLUSION. This method is, despite the controversies, a good method for radiologically well selected patients.

O004

PERIACETABULAR OSTEOTOMY FOR ACETABULAR DYSPLASIA VIA A DOUBLE INCISION

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BACKGROUND. Periacetabular osteotomy (PAO) with realignment of the acetabulum has shown good results

with a survival of the native hip in over 80% after 11 years follow-up (1). We report the initial results with a double incision approach in 16 patients (2).

METHODS. 11 women and 5 men, mean age 30.6 years (20.7-37.2) underwent PAO through a combined short iliac and midline incision. After osteotomy and realignment acetabulum were fixed by two plates (n=8), later two screws (n=8). Preoperative Center Edge angle (Wiberg) and acetabular Index was measured on digital radiographs in a CAD program.

RESULTS. Operation time was mean 113 min (range 95-131), and bleeding per operation was range 800-2700. No major perioperative complication occurred. Two patients had reduced sensitivity of n. cutaneus femoris lateralis. Two patients had reduced function of n obturatorius with full recovery. Harris Hip Score improved from 76 (67-89) to 93 (81-100). The CE angle increased by mean 17.2 (range 1.2 -31.4) from 6.2 (range -8.9 -14.7) pre op to 23.4 (range 9.1-45.5) post op (P=0.0001). The acetabular Index was reduced by 13.3 (range 1.3 -31.1) from 27.1 (range 17.6 -41.1) pre op to 13.9 (range -10.2 -26.9) post op (P=0.0001).

CONCLUSIONS. With the good corrections obtained, few complications, and good early outcome more patients should be offered this operation which addresses the main mechanical problem with dysplastic hips.

O005

TRANSPOSITION OF THE APOPHYSIS OF THE GREATER TROCHANTER FOR RECONSTRUCTION OF THE FEMORAL HEAD AFTER NEONATAL SEPTIC ARTHRITIS OF THE HIP

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BACKGROUND. Previous own experimental studies have shown that apophyseal cartilage remains unossified when transplanted to osteochondral defects in joints. Bearing in mind this experience transposition of the apophysis of the greater trochanter was performed to create a new femoral head in children with total femoral head necrosis after neonatal septic arthritis.

METHODS. Two girls and two boys were operated at the age of 1 to 6 years. Anterior approach was used. After removal of fibrous tissue from the acetabu-

lum, and resection of the gluteal tendons, a subtrochanteric osteotomy was performed. The cartilage was trimmed before transposition of the apophysis. The osteotomy was fixated with Steinmann pins or a plate and the gluteal tendons were sutured to the lateral subtrochantric region. The hips were immobilized with a spica cast for 3 months. The patients have been followed for 18, 15, 10 and 8 years, respectively.

RESULTS. The radiographic controls have shown development of a new femoral head in all the patients, in two of them nearly spherical and covered by a well developed acetabulum. In the other two there was some flattening of the head and dysplasia of the acetabulum. No osteoarthritic changes were seen. All patients were free of pain and had a relatively good walking function and mobility of the hip.

CONCLUSIONS. Subtrochanteric osteotomy with transposition of the apophysis of the greater trochanter into the acetabulum may give good clinical results in total femoral head necrosis after neonatal septic arthritis. Remodelling ossification of the apophysis, and persistence of the peripheral layers of the cartilage, may contribute to the development of a relatively normal femoral head.

O006

DOES FUNCTIONAL SPLINTING OF MILD DYSPLASTIC HIP SIGNIFICANTLY INCREASE HIP MATURATION AFTER WALKING ONSET?

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INTRODUCTION. Functional splinting (HD-Splint) has been proposed as a conservative treatment option in children with mild dysplastic but stable hips. In these children a rapid decrease of the AC-angle can be expected and has been reported. However, it is known that under normal growth and development the AC-angle decreases dramatically during the first year. To address this uncertainty we designed this study to evaluate whether the effect of HD-splint treatment in the walking child on decrease of the AC-angle is significant.

METHODS. 106 Children with diagnosed hip dysplasia were treated in a comparative clinical study. Two groups were established: 1) hips treated with HD-splint 2) hips where no treatment was performed previously, neglected treatment or denial of treatment by the parents. AC-angles were compared using an ANOVA; further criteria were magnitude of onset AC-angle and age.

RESULTS. Results exhibited a permanent decrease of AC-angles, independent whether treated or not. Hips with high AC-angles at first diagnosis demonstrated a tendency towards better improvement by HD-splint.

CONCLUSION. The analysis of residual dysplasia in children with immature hips is complicated, as compliance towards consequent splint treatment is difficult to assess. However, from these data there is no proof that neglecting of splinting in mild dysplastic cases would lead to continuous dysplastic stages. Further parameters have to be identified that predict the course of dysplastic hips.

REVISION - BONE IMPACTION GRAFTING

O007

REVISION ACETABULAR ARTHROPLASTY USING IMPACTION GRAFTING IN CASES WITH MAJOR OSTEOLYSIS

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METHODS. In 30 cases a loosened acetabular component of a THA with combined segmental and cavitary bone defects (AAOS grade III) was revised. The acetabular wall was carefully cleaned from any soft tissue membrane. A lateral acetabular wall defect was repaired from the outside by a thin, perforated titanium plate (Fig. 1) (Waldemar Link GmbH&Co Hamburg, Germany), before impaction of fresh frozen, morcelised and fat reduced bone graft. In cases of a complete central wall defect, a thin perforated titanium cage (Acetabular Graft Cup, from the same company) was anchored with screws inside the partly graft impacted acetabulum, and thus covering the central



Fig. 1 - Segmental bone defects were covered from the outside of the acetabulum by a 0.8 mm thick, perforated and preshaped titanium plate.

bone defect. Finally some additional graft was impacted inside the cage. Subsequently also the central defect is now covered with impacted bone graft. Finally a polyethylene cup was cemented on the thoroughly impacted graft bed. At follow-up after median 6.5 (4.5-8.5) years clinical and radiological results were analysed.

RESULTS. No patient was lost to f.u. There were no surgical complications that could be related to the technique. There was one mechanical loosening and one septical failure. The overall pain relief and the function of all the remaining 28 hips were good. At radiographic evaluation there was generally a healing appearance. 3 cups had a migration of 4-6 mm.

DISCUSSION. The described concept for restoring segmental acetabular bone defects at revision THA had a low complication rate and failure rate. The method is recommended for surgeons with an interest in revision acetabular arthroplasty.

**O008
USE OF IRRADIATED BONE GRAFT FOR IMPACTION GRAFTING IN ACETABULAR REVISION SURGERY**

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INTRODUCTION. Impaction bone grafting is a very useful technique in revision hip arthroplasty. Irradiated bone graft has been favoured in some centres due to concerns about disease transmission through fresh frozen allografts.

METHODOLOGY. We describe 58 cases of acetabular revision surgery done at the Avon Orthopaedic Centre between 1995-2001 and followed up over a period of

48-90 months. The preoperative bone defect was graded by the Paprosky classification as 10 cases of type 1, 15 type 2a, 5 type 2b, 7 type 2c, 14 type 3a and 7 type 3c. The bone graft used was milled, unwashed freeze-dried femoral head allograft. Case notes were reviewed for information about the primary prosthesis, operative details and the cause of the revision.

The radiological picture at 3 months, 6 months, 1 year and yearly thereafter was evaluated for signs of incorporation, remodelling, loosening of the cemented acetabular component. Clinical evaluation was from the last clinic visit notes. Revision was the end point of the study

RESULTS. There were no cases of loosening. One case had recurrent dislocation and was revised. Twenty-six (44.8%) cases showed changes of incorporation, and 4 cases (6%) showed changes of remodelling. Clinically the results were satisfactory with absence of pain in 38 cases (65%). Trochanteric pain was present in 3 cases

CONCLUSION. The results of impaction bone grafting on the acetabular side using irradiated bone graft are comparable to those with fresh frozen allograft and significantly better than those on the femoral side. This could be attributed to the compressive forces acting across the acetabular side and good vascularity. The low percentage of remodelling remains a concern and warrants further studies.

**O009
LONG-TERM BEHAVIOUR OF IMPACTED MORCELISED ACETABULAR ALLOGRAFT IN REVISION HIP SURGERY**

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BACKGROUND. We have prospectively analysed a single-surgeon series of 35 consecutive revision total hip replacements (THRs) with AAOS bone loss grade II-III, requiring morcelised allograft for acetabular defects. Follow-up consists of a minimum 5 years. Despite early encouraging results, we are observing late migration patterns in some cases.

METHODS. Annual follow-up consists of clinical assessment (Charnley activity, pain, function, satisfaction) and a plain radiograph of the pelvis. Study end-points are

1) prosthesis revision and, 2) acetabular cup migration at last follow-up.

RESULTS. There were 6 deaths with less than 5 years follow-up. Two cases have been lost to subsequent follow-up. Two cases had deep infection and were girdlestoned. One case underwent further revision at 4 years due to symptomatic cup migration. Twenty-one eligible cases have had a mean follow-up of 5.83 years (range 5-10 years). Eight cases (38%) have shown no cup migration. Five have shown only late stage migration, 4 cases have shown initial and then late migration whilst 3 cases have demonstrated intermediate migration followed by stability. One case has exhibited constant progressive migration. These 13 migratory cases (62%) remain asymptomatic.

CONCLUSIONS. Our results show that use of morcelised allograft for revision hip surgery with segmental/cavitary acetabular defects can be a useful surgical procedure. Survivorship results are good (rate 96.4%). However, the relatively high number of cases from our data which have shown, as yet, asymptomatic cup migration causes concern for future management. We suggest regular (annual) indefinite follow-up of all allograft patients to help identify migration patterns.

O010

SUBSIDENCE AND IMPLANT STABILITY IN IMPACTION GRAFTING USING BONE ALLOGRAFTS AND CERAMIC BONE SUBSTITUTES. COMPARISON BETWEEN THREE EXPERIMENTAL METHODS

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BACKGROUND. In impaction grafting the limited availability, variable quality and risk of infection associ-

ated with bone allograft have led to the development of synthetic graft extenders such as calcium-phosphate based ceramics. This study describes the mechanical properties of bone and bone/ceramic (b/c) mixes using three *in vitro* models of different complexity in order to characterise bone grafts, identify a suitable graft extender and to validate standardised test methods against complex methods with close clinical relevance.

METHODS. 1) Cyclic subsidence tests on cadaveric femur prepared using the standard Exeter X-change impaction grafting technique, 2) cyclic subsidence tests using a simplified but standardized tube-cone model, 3) a basic compression test. Graft materials investigated were pure human allograft as the gold standard, ovine bone chips as an *in vitro* experimental graft and graft mixes of bone and a hydroxyapatite/tricalcium-phosphate graft extender. Mixing ratios were 2:1, 1:1 and 1.2 b/c.

RESULTS. Subsidence recorded during both the cadaver and the tube-cone model was steep during the initial cycles before settling into a logarithmically constant rate. Stability was significantly higher and less variable for graft mixes than for pure bone. This correlated well with the higher stiffness values recorded during compression testing. Elastic stem displacement and compression recoil were also linked. More intense impaction increased stability in both cyclic tests. Graft mixes showed high stability already at low impaction levels.

CONCLUSIONS. The equivalency of results validates the tube-cone model and compression as simple and reproducible method to analyse bone substitutes. The BoneSave extender can be recommended for clinical application. Bone/ceramic segregation complicating homogenous charging could be reduced by adding clotting agent.

O011

PROXIMAL IMPACTION ALLOGRAFTING FOR FEMORAL REVISION USING THE OXFORD TRIMODULAR STEM

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AIM. To evaluate the clinical outcome of revision hip

arthroplasty using the Oxford Hip prosthesis combined with impaction allografting.

METHODS AND RESULTS. The Oxford hip is a trimodular prosthesis with a polished tapered metaphyseal section that is free to slide on the stem. The stem is inserted uncemented into the diaphysis, bone graft is impacted proximally, with mesh if necessary, and then the proximal wedge is cemented in. Between 1999 and 2002, we revised 72 hips in 69 patients using this technique (mean age 65 years). Fifty-six cases had aseptic loosening, 8 had infection, 7 had peri-prosthetic fractures and 1 had a broken stem. The mean time to revision was 8.5 years. Patients were assessed with the Oxford Hip Score (OHS). Fifty-seven patients also had acetabular revision. Four patients required femoral osteotomy to remove the old prosthesis. We used a mean of 1.8 (1 to 4) femoral heads per operation. Complications included 6 peri-operative femoral fractures diagnosed at operation and fixed successfully, 6 infections, 10 dislocations, 2 PE and one DVT. The average blood transfusion was 1.8 units. The OHS improved from 45 pre-operatively to 24.3 post-operatively (best score 12). No hip has been re-revised for aseptic loosening at a mean follow-up of 32.7 months (16 to 51).

CONCLUSION. The trimodular Oxford stem combined with minimal proximal impaction allografting was found to be a reliable method and a successful way of dealing with revision femoral surgery. The results were comparable with a primary arthroplasty in terms of pain relief and functional results.

O012
STEM SUBSIDIENCE AFTER FEMORAL IMPACTION GRAFTING IN REVISION HIP SURGERY USING IRRADIATED BONE

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INTRODUCTION. Bone stock loss is one of the most significant factors precluding a successful revision total hip arthroplasty. Impaction grafting is arguably one of the most important tools in the management of bone stock deficiency. In this study, we assessed patients who had hip revision with femoral

impaction grafting in our centre.

MATERIALS AND METHODS. A retrospective study in which a consecutive series of all patients who had a revision hip replacement with femoral impaction grafting in the period from 1994-2001 were assessed. Radiographic measurement for stem subsidence on pre-operative X-rays films and post-operative films at 6 months, 1 year, 18 months and 2 years was done by 2 independent observers. Radiographic analysis for graft incorporation and trabecular remodelling was also done. Irradiated bone grafts were used in all cases.

RESULTS. 79 hips were assessed. Radiographic analysis revealed graft incorporation in 38% of cases but no evidence of trabecular remodelling. Moderate subsidence (5-10 mm) occurred in 11 cases (13.9%), and massive subsidence (>10 mm) occurred in 8 cases (10%). Complications included 9 dislocations, 4 periprosthetic fractures and 5 stem revisions.

CONCLUSIONS. Impaction grafting in revision hip replacement produces satisfactory results for most patients but a few hips perform poorly. We are currently looking at the possible reasons. We have concerns about irradiated bone grafts, as the characteristic changes of graft remodelling are not seen.

REVISION - MISCELLANEOUS

O013
MEGA-IMPLANTS IN THE RECONSTRUCTION OF ACETABULAR DEFECTS

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BACKGROUND. In re-revision surgery of total hip replacement there are often patients with major acetabular defects. Because conventional acetabular cups cannot fill these defects, there is the necessity of implantation of mega-implants.

METHODS. In the last 5 years we have implanted 34 of these acetabular mega-implants. In 8 patients the operation was the third revision, in 4 patients the fourth and in 5 patients the fifth revision. To create custom-

made implants we use a process called "Rapid Prototyping", the production of pelvic models from CT-scans. The surface of the mega-implants shows a spongy structure with an excellent fit in bone tissue. RESULTS. The remobilisation occurred regularly with regard to the invasive procedures, even the healing-process of the implants. The greater number of complications (14 cases: infection, luxation, DVT, neurologic, mechanic compl.) causes in the circumstances of preoperative complicated situations. This can be relativated, when we regard the literature, where we can find similar numbers of complications.

CONCLUSIONS. Finally the reconstruction of acetabular defects in multiple-revision surgery can be regarded as a kind of limb-salvage procedure. Because of the individuality the production of custom-made implants is necessary in some cases. The greatest number of complications is caused in the very extended operative procedures.

O014

MANAGEMENT OF TYPE II, III AND IV ACETABULAR DEFICIENCIES IN REVISION TOTAL HIP ARTHROPLASTY

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Acetabular reconstruction with severe bone loss after failed hip arthroplasty is a challenging problem. Defects were defined as cavitory (type II), combined segmental and cavitory deficiencies (III) and pelvic discontinuity (IV). 146 patients were treated with an excentric, cementless, pressfit, porous-coated "cranial-socket" with modular additional fixation devices. The "cranial-socket" with supplemental central screw fixation was used in 58 cases for type II defects. In 69 cases with type III deficiencies "cranial-sockets" with additional acetabular cranio-lateral flap and in 19 cases with type IV defects "cranial-sockets" with additional flap and central acetabular stem for supplemental intramedullary iliac fixation were applied. Average follow-up was 28 months. The overall revision rate

was 5% due to 5 of type II, 1 of type III and 2 of type IV. For aseptic loosening 1 case of type II and 2 cases of type IV were revised. Cup migration has been seen in 4 cases (1 type II, 2 type III, 1 type IV). The dislocation rate was 4% (2 type II, 5 type III, 1 type IV). With respect to the classification of acetabular defects this modular socket system has shown good short- and mid-term results especially for type III and type IV defects. Host bone in the weight-bearing area, primary stability with safe fixation of the socket using flap and intramedullary acetabular stem are most important for the management of type III and IV deficiencies.

O015

A STUDY OF 4762 REVISION HIP PROSTHESES REPORTED TO THE NORWEGIAN ARTHROPLASTY REGISTER

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BACKGROUND. We present the results for 4762 revision total hip arthroplasties with no previous infection in the hip, which were reported to the Norwegian Arthroplasty Register between 1987 and 2003.

METHODS. Cox regression analyses were undertaken separately for acetabular and femoral revision components. Cemented revision components without allograft was set as the reference category.

RESULTS. The ten-year failure rate for revised prostheses was 26% (85% CI 25 to 26). For acetabular components, we found a significantly reduced risk of failure for uncemented revisions both with (RR = 0.66; 95% CI 0.43 to 0.99) and without (RR = 0.37; 95% CI 0.22 to 0.61) allograft. For femoral components, we found a significantly reduced risk of failure for uncemented revisions, both with (RR = 0.27; 95% CI 0.16 to 0.46) and without (RR = 0.22; 95% CI 0.11 to 0.46) allograft. This reduced risk of failure also applied to cemented revision components with allograft (RR = 0.53; 95% CI 0.33 to 0.84) and with impaction bone grafting (RR = 0.34; 95% CI 0.19 to 0.62). Revision

prostheses have generally inferior results when compared with primary prostheses.

CONCLUSIONS. Recementation without allograft, and uncemented revision with bone impaction, were associated with worse results than the other revision techniques we studied.

O016

TRANSFER OF THE TENDON OF THE ILIOPSOAS MUSCLE FOR TREATMENT OF PAINFUL HIP ABDUCTOR WEAKNESS AFTER HIP ARTHROPLASTY

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BACKGROUND. Avulsion of the anterior portion of the abductor muscle after a lateral approach for total hip arthroplasty leads to pain and impaired function. Conservative and surgical treatment of this condition is known to have poor results. We present a new surgical technique for repair of an avulsed abductor muscle after hip arthroplasty.

METHODS. In a first step the abductor muscle flap is reinserted into the greater trochanter, in a second step the tendon of the iliopsoas muscle together with the lesser trochanter are transposed to the anterolateral side of the femoral shaft. With this new direction the iliopsoas tendon leads to internal rotation of the hip joint and unloads the reinserted abductor muscle, allowing a more undisturbed healing.

RESULTS. We operated 23 hips in 22 patients who predominantly complained of severe lateral thigh pain after hip arthroplasty. At a mean follow-up of five months 12 patients were painfree, three had pain occasionally, four had moderate pain and three patients still complained of severe pain. There were no complications related to the mobilization and transfer of the iliopsoas tendon.

CONCLUSIONS. We conclude, that with this technique we are able to reattach the avulsed portion of the abductor muscle and to improve the symptoms of the patient.

O017

MODULAR HIP SPACER SYSTEM (MOHISS) FOR THE TREATMENT OF INFECTED HIP ENDOPROTHESIS

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BACKGROUND. Septic loosening is a serious complication in total hip arthroplasty. For the treatment of such cases the explantation of the endoprosthesis and implantation of a temporary spacer, made of bone cement, is a common procedure. The implantation of a spacer reduces contraction of the soft tissue and, in addition, specific antibiotics can be added into the bone cement to reach high local antibiotic concentration. Besides industrial produced spacers, which are expensive and ask a large storage, hip spacers are usually shaped manually with different results referring to fit and stability.

METHODS. To optimize the quality of the spacer we developed a casting mould to produce spacers with head sizes of 48-64mm combined with different sizes of stem length and thickness.

RESULTS. By analysing the Gentamycinsulfat release of a spacer 5 weeks after implantation it could be shown that there is still 33% of output compared to a new spacer.

CONCLUSIONS. The production process, the advantages and our experiences with MOHISS will be presented.

O018

LONG STEM PRE-FORMED SPACER AND NON CEMENTED LONG STEM MODULAR IMPLANT: A SOLUTION FOR WIDE FEMORAL OPENING OR BONE LOSS IN REVISION OF SEPTIC HIP PROSTHESIS

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INTRODUCTION. Reasons for bone loss in septic hip prosthesis include osteolysis caused by the infection in itself and by the mechanical loosening, while implant removal and the necessary bone debridement usually ends in an even severer bone loss.

In this presentation we will focus on how we currently manage proximal femoral bone loss in two-stage revision of septic hip prosthesis, using a long stem antibiotic-loaded pre-formed cement spacers (Spacer G - Tecres s.r.l., Italy).

The described technique allows to avoid the use of

femoral bone grafts even in the worst cases, by using in the second stage modular non cemented long stem prosthesis, that achieve distal fixation (Profemur- Wright-Cremascoli).

MATERIALS. 30 patients, at a follow-up ranging from 1 to 3 years from revision. All the patients showed severe proximal femoral bone loss (Paproski > 2).

RESULTS. No infection recurrence, two spacer subluxations, that required no intervention, one dislocation after revision, treated with open reduction, one femoral nerve palsy (recovered).

CONCLUSION. Long pre-formed spacers appear to be an easy and reliable choice to treat infected hip prosthesis with proximal femoral bone loss, even in the most difficult cases. Primary stability and mechanical resistance usually allow partial (5 - 10 kg) weight bearing. The patient is asymptomatic and the range of movement is maintained. Other advantages include predictable antibiotic release from the spacer, that assures gentamicin release at therapeutic levels and reduced operator time. Long stem non-cemented modular implants allow effective hip reconstruction, in the short term follow-up.

BASIC - METAL-ON-METAL AND MISCELLANEOUS

O019

EARLY LOOSENINGS OF METAL-ON-METAL BEARINGS. ANALYSIS OF THE FIRST 17 CASES

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METHODS. Seventeen cases with metal-on-metal bearing hip prostheses (Endoplus, Switzerland) were revised due to aseptic early loosening of the implants. The mean time of implantation was 32 months (12-59). In 6 cases the whole system (stems and cups) was revised, in 8 cases the stems only, in 2 cases the

cup only, and in 1 case only the bearings (ball head and inlay) were replaced. The indication for revision was either clinical loosening or progressive osteolysis. All bearings were measured for linear and volumetric wear with a 3D coordinate measurement machine (LH65, Wenzl, Germany) according to ISO 14242-2. The tribologic areas of the bearing partners were inspected with scanning electron microscopy (XL40, Philips, Netherlands) and microanalysis of specific areas were collected with energy dispersive x-ray detection. Additionally, the regeneration joint capsula was histologically examined.

RESULTS. The mean linear wear rate of the bearing combinations was 7.3 µm per year (2.9-12.8 µm) with mean clearance of 38.9 µm (30-53 µm). The volumetric wear rate was 1.96 mm³ per year (0.55-3.74 mm³). The main wear mode was found to be abrasive with traces of third body wear on all specimens. Histologically a mainly diffuse but also localized infiltration of lymphocytes, some plasmacells and also macrophages with incorporated metallic particles were seen. At the surface of the joint capsula a mass of so called fibrinoid necrosis was found. The adjacent synovial lining cells showed a typical palisading arrangement.

CONCLUSIONS. The morphological findings are strongly suggestive of a rheumatoid synovitis and point to an immunological-hyperergical reaction.

O020

METALLOSIS

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In younger patients metal-on-metal and ceramic-on-ceramic articulations are favored for total hip arthroplasty because polyethylene particle induced osteolysis is a problem. Results of the PPF THA with metal-on-metal articulation were not satisfactory. Clinical, radiological and histological analysis showed a new, sometimes dramatical tissue reaction. Low carbon and high carbon alloy components induce excessive liquid production which may lead to luxation up to 5 years and massive lymphocyte reaction combined with osteolysis can result in aseptic socket loosening. We saw first luxations within two years and late luxations were recorded in 12%. In the first fol-

low-up of 84 THA with metal-on-metal we recorded earlier and more osteolysis (27%) after an average of 69 months compared to polyethylene-on-ceramic (5% after 8 years) articulation. In stable hip arthroplasties metallosis causes typical inguinal pain especially while lifting the limb because of a bursitis ileopectinea. The evaluation of radiographs is difficult. In some cases early radiolucent areas around the screw socket were progressive and socket migration occurred. The evaluation of radiographs and sonographs combined with laboratory parameters like CRP and ESR, bacteriological screening of the joint's effusion and typical pain are necessary if metallosis should be identified. The exchange of bearing components with debridement are recommended, when revision in early metallosis is done. Intraoperative, joint's effusion sometimes can look like a purulent discharge. Osteolysis, especially in the acetabular and trochanter area, is presumed to be caused by high liquid production combined with high joint pressure while this weakens the muscles and luxation can follow.

O021

SERUM METAL ION LEVELS AFTER THE CORMET AND BIRMINGHAM METAL-ON-METAL RESURFACING HIP ARTHROPLASTY

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AIM. Bone-conserving resurfacing hip arthroplasty (RHA) with metal-on-metal (MOM) bearing is increasing in popularity. Concern remains with the potential toxicological effects of the metal ions that these bearings release. We measured the serum cobalt and chromium ion levels in patients after Cormet RHA and Birmingham RHA and compared the two groups.

METHODS. We prospectively identified and matched 11 patients with a Cormet RHA with 11 patients with a Birmingham RHA by duration after surgery, activity level and body mass. All patients had well-functioning implants with MOM bearings made of

cobalt-chromium alloy inserted by the same surgeon. Blood serum was taken with full anti-contamination protocols and serum analysed via inductively coupled plasma mass spectrometry. Statistical analysis used the Mann-Whitney-U test.

RESULTS. At a median of 14 months, the serum cobalt ion level after BHR was 6.2 times normal (median 31nmol/L, range 17 to 66 nmol/L) compared to 10.8 times normal (median 54 nmol/L, range 20-29 nmol/L) after Cormet RHA ($p = 0.08$). The serum chromium ion level after BHR was 10 times normal (median 50 nmol/L, range 12 to 100 nmol/L) compared to 13.8 times normal (median 69 nmol/L, range 25 to 110 nmol/L) after Cormet RHA ($p = 0.22$).

CONCLUSIONS. This study has shown that both RHA designs produced significantly raised serum metal ion levels. The differences between groups, however, were statistically not significant. The raised metal ion levels may be clinically relevant when the potential long term effects of chronically raised serum metal ion levels is considered.

O022

HISTOPATHOLOGY OF PERIPROSTHETIC TISSUES SURROUNDING METAL-ON-METAL HIP JOINTS

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QUESTION. Is the histopathological response of the periprosthetic tissue to metal-on-metal bearings comparable to the well studied reactions to polyethylene debris or do specific reactions exist and are these reactions dependant on the implant design?

METHODS. Periprosthetic tissue samples from 19 THR and Hip Resurfacings (11 Birmingham Hip Resurfacings, 2 McMinn Hybrid Hip Resurfacings, 5 MetaSUL THR) with a variety of failure mechanisms were histopathologically and immunohistochemically examined.

RESULTS. Only the samples of the McMinn Hybrid resurfacings showed a stronger histiocytic foreign body reaction and a higher grade metallosis. In all other cases only a mild if any histiocytic foreign body reaction was found. Additionally a chronic lymphoplasmacellular tissue reaction was present in all cases. Three cases showed a higher grade chronic lymphoplasmacellular inflammatory tissue response comparable to a hypersensitivity reaction.

DISCUSSION. We found two different response mechanisms of the periprosthetic tissues to metal-on-metal bearings. In addition to the classic histiocytic foreign body reaction which was usual mild and only stronger in cases with a greater amount of metallic debris a lymphoplasmacellular inflammatory reaction usually was present but not related to the implant or amount of wear. In 3 of our 19 cases that reaction was stronger and comparable to a hypersensitivity reaction.

O023

LYMPHOCYTE-MEDIATED HYPERSENSITIVITY IN METAL/METAL TOTAL HIP ARTHROPLASTY

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BACKGROUND. Metal/metal hips were reintroduced in the late eighties. Despite improved alloy-qualities and encouraging mid-term results, studies from metal/metal retrievals suggested hyperergic reactions. We investigated 16 aseptic revisions (15 patients) of uncemented metal/metal prostheses (one manufacturer, one institution).

METHODS. Patients' age (13 females, 2 males) was 46-78 years. Time of implantation was 4.5-7.2 years. Duration of symptoms before revision was 5-24 months. 2 patients had dislocations, 1 patient had metallic clicking. Tissue samples were retrieved at revision microscopically examined after staining with routine and immunohistochemical methods. Element analy-

ses of tissues were performed. Retrieved components were examined for linear wear.

RESULTS. Seven patients had radiological signs of loosening. Intraoperatively, 5 acetabular cups, 2 stems, in 2 cases stem and cup were loose. Patients were revised to ceramic-UHMWPE (6x), metal-UHMWPE (9x), ceramic-ceramic (1x). 12 patients showed metallosis, 4 bursa formation. The amount of Co, Cr, and Ni in the tissues ranged from 1.4 - 4604.0 µg/g. Histologically, diffuse, perivascular T- and B-lymphocyte infiltrations and plasma cells were observed. Hemosiderin and fibrin exudation were typical in metallosis. Immunohistochemistry proved active cellular reaction. Cases with metallosis showed less lymphocytic infiltration. After revision, patients were free of symptoms.

CONCLUSIONS. A correlation between hypersensitivity reaction and tissue amount of metal was not established. Moreover, patients with metallosis showed less signs of hyperergic reaction. The incidence of a possible hypersensitivity reaction in patients with metal/metal joints is low. Diagnostic hints could be early reappearance of symptoms and marked joint effusion but not metallosis.

O024

THE MECHANICS OF STRIPE WEAR FORMATION IN MODERN ALUMINA-ALUMINA BEARINGS

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BACKGROUND. The extremely low wear rates of 3rd generation alumina-alumina bearings in traditional hip simulators are not reflected *in vivo*. Separation of the bearing during swing phase and edge loading with heel strike is reported to account for this discrepancy.

METHODS. Sixteen bearings (16 heads and 12 inserts) retrieved from a series of 1588 hip arthroplasties with 3rd generation alumina-alumina bearings were analysed in this study.

RESULTS. Eleven bearings had stripe wear, the remaining

5 bearings were used as controls. The wear on the insert was always located at the rim indicating edge loading. The location and orientation of the stripe on the head was not consistent with subluxation during normal gait but was consistent with subluxation with the hip flexed at 90. The average wear volume was 0.7 mm³ per year (heads plus liners). The heads without a wear stripe showed very little damage: under SEM a slight relief polishing of individual grains and minor pitting was noted.

CONCLUSIONS. The subluxation causing the stripe wear in these patients did not occur during normal walking gait. It probably occurred with rising from a chair. Simulator testing of 3rd generation alumina-alumina components must include edge loading if it is to give a realistic indication of *in vivo* performance. None of these bearings were retrieved for bearing failure. Alumina-alumina bearings remain an excellent option for total hip arthroplasty, however more work is required to understand the clinical consequences of stripe wear.

O025

VERY LATE RELEASE OF GENTAMICIN FROM BONE CEMENT IN TOTAL HIP ARTHROPLASTY (THA)

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BACKGROUND. *In vivo* elution studies on Antibiotic-loaded Bone Cement (ABC) have concentrated on the short to medium term. This unit has previously described gentamicin release from cement during revision surgery and its presence in the joint aspirates of THAs at up to 12 years. We elected to study the late elutional behaviour of gentamicin-loaded cement in THA.

METHODS. Fifty-one patients undergoing revision THA surgery, for aseptic failure, at our centre were studied. Pre-operative urine samples and intra-operative joint fluid aspirates (prior to cement disruption) were assayed for their gentamicin concentrations using a

fluorescence polarisation immunoassay. Cement samples underwent an agar plate inhibition bioassay to assess for antimicrobial activity.

RESULTS. Urine samples were obtained in 43 (84%) of the cases. All were negative for gentamicin (sensitivity level of 0.06 mg/L). Cement samples were retrieved in 36 cases (71%) and all of these (100%) demonstrated significant antimicrobial activity when compared to a standard 10 mg gentamicin disc. In 25 cases (49%) the joints were aspirated and 8 (32%) of these had a gentamicin concentration >0.1 mg/L. The concentrations however were all below the Minimum Inhibitory Concentration (MIC) for intermediate sensitivity organisms. The longest interval between the primary and revision operations, in these positive cases was 25 years!

CONCLUSIONS. This study uniquely demonstrates sequestration and local release of gentamicin from cement for up to 27 years. Joint aspirate levels were all sub-therapeutic. There was no evidence of late systemic release. These low concentrations of antibiotics, released after many years, are probably a potent stimulus to the emergence of resistant organisms. The use of antibiotic-loaded bone cement in primary THA remains controversial and requires further scrutiny.

O026

PERIPROSTHETIC BONE REMODELING OF HA-COATED FEMORAL IMPLANTS. A 3-YEAR FOLLOW-UP STUDY ADDRESSING THE INFLUENCE OF PROSTHESIS DESIGN AND PREOPERATIVE BONE QUALITY ON PERIPROSTHETIC BONE LOSS

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Periprosthetic bone loss is a major cause of concern in patients undergoing total hip arthroplasty (THA). In this study we monitored the periprosthetic bone loss around two different femoral implants, the Anatomic Benoist Girard (ABG) and the Mallory-Head (MH), over a 3-year period to evaluate their design and the relationship with the preoperative bone mineral density (BMD) at the spine, hip and radius. Sixty pa-

tients were randomised to either the ABG or MH femoral stem. Pre- and postoperative dual-energy x-ray absorptiometry (DEXA) scans were acquired to measure periprosthetic BMD using a standard Gruen zone analysis. Three months after THA there was a statistically significant BMD decrease in every Gruen zone that varied between 5.6% and 13.8% for the ABG prosthesis and between 3.8% and 8.7% for the MH prosthesis. Subsequently, in most zones BMD reached a plateau or showed a small recovery. However, BMD continued to fall in Gruen zones 1 and 7 in ABG patients and Gruen zone 1 in MH patients. Bone loss was less in every Gruen zone in MH patients compared with ABG with the largest difference (10%, $P = 0.018$) in Gruen zone 7. After adjustment for multiple comparisons the relationship between periprosthetic bone loss and preoperative BMD was highly statistically significant for spine, hip and radius BMD. This study confirmed that prosthesis design influences periprosthetic bone loss. The study also showed that bone quality at the time of operation is a major factor influencing bone loss around the femoral stem.

O027

COMPARISON OF PERIPROSTHETIC BONE LOSS OF AN ANATOMICAL AND STRAIGHT DESIGN OF UNCEMENTED HA-COATED FEMORAL STEMS

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INTRODUCTION. Short term periprosthetic bone loss following THA can occur as a result of patient-related factors such as sex or bone quality but also prosthesis-related factors such as design induced stress shielding and the presence, type or extent of the HA coating.

METHODS. This study investigated bone stock loss for two different design concepts of uncemented HA-coated femoral stems (anatomical versus straight) and the influence of pre-operative bone quality. Sixty patients undergoing THA were randomised to either ABG (anatomical) or MH (straight) femoral stems. Periprosthetic BMD was monitored at 10 days (baseline), 6 weeks and 3, 6, 12, 24 and 36 months

post-operatively using DEXA and a standard Gruen zone analysis. Pre-operative BMD was also measured for the lumbar spine, contralateral hip and the non-dominant forearm.

RESULTS. Three months after THA BMD had decreased significantly in all Gruen zones for both the ABG (5.6-13.8%) and the MH stem (3.8-8.7%). Subsequently, in most zones BMD reached a plateau or showed small recovery. BMD continued to fall in Gruen zones 1 and 7 in ABG patients and zone 1 in MH patients. Bone loss was less in MH patients compared to ABG for all Gruen zones with the largest difference in zone 7 ($\Delta=10\%$, $p=0.018$). The relationship between bone loss and preoperative BMD was highly significant for spine, hip and radius.

CONCLUSIONS. Different design concepts for HA-coated femoral stems (anatomical versus straight) do influence perioprosthetic bone loss. However, the effect is relatively small when compared to the influence of preoperative bone quality.

O028

PHOTOELASTIC AND THERMOELASTIC MEASUREMENT OF STRESS ON THE PROXIMAL FEMUR BEFORE AND AFTER IMPLANTATION OF A HIP PROSTHESIS WITH RETENTION OF THE FEMORAL NECK

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In total hip implantation the femoral head including the neck is usually removed. Earlier attempts at an allo-arthroplastic treatment of coxarthrosis while retaining the femoral neck and head have not proved successful. In 1986, Freeman first described the advantages of femoral component implantation with femoral neck retention. After that it can be assumed that femoral neck retention reduces the risk of prosthetic stem loosening. In 1988 Carlson et al reported improved medial support without investigating the load uptake of the retained femoral neck. In order to demonstrate the improved medial support and load transfer onto the retained femoral neck, two *in vitro* methods of stress and strain measurement on bone were used in our study. Seven fresh individual femurs were obtained from male cadavers aged

between 23 and 42 years. Four femurs were investigated by means of photoelastic surface coating. For the sake of comparison the right femur of a pair and the remaining femur underwent thermoelastic stress analysis. As a result of the test homogeneous stress distribution was observed on all intact femurs with a maximum at the femoral calcar. Following prosthetic implantation with retention of the femoral neck there was a homogeneous distribution similar to that on the intact femurs, with a transfer onto the retained femoral neck. After removal of the femoral neck increased intertrochanteric compression was observed. The medially situated maximum pressure shifted distally. With the thermoelastic stress analysis a corresponding distribution of the total main stress levels was measured. An improved medial support and homogeneous distribution of stress lines was observed with implantation of the prosthesis with femoral neck retention. This study demonstrated improved biomechanical conditions for prosthetic stem implantation retaining the femoral neck.

THR - CEMENT, COATING, MISCELLANEOUS

O029

THE OPTIMUM THICKNESS OF THE ACETABULAR CEMENT MANTLE - A BIOMECHANICAL ANALYSIS

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BACKGROUND. Aseptic loosening is the main cause of revision in hip replacement surgery. The optimum method of acetabular cementation has not been fully evaluated. This study aimed to determine the ideal thickness of cement mantle to resist torsional forces.

METHODS: Mahogany blocks with a 54 mm hemispherical hole were used to simulate an acetabular socket. Machined aluminium cups were created in 5 sizes (52 mm to 44 mm) to give a cement mantle that varied in size from 1 mm to 5 mm. Three 10 mm keyholes were

drilled and appropriate-sized spacers inserted to ensure the mantle was accurate and even. Silicone grease was used to prevent any micro-interlock between cement and wood. The cups were then cemented into the wooden blocks using vacuum-mixed Palacos R cement and left to cure for 7 days at 37 °C in air. The constructs were tested to failure using a servo-hydraulic testing machine. Each experiment was repeated six times.

RESULTS: The stiffness of the cement mantle varied according to thickness:

Thickness (mm)	Stiffness (Nm / Degree)
1	58 ± 4
2	37 ± 1
3	39 ± 1
4	25 ± 0.3
5	24 ± 0.3

CONCLUSIONS: A stiffer cement mantle will transfer more torque to the bone-cement interface, possibly leading to earlier loosening of the prosthesis. This biomechanical analysis suggests that surgeons should aim to achieve a mantle at least 2 mm thick. There appears to be little further mechanical advantage gained if the mantle is increased in thickness beyond 4 mm.

O030

FEMORAL CEMENT PRESSURISATION IN HIP ARTHROPLASTY: A LABORATORY COMPARISON OF THREE TECHNIQUES

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OBJECTIVE. To evaluate three femoral cement pressurization techniques in a laboratory setting. Design- Observational study using a plastic femur (saw-bone) model.

MATERIALS AND METHODS. Twelve femoral bone models were cemented and pressurized using three different cement pressurization techniques (standard technique, pressurizer *in situ* technique, and thumb pressurisation technique). Four sets of observations were taken for each technique. Intramedullary pressure readings were obtained using proximal and distal pressure monitoring transducers. The peak pressure and the time for which the pressure was

above a particular cut off level (5 KPa and 100 KPa) were compared.

RESULTS. There were significant variations between the peak pressure and the duration for which the pressure was above 100 KPa. The pressuriser *in situ* technique yielded significantly ($p < 0.001$) higher peak pressure both proximally (397.5 ± 40.2 KPa) and distally (597.3 ± 102.4). The standard technique produced the optimum pressure of 100 KPa for significantly ($p < 0.001$) longer duration proximally and distally (66.8 ± 29.5 and 45.2 ± 15.5 seconds respectively) compared to the other two techniques (less than 5 and 17 seconds for thumb pressurization technique and pressurizer *in situ* technique respectively, both proximally and distally).

There were no significant statistical differences between the three methods for the time for which the cement pressure was higher than 5 KPa.

CONCLUSION. Although the pressurizer *in situ* technique produced highest peak pressure, the standard technique produced optimum pressure for longer duration. The standard technique seems to be adequate to achieve optimum pressurization during femoral cementing without increased risk of embolisation.

O031

THE MECHANICAL PROPERTIES OF RECOVERED PMMA BONE CEMENT

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BACKGROUND. Samples of polymethylmethacrylate (PMMA) bone cement, used in the fixation of hip prostheses, have been recovered from 11 patients after in service life spans of between 15 and 24 years. Eighteen samples in total have been recovered from the acetabular and/or femoral cement. The properties of these samples have been tested under various conditions.

METHODS. Tests on recovered samples were carried out with the aim of establishing what relationships, if any, could be found between (i) the various properties being measured (ii) the material properties and the test conditions (iii) the specimen properties and the duration *in vivo* and/or the clinical performance

of the hip implants. Tests were carried out on the samples in both hydrated and desiccated states. Three-point bend tests and Knoop hardness tests were used to establish Young's modulus and microhardness respectively. The porosity of specimens was calculated using specimen and matrix densities, with the latter being established using flotation.

RESULTS. The porosity of recovered samples ranged from 1.8% to 21.9%. Data from 3-point bend tests was also used to show that the degree of stress relaxation exhibited by recovered samples was comparable to that of 1 year-old laboratory made cement.

CONCLUSIONS. No evidence has been found to suggest that the PMMA has deteriorated whilst *in vivo* and the mechanical properties of the cement matrices appear to be comparable to freshly made PMMA. Since the porosity of many of the samples is very high, the continuous matrix properties are inferred from the performance of individual specimens - there being an extremely good correlation between certain specimen properties and the specimen porosity.

O032

HISTOLOGICAL REACTION OF BONE TO A HA COATING IN PRIMARY THA

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INTRODUCTION. Notwithstanding the proven osteoconductive properties of HA coatings, long term bone reactions to HA are scarce and under debate because of noted adverse tissue reactions and possible chance of third body wear leading to early revisions.

METHODS. Out of a consecutive series of 1000 primary Total Hip Arthroplasties (ABG I; StrykerHowmedicaOsteonics), 10 hips with surrounding tissue were retrieved at autopsy (3.3 - 10.5 years). Sections of ca. 30 μ m thickness were cut according to the Gruen zones (femur) and the DeLee-Charnley zones (acetabulum). The length of bone ongrowth, residual HA coating and the coating thickness were measured. Tissue reactions were interpreted.

RESULTS. All components were completely stable at retrieval. No signs of adverse tissue reaction, delamination or third body wear were present. Distal or linear os-

teolysis was absent while the femoral medullary cavity was proximally sealed by circumferential bone ongrowth. The amount of bone ongrowth varied between 21-44% (cup) and 22-56% (proximal stem) with higher values for younger patients. The level of residual coating had no influence on the percentage of bone ongrowth.

CONCLUSIONS. Highly crystalline, plasma sprayed HA coatings ($\pm 60 \mu\text{m}$ thickness) enhance fast bone ongrowth while allowing only slow HA resorption. Resorption was correlated to bone remodelling as a function of patient characteristics such as age, activity or implantation time. Even with fully resorbed coatings, the bone ongrowth remained stable at a range of 21-56% sufficient for long term stability of the components. Complete circumferential bone ongrowth to the proximal stem seemed essential for preventing ingress of wear debris and thus aseptic loosening.

O033

DOES AN ELECTROCHEMICAL COATING WITH SOLUBLE CALCIUM-PHOSPHATE INFLUENCE THE OSSEOINTEGRATION OF A POROUS COATED HIP SOCKET? RESULTS OF AN ANIMAL EXPERIMENT

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PURPOSE. The purpose of this pilot-study was to evaluate if an additional coating with soluble calcium-phosphate influences the osseointegration of a hip socket with a titanium plasma-spray surface.

METHODS. Twelve adult, female sheep were fitted a THR unilaterally. Standing periods were 12 and 24 weeks. The used hip sockets were similar according to the design (hemispherical press-fit hip sockets) but different in the surface modification. We used hip sockets with a porous titanium plasma-spray coating and sockets with an additional coating with soluble calcium-phosphate. According to the two different implants and standing periods there were 4 groups of 3 animals each. The specimens were evaluated radiographically, histomorphologically, histomorphometrically and by fluorescence microscopy.

RESULTS. All cups were osseointegrated. There were no differences between the groups with a 12 weeks stand-

ing period. The calcium-phosphate coated cups showed a slightly higher osseointegration rate after 24 weeks especially in the equatorial area compared to the titanium plasma-sprayed cups. Values of the calcium-phosphate-groups showed a higher constancy.

CONCLUSION. The calcium-phosphate coating seems to influence the osseointegration and possibly evens out interindividual differences concerning biology or implantation differences. The data must be proved statistically by a more powerful study.

O034

BIOLOGICAL BEHAVIOUR OF POROUS TANTALUM ACETABULAR IMPLANTS

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PURPOSE. To investigate the biological behaviour of porous tantalum acetabular implants as well as to assess its osteoinducting and bone ingrowth properties.

MATERIALS AND METHOD. Between January 1988 and December 2001, 180 porous tantalum acetabular prosthesis were implanted in 172 patients. This implant is non-modular with the polyethylene moulded to the metallic shell. The press-fit elliptical shell is made of porous tantalum, which is a new biomaterial similar to titanium, with a 3-D architecture similar to cancellous bone and stiffness very close to that of the subchondral bone. During the learning curve period, at the immediate post-op radiographs, 1-4 mm gaps were observed between the prosthesis and the host bone in 25 cases. This was attributed to the fact that it was not possible to check the back of the shell for bone contact due its en-block construction with the insert. Post-operatively all patients were mobilized PWB the 2nd post-op day and FWB was allowed from the 6th post-op week. All these patients were closely monitored with radiographs at 6, 12, 18 and 24 weeks post-op. The radiographs were analysed with the EBRA - cup software, for early migration. In one patient the cup was removed at 23 weeks due to mal-positioning and was examined for bone ingrowth.

RESULTS. By the end of the 24 weeks all gaps were completely filled with bone. Radiographically there was no evidence of prosthesis migration, which was further confirmed after the analysis with the EBRA-cup software.

The examination (macroscopic and microscopic) of the removed cup, showed large amounts of new bone formation, inside the pores of the metallic shell with almost no fibrous tissue.

CONCLUSION. Porous tantalum is a bone friendly new bio-material, with excellent osteoinductive and osteoconductive properties which promises good long term results.

O035

EFFICACY OF h-MSC+BPM-7 IN BONE GRAFT

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BACKGROUND. In our experimental design we evaluated the osteogenic potential of h-bone marrow (h-BM), h-mesenchymal stem cells (h-MSC), bone morphogenetic proteins (BMP-7) and the combination hMSC plus BMP-7. The aim of the study was to define the capacity to elicit bone formation of expanded hMSC alone and associated with BMP-7

METHODS. A rat femoral segmental defect model was used in this study. Twelve male athymic rats were used. The institutional Animal Ethics Committee approved the study. Athymic rats test graft groups consisted of: G1-autoclaved bone and h-BM; G2-bone and h-MSC; G3-bone with BMP-7; G4-bone and h-MSC with BMP-7. h-BM aspirates were harvested from iliac crests of patients undergoing to THA. A plate was fixed on the femurs with four cerclage wires before a femoral gap of 6 mm was realized in the diaphysis. Gap was filled with different grafts. Defect was evaluated at 2, 4, 8, 12 weeks after implantation with radiographs. Evaluation of bone graft has been done using a Cook classification. Histological study with toluidine blue and safranin O at 12 weeks was performed in each group.

RESULTS. At 8-12 weeks after surgery G1 showed non visible new bone formation, G2 minimal new disorganized bone and G3 disorganized new bone bridging graft to host at both ends. The G4 group showed significant new bone and graft remodelling. Histological analysis confirmed the rx results.

CONCLUSIONS. The association h-MSC plus BMP-7 determines a significant activation of the osteogenic ac-

tivity at 8 weeks that may have a remarkable impact on the future orthopedics surgery strategies.

O036

MICROSEPARATION WITH DIFFERENT BEARING SURFACES UNDER SIMULATED GAIT CONDITIONS

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AIMS. After Total Hip Replacement (THR), bearing surface pistoning during the gait cycle can affect wear rates. This "micro-separation" has been shown clinically by video-fluoroscopy to be greater with Metal-on-Polyethylene (MOP) bearings than Metal-on-Metal (MOM) ones. We quantified the suction forces that these bearings generate during the swing phase of the gait cycle as a result of interfacial tension from the thin fluid film present at the bearing surface.

METHODS. We used a servo-hydraulic universal testing machine with 250N load cell and programmed a sinusoidal waveform that could vary the loads and frequencies applied to MOP or MOM bearings submerged in 25% serum. We measured the bearing separation (within 2µm) at tensile loads of 10N to 100N lasting 0.1s to 0.5s per 1Hz cycle.

RESULTS. MOM bearings resisted tensile loads of up to 35N when applied for 0.1s to 0.5s of the simulated gait cycle. Bearing separation was measured at a maximum of 198 microns. Above 50N, the MOM bearing was unable to prevent separation occurring even when applied for only 0.1s of the simulated gait cycle ($p < 0.001$). The MOP bearing could not resist separation at any of the applied tensile loads ($p < 0.0001$).

CONCLUSIONS. The suction-fit of the MOM bearing used in this study is insufficient to prevent bearing separation due to gravity (110N). However, it may reduce the total bearing separation distance by delaying the time point at which separation occurs during the finite period of the swing phase ($< 0.5s$) during the gait cycle.

O037

DEVELOPMENT AND VALIDATION OF A CT-SCAN BASED TOOL TO ANALYSE THE CEMENT MANTLE OF FEMORAL HIP IMPLANTS

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BACKGROUND. We developed, validated and assessed the reproducibility of software to analyse the polymethylmethacrylate layer surrounding femoral hip implants after CT-scanning.

METHODS. A polished tapered CPT-stem (Zimmer, USA) and a plastic stem replica, both cemented in dried cadaver femurs were analysed. The metallic CPT-stem was removed before CT-scanning while the radiolucent replica was left in place. Two CT-scans (Volume Zoom & Somaton Sensation 16, Siemens, Germany [collimation, slice thickness, slice interval, pixel spacing: 4x1, 1.25, 0.6, 0.145 & 16x0.75, 1.0, 0.5, 0.148 mm]) were used to produce over 230 connective images per specimen. Segmentation software was developed to find the contours of the whole specimen, the cement mantle and the femoral implant (replica or CPT-stem cavity). Based on these contours, distances between centroids (measure of concentricity), volumes (whole specimen, cement, prosthesis, air in cement and in bone), bone-cement contact area and cement mantle thickness were calculated. Validation occurred by comparing 41 manually segmented cross-sections (25 CPT, 16 replicas) with data of corresponding CT-scan slices. To assess inter-observer reliability, both models were CT-scanned and segmented four times by one person. To assess intra-observer reliability, four observers segmented 97 representative CT-images (46 CPT, 51 replicas).

RESULTS. Average accuracies are: 0.38 mm for distances between centroids, 0.27 mm for contours, 0.51 mm for cement mantle thickness and 7.47 mm² for surfaces within slices. Average intraclass-correlation coefficients for inter- and intra-observer reliability are 0.91 and 0.93 respectively.

CONCLUSIONS. As such, the proposed technique en-

ables assessment of cement mantles produced by different cementing techniques, stem types or centralisers.

O038

POST-OPERATIVE STABILITY OF THE SL-PLUS STEM: AN IN VITRO COMPARISON BETWEEN CADAVERIC AND COMPOSITE MODELS

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BACKGROUND. Immediate postoperative stability of cementless stems is a prerequisite for osteointegration, a key factor for the long-term success of cementless hip arthroplasty. The ability to identify initial stability of hip stems in the laboratory is desirable as it would enable identification of unsuitable stem designs prior to clinical trials. The use of composite femora for stability investigations is wide spread (1, 2) although their use in this application is yet to be validated.

METHODS. This study aimed to assess immediate postoperative stability of the SL-Plus stem (PLUS Endoprothetik AG, CH) in terms of micromotion and migration in both composite and cadaveric femora. Each femur was tested during single leg stance (SLS) and stair climbing (SC).

RESULTS. The proximal part of the implant was subject to the highest amplitudes of micromotion in both loading configurations independent of the host. During SLS the largest micromotion was measured along the axis of the femur, its magnitude was independent of the host. During SC sawbones produced anterior-posterior oscillations one order of magnitude higher than the cadaveric models. Implant migration was minimal during SLS and SC for both hosts. The medio-lateral migration produced in cadaveric models during SC was one order of magnitude higher than that measured in sawbones.

CONCLUSIONS. This study has demonstrated that Sawbones provide an effective model to establish micromotion with oscillation patterns and amplitudes similar to cadaveric models. In both hosts the micromotion measured was well below the upper threshold for achieving osteointegration. However the migration is much more dependent on the quality of fit and the internal geometry of the femur and therefore caution should be placed on interpreting migration data from Sawbones.

THR - SURVIVAL

O039

THE EXETER POLISHED STEM IN THE LONG-TERM: A SURVIVORSHIP STUDY TO THE 33rd YEAR OF FOLLOW-UP AND A STUDY OF STEM SUBSIDENCE

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INTRODUCTION AND AIMS. To study the survivorship and subsidence patterns of the first 433 Exeter stems inserted between 1970 and 1975 by 16 different surgeons utilising first-generation cementing techniques.

METHOD. A survivorship study up to the 33rd year of follow-up was performed, the end point being revision for aseptic stem loosening. Stem subsidence was measured in all survivors, as well as an assessment of the grade of cementing, "calcar" resorption, visible cement fractures, focal lysis and radiolucent lines at the interfaces.

RESULTS. Of the 433 hips, 21 were revisions of previously failed hips. 17.8% of patients have had a re-operation of some sort including 3.69% for stem fracture, 3.46% for neck fracture (all from a group of 95 stems with excessively machined necks), 8.54% for aseptic cup loosening, 3.46% for aseptic stem loosening, 1.84% for infection and 0.23% for recurrent dislocation. For the overall series, with revision for aseptic stem loosening as the end point, the survivorship is 91.46% to the 33rd year with 95% confidence intervals, 72.33% to 100%. The average age at opera-

tion of the 30 survivors was 57.6 years. No significant bone-cement subsidence was found. Mean stem-cement subsidence was 2.15 mm, most occurring in the first 5 years and in all but one being less than 4mm. Cementing grades were B in 65%, C in 27% and D in 8%. Resorption of the neck (13%) was associated with excessive socket wear or cement left over the cut surface of the neck (the "pseudocollar"). Visible cement fractures were seen in 14%, none associated with focal lysis, which was seen in 10%.

CONCLUSIONS. Although nearly 18% of patients in this series of the first 433 Exeter Hips to be inserted in Exeter needed a re-operation of some sort, the stem rarely required revision surgery for aseptic loosening and was associated with benign long-term x-ray appearances in spite of first-generation cementing.

O040

CLINICAL RESULTS AND POLYETHYLENE WEAR PERFORMANCE IN TWO DIFFERENT GENERATIONS OF A CEMENTLESS POROUS-COATED ACETABULAR CUP. A 9.3-YEAR FOLLOW-UP PROSPECTIVE STUDY

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BACKGROUND. To analyse prospectively the clinical results and polyethylene wear performance in two different generations of a cementless porous-coated acetabular cup (DePuy).

METHODS. 121 cups: 40 ACS (1989-1991) and 81 Duraloc-500 cups (1992-1995). All polyethylene (PE) liners were irradiated in gamma-air. The average follow-up was 9.3 years. Anteroposterior pelvic radiographs were scanned digitally and PE linear wear was estimated using a software package. All cups were associated with a Profile (DePuy) HA-coated.

RESULTS. All cups were radiographically stable and 7 ACS cups showed osteolysis. (Kaplan-Meier survival 79.6 [65.0-94.1%] for the ACS group and 100% for Duraloc cups (p=0.0017) (mean time of appearance 60.1+35.12 months). Osteolysis was associated with a higher PE wear (p=0.021). There were 13 cup revisions: 2 revisions due to existence of excessive wear and acetabular osteolysis and 11PE ruptures in the

ACS group (Kaplan-Meier survival 67.7 [84.94-50.14.7%]) (mean time of appearance 71.6+29.6 months), associated with a higher bedding-in ($p<0.0001$) and a vertical cup position ($p=0.0016$). Post-operative bedding-in for cups without liner rupture was 0.233 mm for ACS and 0.165 for Duraloc cups ($p=0.003$); mean wear was 0.1188 and 0.1108 respectively. CONCLUSIONS. All cups showed stable fixation. Osteolysis was related with a major ACS liner failure and it was related with a greater bedding-in and a vertical cup position. The second generation cups show a decrease in the bedding-in process that led to a less PE wear at the end of the follow-up, but do not have a lower wear rate.

O041

HYDROXYPATITE CERAMIC COATED FEMORAL STEMS IN YOUNG PATIENTS. A PROSPECTIVE TEN YEAR STUDY

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BACKGROUND. We describe the clinical and radiological results of thirty-eight consecutive total hip replacements, using the JRI Furlong Hydroxyapatite ceramic coated femoral component in patients under the age of 50 at the time of surgery. The mean age at the time of operation was 42 years. The average length of follow up was 10 years. All patients receiving a Furlong HAC THR were included regardless of their primary aetiology. These included patients on whom previous hip joint surgery had taken place.

METHODS. The following data was recorded: 1) Visual Analogue Score for pain. 2) Harris Hip Score. 3) WOMAC index. 4) Oxford Hip Score. 5) MDP Score. 6) The presence of thigh pain and level of activity. Radiographic evaluation was carried out by all three authors independently.

RESULTS. The mean Harris hip score improved from 44 pre-operatively to 92 at the latest post-operative review. The mean WOMAC and Oxford scores at the latest review for this study were 29 and 16 respectively. Using the Charnley modification of the Merle d'Aubigne and Postel hip score, at the latest follow up the mean scores were as follows: Pain 5.37, Func-

tion 5.47, and Range of Motion 5.71. The mean pain visual analogue score was 1.1 and 94% of patients returned to outdoor activities or sports. There were no reports of thigh pain at any review. There was no loss to follow-up. There were no revisions of any femoral component. Radiological review of the femoral components revealed no continuous or progressive radiolucent lines around the stem. No osteolysis was noted. Using revision or impending revision as the end point at 12 years the cumulative survival for the stem was 100% (95% CI 89 to 100).

CONCLUSIONS. We present excellent clinical, radiological and survivorship results with the use of HAC components in young, active patients with varying primary pathology, after ten years' use.

O042

CEMENTED HIP IMPLANTS. THE NORWEGIAN ARTHROPLASTY REGISTER 1987-2002

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The aim of the study was to assess the performance of cemented primary total hip replacements in Norway. All total hip implants cemented with Palacos or Simplex cement which had been used in at least 250 operations (48203 operations, 22 prostheses) were included. Kaplan-Meier survival curves were established for the prosthesis brands, and Cox regression was used to give relative risk estimates (RR) adjusted for differences in patient material. Separate analyses were performed for prostheses with median follow-up ≤ 5 years and > 5 years. Results: The 5 most common prostheses was used in 81% of the operations. The revision percentage (unadjusted) at 4 and 12 years was 2.6 and 8.3% for Charnley prostheses, 2.2 and 6.7% for Exeter, 1.8 and 6.2% for Titan, 0.8 and 5.8% for Spectron/ITH (acetabulum/femur). Of 12 prostheses with a median follow-up of > 5 years, only 4 was used in 2002. Compared with Charnley ($n=23571$, median follow-up of 5.5 years), the adjusted relative risk estimate varied from 0.2 (95% CI:0.1-0.6) for Spectron/Titan ($n=401$) to 1.6 (1.2-2.2) for Spectron/SP ($n=431$) and Titan/Fjord (1.0-2.6, $n=343$). The results for the

Spectron/SP was based on information from one hospital only. Among 10 prostheses with median follow-up of ≤ 5 years, 9 was in use in 2002. Compared with Reflection/Spectron (n=2212, median follow-up of 1.6 years) none of the prosthesis brands had a statistically lower revision rate, but Elite (RR=2.2, n=371), Elite/Titan (RR=2.3, n=420) and Charnley/Elite (RR=2.7, n=348) had higher revision rates.

CONCLUSION. The majority of the operations were performed with brands with a 12-year revision percent lower than 10%.

O043

ROLP: THE INSTITUTION OF A REGIONAL HIP ARTHROPLASTY REGISTER IN LOMBARDIA

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The implant registers, with a great number of cases recorded, bring advantages and have a great influence in the clinical practice, as documented by the Scandinavian examples. Precise statistical evaluations are requested. In big countries, like France, Italy, UK and Germany, the organisation of national registers is not easy because of the number of hospitals involved. For this reason a number of regional registers was born in recent years. Lombardia, with 9 millions inhabitants, is the most populated Italian region, and one of the first in Europe. More than 13,800 hip prostheses are performed every year. Starting from April 1997, the Lombardia Sanitary System has been paying 25% of the cost of all the hip arthroplasties implanted in the Region, but want to know the commercial characteristics of every implant. For this reason hospitals must send a complete set of data monthly regarding every prosthesis (first implant, bipolar and cephalic, total and partial revisions, type of components, etc). In the same regional service all the demographic data have been collected (age, sex, length of stay in hospital, diagnosis, etc.). In this way all the minimal data set for a hip arthroplasty register are already available. In 2003 it was decided to organise all these data in a regional register (ROLP: Register of Orthopaedic Prosthesis of Lombardia) in

which the end of the implant is the death of the prosthesis (which means removal or partial/total revision), according to the Swedish Register. One of the advantages of this kind of system is that the preliminary agreement of the orthopaedics is not necessary and, moreover no more additional work for the surgeons is requested.

O044

WHAT IS THE IDEAL CUP ORIENTATION TO REDUCE THE RISK OF DISLOCATION AFTER TOTAL HIP ARTHROPLASTY?

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BACKGROUND. Malposition of the socket is a potential major risk factor for postoperative dislocation after THR. This study investigates the impact of cup orientation on the probability of dislocation.

METHODS. Radiographic anteversion and inclination of the socket of 127 patients with postoperative hip dislocations were measured with the EBRA-method (Einzel-Bild-Röntgen-Analyse). The results were then compared with a control group of 342 patients.

RESULTS. For the control group the mean value was 44 for inclination and 15 for anteversion. Patients with anterior dislocations after primary hip replacements showed significant differences of mean inclination (48) and anteversion angle (17), as did patients with posterior dislocations (inclination: 42 ; anteversion: 11). After revision surgery patients with posterior dislocations showed significant differences of inclination (40) and anteversion (12).

CONCLUSIONS. The results demonstrate the importance of accurate positioning. They challenge tolerance limits in the orientation of the hip socket for the minimisation of subsequent dislocations. Radiographic anteversion of 15 and an inclination of 45 are the lowest at-risk measures for dislocation.

O045
INCREASED RISK OF EARLY DISLOCATION AFTER PRIMARY TOTAL HIP ARTHROPLASTY IN RHEUMATOID ARTHRITIS

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BACKGROUND. Patient-related risk factors of dislocation after total hip arthroplasty (THA) that have been identified are previous hip surgery, old age and female gender. However, there have been no prospective reports whether rheumatoid arthritis (RA) is an independent risk factor.

METHODS. Prospective evaluation of the incidence of early (< 2 year post-surgery) dislocation in a consecutive series of primary THA. From 1996 to 1999 341 THA in 311 patients with osteoarthritis (OA) and 70 THAs in 60 patients with RA were included in this study. One type of prosthesis having a 28 mm ball head was implanted in every hip through an anterior approach.

RESULTS. Both groups were comparable with respect to the following risk factors: gender, position of the acetabular component and experience of the surgeon. Average age was lower in the RA group than in the OA group: 61.0 vs 68.1 years. Furthermore, the incidence of previous hip surgery was higher in the OA group. Despite this, the incidence of dislocation was higher in RA than in OA: 10% vs. 2.9% (p=0.006). Multivariate analysis showed that RA is an independent risk factor for dislocation (Odds Ratio 3.7, 95% CI 1.3-10.6). All dislocations in RA were posterior, in OA 5 were posterior and 4 were anterior (1 unknown).

CONCLUSIONS. Rheumatoid arthritis is an independent risk factor of dislocation after THA. Both the polyarticular impairments and the lower quality of the soft tissues in RA could explain this increased risk.

O046
IS LENGTH IMPORTANT? IMPACT OF INCISION LENGTH ON IMMEDIATE POSTOPERATIVE REHABILITATION AFTER TOTAL HIP REPLACEMENT

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BACKGROUND. It has been suggested that smaller skin incisions may be associated with better short-term outcome after hip replacement (THR).

METHODS. We wished to establish that and, therefore, prospectively studied 43 consecutive patients undergone a THR, inserted through a posterolateral approach and performed through skin incisions of varying lengths. Mean incision length was 13.8 cm; range 10-21 cm. The patients were assessed for post-operative rehabilitation and length of hospitalisation. Rehabilitation was assessed in terms of specific activities and the time achieved.

RESULTS. Hospitalisation mean length was 5.4 days. Age, body mass index, length of incision, duration of the procedure, muscles detached and repaired, and operative and total blood losses were also recorded. We found that the body mass index correlated significantly with the length of skin incision (p<0.01). The size of the incision correlated significantly (0.05) with postoperative pain. However, no significant correlation was found between the size of incision and blood losses, post-operative rehabilitation, or the length of hospital stay. Similarly, the muscles detached and repaired at surgery did not correlate with postoperative rehabilitation or length of stay. In contrast, age did significantly correlate (p<0.01) with hospitalisation length and patients' rehabilitation.

CONCLUSIONS. We conclude that neither the size of the incision nor the muscles detached or repaired at surgery, correlate with the immediate postoperative rehabilitation after a THR. Speed of rehabilitation is influenced by a patient's age. It appears that the length of surgical incision is an irrelevance to the short-term success of a THR.

O047
PREVENTION OF NEURAL LESIONS IN HIP RECONSTRUCTION AND SIMULTANEOUS LEG ELONGATION WITH MULTIMODAL NEUROMONITORING

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MATERIAL AND METHODS. Reconstruction of dysplastic hips with THA and concurrent elongation of the leg

involves a risk of 2.5-3% of sciatic nerve palsy. To reduce the rate of nerve injuries or ischemic events Sensory Evoked Potentials or Electromyography have been used without influence on the outcome. At the Schulthess Clinic Zurich, multimodal electrophysiological monitoring (MEP, SEP, EMG) in hip surgery has been routinely established. Critical nerve segments are monitored through cortical and/or cauda equina evoked motor and sensory responses.

RESULTS. To date, in 22 patients with hip dysplasia and previous surgery multimodal intraoperative monitoring has been applied, of whom 13 had total hip arthroplasty with a mean elongation of the leg of 3 cm and 9 patients additional periacetabular correction osteotomy. In 1 patient with transient intraoperative signal alteration, the postoperative neurological state remained unchanged. One patient with probably traction induced disturbance of the sciatic function showed a delayed sciatic palsy. Six patients showing significant functional disruptions in the sciatic nerve and therefore requiring a change in operational strategy, completely recuperated by the end of the operation and showed no neurological deficit.

CONCLUSION. The presented method allows the surgeon to obtain immediate information on the peripheral nerve functions during repositioning of the prosthesis or when correcting the location of the cup or elongate the femur. The use of intraoperative multimodal electrophysiological monitoring in reconstructive surgery of hip dysplasia with inherent risk of nerve palsy is therefore recommended.

O048

THE CLS UNCEMENTED EXPANSION CUP: SIX CASES OF COMPONENT FAILURE

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BACKGROUND. We report six cases of fracture of the metal backing of the CLS expansion cup. The aim of this paper is to draw attention to this mode of failure. **METHODS.** We implanted 371 CLS cups between July 1989 and December 2001. Two patients died and 17 were lost to follow-up. In 182 operations the CLS cup was used with a CLS stem and in 189 operations the CLS cup was used with a cemented stem.

RESULTS. To date 6 cases of fracture of the metal backing of the acetabular component have been identified, 1 catastrophic. These have all been revised.

CONCLUSIONS. The senior author previously considered the design concept of the CLS expansion cup to be sound with good short-term results. However we now consider these subsequent failures of the CLS cup to be a cause for concern despite the design modifications that have been made. We have identified to date 6 fractured cups between 4 and 14 years after operation in 371 implantations, an apparent incidence of 1.6%. This probably does not represent the true incidence of this complication as it could be time dependent and not all fractures may be revealed on a single antero-posterior X-ray that is usually taken. We no longer use this implant in our centre and suggest that it should be used with extreme caution until a formal long-term outcome study is published.

THR - NEW DESIGN, NAVIGATION, MINIMAL INVASIVE THR

O049

METAL ON METAL HIP RESURFACING. WHAT ARE THE CONSEQUENCES FOR ACETABULAR BONE STOCK?

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BACKGROUND. Hip resurfacing is a bone conserving procedure with respect to proximal femoral resection. For previous generations of conservative hip replacement, preservation of the natural femoral head diameter necessitated additional sacrifice of acetabular bone in order to accommodate a sufficiently thick polyethylene acetabular component. We have investigated whether metal on metal resurfacing offers a bone conserving procedure with respect to the acetabular bone stock. **METHODS.** We reviewed 284 Birmingham resurfacing hip replacements (BHR), and 479 primary hip replacements, in which an uncemented acetabular component (THUA) was used. The BHR and THUA group had mean age at surgery of 55 and 65 years respectively. In 32

BHR's and 21 THUA's, pre-operative templating measurements were available for subsequent comparison with size of component implanted.

RESULTS: Comparison of component sizes, for both implant types, confirmed bi-modal distribution according to patient gender. BHR cups, implanted by the first author, in females, were significantly smaller than those implanted, by the same author, in THUA ($p < 0.0001$). Pre-operative templating overestimated component size for all groups but the difference was only significant in male BHR cases ($p = 0.03$). BHR cups implanted by the first author were significantly smaller than the second author, for both male ($p = 0.0001$) and female patients ($p < 0.001$).

CONCLUSIONS: In females, metal on metal resurfacing is bone conserving procedure for femoral and acetabular components. In males, the procedure is not bone sacrificing when compared to THUA. Pre-operative templating can overestimate size of acetabular component that will be used for men. A significant difference was found between size of acetabular components used by two surgeons for metal on metal resurfacing.

O050
RESULTS OF THRUST PLATE PROSTHESES AND STELCOR SHORT STEM PROSTHESES - IS METAPHYSEAL ANCHORAGE A RECOMMENDABLE ALTERNATIVE?

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Metaphyseal anchorage is said to be a good alternative to conventional long-stem fixation. Load transmission should be more physiological and at least re-operation should be easier because of bone preserving. The results of 86 thrust plate prostheses with a mean follow-up of 2.5 years (range 15 to 35 m) and 65 Stelcor short-stem prostheses with a mean follow-up of 1.8 years (14 to 25 m) are reported. In the thrust plate prostheses we found a high rate of patients with pain in the region of the trochanteric fixation plate, 5 (5.8%!) loosening and typical fractures below the distal fixation screw and there were special problems in revision cases. In the Stelcor group we had two loosening (3.1%) and some special problems with the spe-

cific socket which is obligatory in this system with the 38 mm diameter head. We stopped both systems: The thrust plate prostheses because of the high failure rate in comparison with conventional uncemented or cemented stems. The Stelcor prosthesis was eliminated because the manufacturer stopped the production; there seemed to be problems with the acetabular component of the system. Our results indicate that metaphyseal fixation is not a real alternative.

O051
IS MORE BONE REMOVED FROM THE ACETABULUM IN HIP RESURFACING COMPARED TO UNCEMENTED TOTAL HIP ARTHROPLASTY?

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BACKGROUND. To test the hypothesis that hip resurfacing does not remove more bone from the acetabulum than an uncemented total hip replacement in an equivalent patient.

METHODS. We evaluated a consecutive series of 35 Birmingham Hip Resurfacings and 34 hybrid Exeter total hip replacements, using an uncemented acetabulum. All operations were performed by the same experienced resurfacing surgeon, using an identical posterior approach. From standardised AP pelvic radiographs the femoral head diameter in the contra-lateral normal hip was obtained (as a measure of the size of the patient) and corrected for the magnification of the radiograph. The implanted acetabular component size was obtained from theatre records. Comparison was made between the size of the implanted acetabulum in the two groups after correction for the size of the patient.

RESULTS. The two groups were not directly comparable with significantly larger patients in the resurfacing group (based on the mean femoral head diameters of 48.0 mm and 45.8 mm respectively). A significantly larger acetabulum was inserted into the resurfacing patients (56.4 mm vs 52.0 mm in the THR group). The ratio of acetabular size/contra-lateral femoral head diameter was 1.18 and 1.14 in the resurfacing and THR groups respectively. This difference is statisti-

cally significant ($p = 0.003$).

CONCLUSIONS. Our study demonstrates that resurfacing results in implantation of a significantly larger diameter of component, and therefore removal of more bone from the acetabulum in an equivalent patient. The mean increase in difference between femoral head diameter and implanted acetabulum is 2.2mm greater in the resurfacing group which is greater than the size increments of a typical uncemented cup.

O052

COMPARISON OF SHORT-TERM FUNCTIONAL OUTCOMES OF METAL-ON-METAL HIP RESURFACING AND UNCEMENTED TOTAL HIP REPLACEMENT: THE RESULTS OF ONE SURGEON

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BACKGROUND. Historically, young and highly active patients have fared badly with total hip arthroplasty (THA) because of accelerated implant failure and consequent progression to multiple revision procedures. Metal-on-metal hip resurfacing (HR) was developed with this group of patients in mind. In addition to the bone conserving property of HR, it has been suggested that the functional results are superior to those of THA. The senior author has used uncemented THA in this group of patients since 1989 and has also used HR as an option since 2000. This provides an ideal study population to compare the functional outcomes of the two procedures performed by a single surgeon.

METHODS. All patients under 65 years old at time of operation with a primary diagnosis of osteoarthritis were included in the study. The study period ran from August 2000 for 29 months with a minimum follow-up period of 3 months. All procedures were performed by the senior author using a posterolateral approach. Function was assessed preoperatively and postoperatively using Oxford, WOMAC and Harris hip scoring questionnaires.

RESULTS. There were no statistically significant differences in the postoperative scores of either group, each obtaining excellent mean functional outcome.

CONCLUSIONS. Our results suggest that functional outcome should not be a factor in deciding to choose

HR over THA. However, HR appears to be a very good option in young patients with encouraging early results. Certainly, even if this prosthesis fails, conversion to a traditional stemmed prosthesis and large modular head (to avoid changing the socket) is a relatively simple procedure.

O053

CT-FREE ASSISTED HIP-PLASMACUP REPLACEMENT (NAVIGATION ORTHOPILOT)

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AIMS. The cup orientation is one of the most important aspects having influence not only to the stability of the replacement but also to the polyethylene wear and the long-term clinical results. The purpose of this study is to evaluate the position of press-fit plasmacups implanted by the OrthoPilot versus conventional free-hand hip-cup replacement.

METHODS. Since October 2001 we performed a prospective randomized trial in 90 hips with primary osteoarthritis. Fifty patients had the press-fit Plasmacup (Aesculap) implanted with use of the CT-free OrthoPilot navigation system. This CT-free navigation system gives information about reaming depth and cup orientation. In the control group, we evaluated 40 conventional free-hand hip-cup placements. All patients were followed with standard anteroposterior radiographs. We measured the acetabular cup inclination and anteversion according to the method of Ackland et al.

RESULTS. No dislocation occurs in our patients sample. In the first group, we found out the range of inclination of the navigated cups from 43 to 46. The anteversion ranged from 13 to 18. In the control group of acetabular components implanted without navigation, we measured an inclination between 36 and 51 and anteversion between 0 and 32.

CONCLUSIONS. CT-free assisted hip-cup placement OrthoPilot improves process quality. It reduces hip-cup malplacement and diffraction of cup position significantly in comparison to the established free-hand method. Accurate position of the cup has an influence to longer survival of the implant.

O054

ACCURACY OF NAVIGATION-ASSISTED POSITIONING OF ACETABULAR CUPS STUDIED BY CT MEASUREMENT: METHODS AND RESULTS

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BACKGROUND. Maximum accuracy in positioning artificial acetabular cups has positive effects on the clinical outcome of hip joint replacement over the short- and long-term. Navigation-assisted methods allow positioning of the hip implant to be controlled within a few degrees. Similarly, high accuracy is required of measurement methods assessing the anteversion and inclination angles achieved in individual patients. It is also of interest to assess the factors that can cause negative outcome when navigated implantation methods are used.

METHODS. In a prospective multicentre study involving 4 clinics carrying out orthopaedic operations, acetabular cups were implanted with the assistance of a computer navigation system. The landmarks registered for acetabular orientation were both anterior superior iliac spines and the mid-point of the symphysis. All participants in the study had many years' experience of hip joint replacement. Postoperative CT scans were made on 10 patients from each clinic and evaluated by one independent radiologist. In addition to the data recorded intraoperatively, quantitative evaluations were made using CT data of the 3D angular alignments of the implant relative to skeletal landmarks and also of the effects of soft tissue in the area of these landmarks.

RESULTS. Three dimensional evaluation of acetabular orientation (anteversion / inclination) using spiral CT scans can be performed to a high level of accuracy.

Tissue coverage has a significant effect on intraoperative registration of skeletal landmarks on the pelvis.

CONCLUSIONS. When registering landmarks, skeletal reference points should be touched as accurately as possible and soft tissue firmly compressed. Alternatively, technologies should be used and further developed to allow more accurate referencing of landmarks than provided by the conventional touching method.

O055

NAVIGATED VERSUS NON-NAVIGATED MIS-THA THROUGH THE MINIMALLY INVASIVE DIRECT ANTERIOR APPROACH: A CADAVER STUDY

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OBJECTIVE. To compare cup and stem position in matched pairs of cadaveric hips in a minimally invasive total hip arthroplasty (MIS-THA) with implant-placement performed by the use of manual guidance tools or by the use of the STRYKER Hiptrack Navigation System.

BACKGROUND. Minimally invasive techniques are currently introduced to THA. Our workgroup has developed a direct anterior single incision approach. Special instruments have been designed for retraction and implantation. Instruments are navigable with the hip-track-system. Perfect positioning of the acetabular and femoral component are among the most important factors in THA. Malpositioning may result in significant clinical problems such as dislocation, impingement, limited range of motion or extensive wear.

DESIGN/METHODS. In twelve fixated human cadavers hemispherical pressfit cups (TRIDENT, Stryker, Allendale, NJ) and straight femoral components (ACCOLADE, Stryker, Allendale, NJ) were implanted. All implantations were done through the minimally invasive direct anterior approach. On one side, the surgery was performed with special MIS-tools, but using standard mechanical alignment guides. On the other side, the navigation system was used to navigate placement of the implants. The aim was to implant all cups in 45 of inclination and 15 of anteversion in reference to the frontal pelvic plane. For the

stem the goal was to position the stem in 0 of varus/valgus relative to the proximal shaft axes. This plane and the resulting cup positions were measured on CT-scans with a 3D imaging software.

RESULTS. The Innsbruck MIS approach to the hip could be performed in all cases. For both groups cup and stem position were within the range of variation reported in the literature. Yet, variance of the deviation from the goal was higher in the conventional group for both inclination and anteversion with the medians for the navigated group for inclination, anteversion and stem position being closer to the goal than in the conventional group.

CONCLUSION. The described minimally invasive approach to the hip is feasible and renders results comparable to those reported for conventionally operated THA. By the use of the navigation system tested it is possible to increase placement precision.

O056

IMPLANTATION OF CEMENTLESS ACETABULAR CUP USING THE NAVIGATION SYSTEM

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PURPOSE OF THE STUDY. The purpose of this study is to compare the clinical and roentgenographic results in patients who had implanted acetabular cup of the THR with and without the use of the Ortho-Pilot kinematic CT-free navigation system.

MATERIAL. Fifty patients, operated between April 2002 and September 2003, were divided into two groups. Twenty five patients in group 1 were operated by standard procedure, and 25 patients in group 2 were operated with use of the kinematic navigation system.

METHODS. We evaluated both groups roentgenologically and clinically. The acetabular cup abduction angle was measured as the angle between the horizontal line drawn through the interteardrop line and the long axis of the cup ellipsoid. The acetabular cup anteversion was calculated using the method of Ackland et al. Clinically, evaluation was provided by Merle d'Aubigne and Postel. Both groups were compared statistically.

RESULTS. In group 1 the average inclination was 50.6

(range, 38 - 62), anteversion 9.4 (range, 3 - 18). In group 2 the average inclination was 43.0 (range, 32 - 55) and anteversion 10.4 (range 8 - 16). Statistically significant differences between both groups was found in the inclination angle - Mann - Whitney U test ($p < 0.004$). Statistical analysis of accuracy with use of the Bartlett test found significant differences in anteversion ($p < 0.003$).

DISCUSSION. Good acetabular cup position is one of important factor for the long-term good results of THR. In optimal position, 45 ± 10 inclination and 15 ± 10 anteversion, as recommended by many authors, is sufficient stability, low polyethylene wear, and sufficient range of moving of the hip joint. The results of the second group are close to these conclusions.

CONCLUSIONS. Use of the kinematic navigation CT-free system allows to carry out implantation of acetabular cup more accurately.

O057

MINIMALLY INVASIVE TOTAL HIP ARTHROPLASTY VIA SINGLE INCISION DIRECT ANTERIOR APPROACH

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BACKGROUND. Various attempts have been made to find the most suitable technique for minimally invasive total hip arthroplasty. We report on the feasibility of total hip arthroplasty via minimally invasive single incision anterior approach.

METHODS. One hundred consecutive patients (52 f, 48 m) who had minimally invasive hip surgery, were prospectively followed up for at least twelve weeks following surgery. There were no exclusion criteria based on age, gender, BMI, previous hip surgery, secondary osteoarthritis. Surgical technique was single incision direct anterior approach. Accolade stem and Trident cup were used for cement-less and ABGII stem and All-Poly cup were used for cemented prosthesis.

RESULTS. No major misalignment of acetabular or femoral component occurred; median cup inclination angle was 44.1, median position of stem 0. No dislocations, no nerve palsies occurred. Four patients complained

about numbness of lateral thigh.

COMPLICATIONS. One fissure of proximal femur, 1 perforation of acetabulum, 1 deep infection. Blood loss was diminished, patients experienced little postoperative pain. Discharge was earlier, rehabilitation accelerated (mean WOMAC score 90.4 at 6 weeks). Scarring was satisfactory, median length 6.75 cm.

CONCLUSIONS. Minimally invasive hip arthroplasty via single incision anterior approach is a safe procedure that allows correct placement of acetabular as well as femoral implants. The exposure is alleviated by special retractors, reamers, broachers and inserters; the implantation is eased by specially designed prostheses. The proposed technique can reduce operative blood loss, postoperative pain, and hospitalization time and it may speed the postoperative recovery and lead to small cosmetically satisfactory surgical scars.

O058

A NEW METHOD OF MINIMALLY INVASIVE THR VIA SUPERIOR CAPSULOTOMY

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Seventy-six minimally invasive total hip arthroplasties were performed using a newly developed, fully tissue preserving, minimally invasive technique. In a lateral position, an 8cm incision is made from the tip of the greater trochanter extending proximally.

After the maximus fibers are bluntly spread, the medius and minimus are reflected anteriorly and the piriformis is retracted posteriorly. The femoral head is left in the acetabulum and the femur is reamed. The superior neck is excised with an osteotome for the insertion of femoral broaches. The femoral neck is transected and the head is excised.

The acetabulum is reamed with an angled reamer and the uncemented acetabular component is inserted using a Z-shaped impactor. After trial reduction, the real head is inserted into the acetabulum, the femoral component is inserted and the neck is reduced into the head. The superior capsule is closed. There is no postoperative restriction of weight bearing or motion. Complications in the 76 hips were one trochanteric fracture (ORIF) one transverse acetabular fracture (crutch-

es for 12 weeks), and 1 cup displacement during reduction treated by insertion of a cup with screws. There have been no dislocations despite unrestricted motion. Length of stay was 3.0 days (2 to 5 days). 75% of patients went directly home. By contrast, data for the institution as a whole showed a mean length of stay of 4.3 days with only 55% discharged directly home. The technique of superior capsulotomy is technically feasible and appears to shorten length of stay and dramatically accelerate recovery.

ADULT HIP - OSTEOTOMY, FRACTURES, NECROSIS, ARTHROSCOPY

O059

MULTI DIRECTIONAL INTERTROCHANTERIC CORRECTION OSTEOTOMY FOR PRIMARY OR SECONDARY OSTEOARTHRITIS - RESULTS AFTER 15 TO 29 YEARS

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BACKGROUND. In the young and active patient the life-expectancy of a total hip replacement (THR) may be shorter than that of the patient. Therefore, it is important to delay its need by joint preserving surgery, without compromising its subsequent possibility. In this retrospective study we have analysed the long-term results of a multidirectional intertrochanteric correction osteotomy for primary or secondary osteoarthritis (OA).

METHODS. Between 1974 and 1987, 276 osteotomies were performed in 216 patients by the senior author. In 48 hips the osteotomy was done for primary (or idiopathic) OA. In 166 hips the OA was secondary to acetabular dysplasia, in 23 secondary to trauma, in 14 after slipped capital femoral epiphysis (SCFE) in 5 after a previous Legg-Calve-Perthes' disease (LCPD) and in 20 for avascular necrosis of the femoral head (AVN).

RESULTS. In 126 patients with 145 osteotomies a THR or a fusion was done after an average of 9.4 years. Thirty-one patients (36 osteotomies) had died. The

remaining 79 patients had a mean follow-up of 19.4 years. Sixty-eight percent of them scored a good or excellent clinical result. Overall 10-year survival was 70% and 15 year survival 53%. Osteotomies for acetabular dysplasia had a 10-year survival of 72% and a 15-year survival rate of 56%. Osteotomies for acetabular dysplasia in patients younger than 45 with a grade 0 or 1OA had a 10 year survival of 100% and a 15 year survival rate of 97%. Osteotomies performed for posttraumatic OA had a 10 year survival of 91%. Osteotomies performed for the other indications had poorer survival rates.

CONCLUSIONS. For osteoarthritis secondary to acetabular dysplasia or trauma an intertrochanteric correction osteotomy is a good alternative to a THR in the young patient. For all other indications good results may be achieved, but the outcome is far less predictable.

O060
INTERTROCHANTERIC OSTEOTOMIES COMBINED WITH SHELF PLASTY IN YOUNG PATIENTS WITH SEVERE FEMORAL HEAD DEFORMITIES AND SECONDARY OSTEOARTHRITIS – A LONG-TERM FOLLOW-UP

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BACKGROUND. Multidirectional intertrochanteric osteotomies (ITO) are an effective joint preserving surgical treatment to postpone the need of a Total Hip Replacement (THR) in selected patients. However, in some young patients with a secondary osteoarthritis (OA) an intertrochanteric correction osteotomy alone is not sufficient. In young patients with an acquired femoral head deformity and a secondary osteoarthritis a valgus intertrochanteric correction may give a better congruency, but the acetabular coverage can become insufficient by subluxing of the femoral head. In this study we present the long-term results of 16 hips (15 patients) with a femoral head deformity and a secondary osteoarthritis in whom an ITO was combined with a superolateral acetabular bone graft.

METHODS. Between 1974 and 1993 the senior author performed 16 ITO's combined with a acetabular shelf plasty for acquired femoral head deformities with sec-

ondary osteoarthritis. The average age was 30 (range 16.50). The indication was congenital dysplasia with a Perthes like deformity of the femoral head in 7 hips, 4 patients had an OA after pure Legg-Calvé-Perthes disease and 5 patients had a osteonecrosis of the femoral head.

RESULTS. After an average follow-up of 18 years 6 patients (33%) received a THR after an average of 14.1 years. For the patients who still had their own hip joint at final follow-up 82% had a good to excellent Harris Hip Score (HHS).

CONCLUSIONS. In our opinion the acetabular shelf plasty is an excellent addition to an ITO to provide a full acetabular coverage of the femoral head in patients with a femoral head deformity and a secondary osteoarthritis.

O061
COMPARING DYNAMIC HIP SCREW TO EXTERNAL FIXATION FOR TREATMENT OF OSTEOPOROTIC PERTROCHANTERIC FRACTURES: A PROSPECTIVE RANDOMIZED STUDY

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Our purpose was to conduct a well-controlled prospective randomized study in osteoporotic pertrochanteric fracture patients treated with either Dynamic Hip Screw (DHS) fixed with standard stainless steel screws or Orthofix pertrochanteric fixator (OPF) fixed with HA-coated pins. Forty consecutive pertrochanteric fracture patients were randomized to receive either 135 4-hole DHS (Group A) or OPF with 4 HA-coated pins (Group B). Inclusion criteria were: female, age = 65 years, AO (type A1 or A2) and BMD less than -2.5 T-score. There were no differences in patient age, fracture type, BMD, ASA, hospital stay, or quality of reduction. Operative time was 64 ± 6 minutes in Group A and 34 ± 5 minutes in Group B (p < 0.005). Average number of post-operative blood transfusions was 2.0 ± 0.1 in Group A, and none in Group B (p < 0.0001). Pain was measured 5 days post-operatively and was lower in Group B (p < 0.005). Fracture varization at 6 months was 6 ± 8 in Group A and 2 ± 1 in Group B (p = 0.002). In Group B, no pin track infections occurred. Pin fixation improved over

time, as shown by pin extraction torque (2770 ± 1710 N/mm) greater than insertion torque (1967 ± 1254 N/mm), ($p = 0.001$). HHS at 2 years was 62 ± 20 in Group A and 63 ± 17 in Group B. Our results show that OPF with HA-coated pins is an effective minimally-invasive treatment option that surgeons should consider for pertrochanteric fractures in patients with osteoporosis.

O062

FACTORS AFFECTING MORTALITY AFTER FRACTURE NECK OF FEMUR. DO CEMENTED AND UNCEMENTED HEMIARTHROPLASTY DIFFER?

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BACKGROUND. The aim was to analyse the factors that may contribute towards the mortality in cemented versus uncemented hemiarthroplasty of hip.

METHODS. In this study, we reviewed the records of 881 patients with fractured neck of femur over 5 years. Of these, 372 patients underwent hemiarthroplasty (231 cemented and 141 uncemented).

RESULTS. The mean age in the cemented and uncemented group was 82 and 81 years respectively. One hundred and thirty-six (58.8%) patients were operated within 24 hours of admission in the cemented group as compared to 63 (44.6%). The mean operative time was 81 minutes for cemented hemiarthroplasty and 61 minutes for uncemented hemiarthroplasty. 77% of the cemented hemiarthroplasty was performed by Registrar grade as compared to 69% in the uncemented group. Of the 231 patients in the cemented group, 52% received general and 48% received spinal anaesthesia. Of the 141 patients in the uncemented group, 30% received general and 70% received spinal anaesthesia. There was an 8% 30-day mortality compared to 11% 30-day mortality in uncemented group ($p < 0.05$). The mean age of patients in the mortality group was 86 yrs in cement and 84 yrs in uncemented group. Most operations were done within 24-48 hours. There was significant co-morbidity in patients who died. The average operative time of patients who died in both groups was same.

CONCLUSIONS. There was an increased mortality rate in the uncemented group as compared to the cemented group ($p < 0.05$). Based on our study, we conclude that cement is not a risk factor. Duration and timing of surgery is not associated with increased mortality. There was no difference in 30-day mortality rates between patients receiving general or spinal anaesthesia. Significant co-morbid factor is associated with increased mortality.

O063

THE MANAGEMENT OF PERIPROSTHETIC FEMORAL FRACTURES USING THE OXFORD TRIMODULAR FEMORAL STEM

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AIM. To evaluate the effectiveness of the Oxford trimodular femoral stem to achieve fracture healing, prosthetic stability by assessing the functional and radiological outcome, with a minimum five-year follow-up.

METHODS. The Oxford Universal Hip System has long stem options, which can be used with cerclage wires to stabilize the fracture. The modular metaphyseal section is free to slide and rotate on the stem loading the proximal femoral bone consequently, compressing the fracture and allowing fracture healing while maintaining implant stability.

A consecutive series of forty periprosthetic femoral fractures were retrospectively reviewed. The average follow-up was 7.9 years (range, 5.5-12). Fractures were classified according to the Vancouver classification. The Oxford hip score (OHS) was used for clinical assessment. The Kaplan-Meier survivorship analysis was performed.

RESULTS. The average age at surgery was seventy-six years. There were two type A fractures, three type B1, twenty-eight type B2, seven type C. Radiographic union was achieved in 95% of hips.

Average time of union was 3.5 months. Prosthesis survival at five years, when there were twenty-six patients at risk was 95% (CI, 88%-100%). There was aseptic loosening in 83% of hips before the fracture. Complications included non-union in one hip, infection in one, dislocation in one, and aseptic loosening

in two hips.

Acetabular components were revised in 11 hips. At the time of last follow-up, there were 11 deceased and the mean OHS was 30 (maximum score: 48).

CONCLUSIONS. The Oxford trimodular femoral component is a reliable method for the treatment of periprosthetic femoral fractures.

O064

EXCHANGE ARTHROPLASTY TO TREAT PERI-PROSTHETIC FEMUR FRACTURES

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BACKGROUND. Besides a number of rarely used procedures, periprosthetic femur fractures are usually treated by exchange of the femoral component with re-implantation of a revision stem or, if the prosthesis is still firmly in position, by plating. Although plating is an established method of treatment which is now increasingly performed by minimally invasive techniques, complication rates of up to 50% have been reported.

METHODS. The results of 897 consecutive exchange operations to treat periprosthetic femur fractures by re-implantation of an extra-long stem prosthesis or total femur replacement were analysed on the basis of medical records, a specially compiled questionnaire and radiographs. A representative group of 136 patients was examined after an average of 6.5 years (2-13 years) post operation. The results of these follow-up examinations were classified according to the Harris Hip Score (HHS) method.

RESULTS. We performed 558 total exchanges, 247 stem exchanges and 92 revisions with re-implantation of a total femur replacement. Postoperatively, 25% of the patients were able to fully weight-bear and the remaining 75% achieved full weight-bearing after a mean period of 1.5 months (0-4 months). The functional results achieved an average of 86 points (49-100) according to the Harris Hip Score. Correspondingly, 90.2% of patients rated the result of their operation as good or excellent (9.8%: "satisfactory"). The overall rate of complications was 12%.

CONCLUSIONS. Component exchange with re-implantation of a revision stem or total femur replacement

is a standardised, reliable concept for treatment of periprosthetic femur fractures. The functional results are good and the rate of complications low. The possibility of increasing the degree of weight-bearing at an early stage or even immediate full weight-bearing greatly facilitates early postoperative mobilisation of the mostly elderly and sometimes polyarthritic patients.

O065

MUSCULAR PEDICULAR GRAFT IN THE SURGICAL TREATMENT OF THE AVASCULAR NECROSIS OF THE FEMORAL HEAD – MISTAKES AND COMPLICATIONS

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The purpose of this study is to analyze the mistakes, allowed in the surgical treatment, that lead to poor postoperative results. For the period 1982- 2001 226 patients with avascular necrosis of the femoral head have been surgically treated. Eighteen of them have suffered a fracture of the femoral neck (mean age 36 years) and in the other 208 patients, the disease was with different etiology (mean age, 39 years.) All patients were operated using the surgical technique of Vanable and Stuck. The patients had a follow-up period of more than 18 months. In 78 of the cases we classified the results of the surgical treatment as poor. We consider that the reasons in 27 of them are the permitted mistakes. To avoid them we have to respect the following principles:

1. Bone graft - it has to be taken about 10 to 15 mm distally from crista iliaca and to be of a proper length. If it is shorter it cannot be fixed well in the necrotic focus and laterally to the great trochanter. If the graft is taken more distally from crista iliaca, the result is a thinner graft and shorter muscular pedicle. It is obligatory to heparinize the graft.
2. Muscular pedicle - it has to be of an optimal length, not to be under pressure, twisted or disinserted from the graft.
3. Recipient zone - we have to curette the necrotic focus, until bleeding cancellous bone is reached and to heparinize the same. The recipient bed has to be of a proper depth to take the graft in, without changing the transverse section of the neck. We consider the

strict following of the operative technique, leads to very good results in cases with III stage (Arlet-Ficat) avascular necrosis and traumatic problems with the femoral neck in young patients.

O066
ANATOMY OF ACETABULAR AND FEMORAL HEAD DEFORMITIES CAUSING SEQUALAE OF PERTHES' DISEASE IN ADULTS

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BACKGROUND. Only a small number of patients who suffered from Legg-Calvé-Perthes' disease (LCPD) in childhood develop pain early in adulthood. The classical hinged abduction causing pain is well known and even made responsible for secondary lateral insufficiency of the acetabulum. After anterior femoroacetabular impingement was shown to exist not long ago, recent reports have further shown 'functional retroversion' and 'functional coxa vara'.

METHODS. We gathered information about the exact anatomy of femoral and acetabular anatomy in a group of 21 patients who were treated for the sequelae of LCPD in adulthood. We evaluated the deformed hips on plain AP and lateral radiographs.

RESULTS. We could confirm a lateral bulging of the femoral head averaging 115% of the functional radius, made responsible for hinged abduction. In addition, we found an even greater anterior bulging averaging 119% of the functional radius. This latter could well be responsible for anterior femoroacetabular impingement and explain the typical groin pain in these patients. More to our surprise this anterior bulging was not accompanied by an anterior acetabular deficiency, but by an unexplained posterior deficiency and thus retroversion of the acetabulum in 13 patients.

CONCLUSIONS. It is clear that the observed anatomy favours hinged flexion, which could well be a major contributor to groin pain and other sequelae of LCPD and in fact enhance the development of later osteoarthritis in these patients.

O067
HIP ARTHROSCOPIC AUTOLOGOUS CHONDROCYTE TRANSPLANTATION

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Since June 2002, 15 hip autologous chondrocyte transplantations were arthroscopically performed for acetabular and femoral head chondral defects.

Fifteen patients affected by hip chondral defects were treated by arthroscopic autologous chondrocyte transplantation. The mean follow-up was 13.8 months (16 - 12 months) and the chondral defects were classified as 3rd - 4th degree, according to the Outerbridge's classification. The defects were located on the acetabular roof in 12 cases, on the femoral head in 2 cases and on both in 1 case.

Nine patients were female and 6 male. The mean age was 40.7 years (52 to 22). A Bioseed C tissue was employed as a scaffold for chondrocytes.

A group of 15 untreated patients, matched for chondral defect degree, sex distribution and mean age, was selected as control. All the patients were pre- and post-operatively evaluated with the Harris Hip Score (HHS). Patients treated by autologous chondrocyte transplantation significantly improved after surgery (mean pre-op HHS 51.3; mean post-op HHS 85.3) compared with the untreated group (mean pre-op HHS 52.1; mean post-op HHS 64.5). Worse results were obtained when the chondral defect was located on the femoral head and when the joint space was reduced.

Chondral defects of the hip, when located on the acetabulum, can be treated by arthroscopic autologous chondrocyte transplantation. This study demonstrates the efficacy of this procedure, compared with untreated patients.

O068
A MODIFIED LATERAL APPROACH TO THE HIP
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We described a modified lateral approach to the hip which expose widely and safely the hip joint. The safe-

ty of such exposure has been verified by cadaveric dissection of 16 formalin fixed cadavers in the dissection room. Measures were taken to investigate the topographic anatomy of the site of entry of the superior gluteal nerve in relation to the muscle from its deep surface and in relation to a midpoint of the tip of greater trochanter. The exact site of entry of the superior gluteal nerve into the three regions of gluteus medius muscle, which were defined as proximal, middle, and distal third were also investigated in our cadaveric dissection as regards their exact relation to our surgical flap. Our study showed that the average distance between the innervation point of the gluteus medius and the tip of greater trochanter is 4.8 cm in males (3.8 cm-5.5 cm) and 4.4 cm in females (3.4 cm-5.1 cm). Also our dissection proved that the entry site of the nerve on the deep surface of the muscle is at the junction of the proximal and middle one-third of the gluteus medius muscle. This entry point is far away proximally situated, from the distally taken muscle flap in the gluteus medius muscle of our surgical exposure, which is reflected medially. This dissection proved that the superior gluteal nerve cannot be injured or even subjected to traction during this modified lateral hip exposure.

II. ABSTRACTS - POSTERS

FRACTURES

P001

PIPKIN I + PIPKIN IV- A CHALLENGE

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The purpose of the study is to present a patient, who suffered two consequent fractures of the femoral head (Pipkin I and Pipkin IV), during a period of two years. We present the following case: The patient G. I. M., 32 years old, male, after a car accident suffered a fracture (Pipkin I).

Because of the current injuries and the necessity of

stabilization of the common status, the surgical treatment (open reposition and internal fixation) was performed on the 12th day after the accident. The early postoperative period was smooth and bone healing and rehabilitation was achieved in optimal terms. Two years later this patient suffered a new fracture of the same femoral head, this time Pipkin IV. This time we used for internal fixation McLeaglin's system. The follow up period was about 8 years. The long-term results are: normal walk, without limping; full range of motions in the affected joint; subjectively there is no pain in the hip. There are no radiological signs of osteonecrosis of the femoral head.

P002

COMPARISON OF A BARBED COMPRESSION SCREW TO STANDARD LAG SCREWS IN INTERTROCHANTERIC FEMUR FRACTURES: A RADIOGRAPHIC ANALYSIS

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BACKGROUND. Intertrochanteric femur fractures are commonly stabilized surgically with a compression screw through a plate or rod. We reviewed our experience with a new barbed lag screw over a 31-month period in an elderly population with intertrochanteric fractures.

METHODS. We reviewed all intertrochanteric femur fractures treated with a plate/sliding screw combination between 10/2000 to 5/2003. Group I included 33 patients with standard lag screws while Group II had 43 patients with barbed lag screws. These patients were followed until healing or failure. The injury radiographs were evaluated for bone quality and fracture classification. Screw position within the femoral head was noted and fracture collapse and shortening was evaluated with the methods described by Doppelt & Bendo.

RESULTS. The groups were equal in male-female ratios, Singh Index, age and side injured. Group II had a higher percentage of stable fractures with both Evans and the OTA classification. Three (9.1%) regular lag screws failed prior to healing compared to two (4.7%) barbed screws. Modes of failure were one nonunion and two plate-shaft failures in Group I and one nonunion

and one hardware failure with screw cutout in Group II. Group II trended towards less collapse with Döpfel's original method and with Bendos modification. Only one fracture in either group had an accessory derotation screw placed.

CONCLUSIONS. There is a trend toward less collapse and shortening with increased rates of healing in intertrochanteric fractures treated with a barbed lag screw. Some of this may be due to surgeon selection in the fractures treated with this device.

P003
DETERMINATION OF FRICTION COEFFICIENTS IN ACETABULUM FRACTURES WITH MALREDUCTION

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BACKGROUND. In order to prevent posttraumatic arthrosis, the surgical aim of the operative treatment of acetabulum fractures is the anatomically reduction of the articular surface. One indication for operative intervention is a cartilage step-off of more than 2 mm. The exact biomechanical consequences of step-offs of the articular surface with regard to the friction coefficients are unknown.

METHODS. To evaluate the friction-coefficients in a model of acetabular posterior wall fractures with varying degrees of articular cartilage step-off. A pig model of acetabular posterior wall fractures was created. After reduction at various step-off levels from 0 to 4 mm in 1 mm increments the specimens were tested in the HEPFIEx- simulator (HemiEndoProstheses Flexion-Extension hip simulator, lubricant: new born calf serum). This simulator enabled the determination of friction-coefficients between a hemiendoprosthesis femur head and the 'fractured' acetabulum.

RESULTS. With an increasing degree of malreduction from 1 to 4 mm the friction coefficients raised continuously. A cartilage step in a posterior wall fracture of 4 mm leads to more than 100% higher frictional values than a step of 1 mm.

CONCLUSIONS. The clinical relevance of the high frictional values determined with increasing the cartilage

steps of posterior wall fractures in the used model is not known, though higher wear rates of the corresponding joint partners and development of arthrosis is to be expected.

P004
HOW TO DISTINGUISH DISPLACED FEMORAL NECK FRACTURES USING GARDEN'S SYSTEM. COMPUTED TOMOGRAPHY FEATURES

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BACKGROUND. Many authors point out that observers give different opinions assessing displaced intracapsular hip fractures using Garden's classification. The goal of this study is to present CT criteria for distinguishing stage III and IV Garden's fractures.

METHODS. Forty-two displaced femoral neck fractures were studied, all with women between 55 and 89 (average age 74.2). Conventional X-rays and CT were made.

RESULTS. According to conventional X-rays 29 are stage III and 13 stage IV. CT images show 34 stage III fractures and 8 stage IV, i.e. in 6 cases (11.9%) antero-posterior and stage IV lateral projections fractures are assessed as stage III. CT features of displaced femoral neck fractures: In all fractures diaphysis, respectively femoral neck is externally rotated. The neck and the head form an angle open backward. Usually there is comminution or small bone fragment from the posterior wall of the neck. Garden stage III fractures are displaced, as assessed by the direction of the trabeculae, but the two fragments remain in contact with each other. In Garden stage IV fractures the fragments are completely displaced and the trabeculae of the head and neck formed angle close to right. Head trabeculae realign with the trabeculae of the acetabulum.

CONCLUSIONS. Routine X-ray projections prove insufficient to establish a diagnosis in approximately 12% of our cases. Because of the poor ability to classify hip fractures according to the given classification we recommend CT-scanning as a necessary feature for the diagnostic protocol.

FRACTURES AND THR

P005

SURGICAL TREATMENT OF THE PERIPROSTHETIC FRACTURES OF THE FEMUR AFTER ARTHROPLASTY OF THE HIP

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The purpose of the study is to determine the surgical treatment of the different types of periprosthetic fractures, according to Johanssen's staging system. For the 1988-2002 period we surgically treated 12 patients with periprosthetic fractures of the femur after total hip arthroplasty; 2 were male and 10 female. According to the staging system of Johanssen the patients were divided as follows: type I - 2 cases, type II - 3 cases and type III - 7 cases. For the first type, the surgical treatment included fixation of the fracture with wire, because the femoral stem of the prosthesis played the role of intra medullar fixation. Bone healing occurred after 6.5 months, and the range of movements was quite satisfactory. For the second type, because the fracture was distally located from the end of the stem, we used compressive AO plate in combination with wire fixation. Good bone healing occurred about 6 months after surgery. For the third type we used osteosynthesis plate, and in 3 of the cases a replacement of the stem with longer one was performed. We consider that the surgical treatment of the periprosthetic fractures is the efficient one. Fractures of the type I and II femurs are comparatively more suitable for surgical treatment, than type III fractures. The choice of a certain surgical technique in the cases with type III fractures is individual and depends on the age, activity (mobility) of the patient, as well as the experience of the surgeon.

P006

REVISION HIP ARTHROPLASTY AFTER PERIPROSTHETIC FEMORAL FRACTURE

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BACKGROUND. The bone-stock in periprosthetic femoral fractures after total hip replacement is often weak and osteoporotic. This is a bad condition to do an osteosynthesis. Lastly, many of these osteosyntheses fail and further operative procedures result from these circumstances. There is the question if it is better to do a revision-procedure in changing the femoral stem of the hip arthroplasty after periprosthetic fracture.

METHODS. In nearly 80% of the cases of periprosthetic fractures of the femur we do revision surgery changing the stem. Additional cerclage-systems surrounding the fracture-region give better stability to the diaphysis of the femur. In all patients we use long revision-stems, mostly cementless, to bridge the fracture-region. Modular systems give the possibility to get a better adaptation to the inner surfaces of the bone.

RESULTS. In 29 patients we did a revision of the stem after fracture. The remobilisation took place in an uncomplicated way. Especially the problem of weight bearing, difficult in the older population (aver. 72 years), is not as important, than after osteosynthesis, because the patients are allowed to do full weight bearing normally because of the high primary stability. A disadvantage is the greater dimension of the operative procedure (oper.-time, blood-loss, more invasive).

CONCLUSIONS. In spite of these disadvantages we prefer the revision-procedure in relation to the osteosynthetic one. The primary stability with the possibility of early weight bearing and early remobilisation without complications seems to bring a lot of benefit in comparison to the osteosynthetic reconstruction.

P007

LONG STANDING FEMORAL NECK FRACTURE. CASE REPORT

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BACKGROUND. E.V.C., female, 57 years old, with a painful left hip and gross limp. She suffered a femoral neck fracture in her youth, left untreated for fifty years.

METHODS. Submitted to a reconstruction program of the hip in two steps with the implantation of an S-ROM T.H.R.

RESULTS. With 8 years' follow-up we present the re-

sults of her clinical and radiological assessment.
CONCLUSIONS. Good long-term results and great improvement in her quality of life.

P008
TOTAL HIP ARTHROPLASTY FOR DISPLACED FRACTURE NECK OF FEMUR

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PURPOSE OF THE STUDY. To analyse the outcome following total hip replacement for displaced fracture neck of femur and to develop a scoring system for decision making prior to surgery.

METHODS AND RESULTS. A retrospective analysis of patients who underwent total hip replacement for fractured neck of femur was done by reviewing the case records. Age of the patient at surgery, mobility, residential and mental status prior to surgery were noted. Grade of the operating surgeon, implant type, post operative complications and functional status were noted. Fifty-two patients were operated between 1997 and 2002. Forty-four patients were female and mean age at surgery was 70 years. Majority of the operations was done by consultants or supervised by them. Stanmore system was used in 34 patients. There was one dislocation, which was reduced under sedation. None of the patients had deep wound infection. Forty-five patients walked independently without any aids at the time of the review. Three patients have died since surgery.

CONCLUSIONS. In properly selected patients with displaced fracture neck of femur, total hip replacement can restore pre operative functional status. Based on our study, we have developed a simple scoring system to help in decision making prior to surgery.

P009
PERIPROSTHETIC FEMURAL FRACTURES IN THA. INDICATIONS TO TREATMENT AND RESULTS

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Periprosthetic fractures of the femur in THA are becoming more and more frequent with the increasing number of 1st and revisions implant, 1.5% for primary and 4% for revisions (1). Many classification systems are available considering the timing and the location of the fracture, the stability of the stem, the quality of the bone. We are using for indications to treatment the Vancouver classification system developed by Duncan and Masri in 1995 (2) based on the site of fracture and the stability of the prostheses. The most difficult fracture to treat is the B2 fracture, located around and/or distally to the prostheses with loosening of the stem. Another kind of classification is based on fracture's date dividing into 3 types: intraoperative, early post-operative before 6 months and late post-operative after 6 months. In the last 5 years we have treated 15 periprosthetic femoral fractures in 15 patients. There were 5 type-A fractures all treated surgically, 3 B1-type treated conservatively, 2 type-B2 treated with revision with a long stem and cable wires, 1 B3 not treated for patient's bad general health conditions and 4 C fractures all treated surgically with plate and cable except for one for bad health status. We had 8 female and 7 male, the mean age was 74.2 years (range from 35 to 91 years). The mean time from the date of the implant to the fracture's date was 7.6 years (minimum 6 months, maximum 19 years).

HEMIARTHROPLASTY

P010
DETERMINATION OF FRICTIONAL COEFFICIENTS OF DIFFERENT HIP-HEMIENDOPROSTHESES AGAINST CADAVERIC ACETABULA

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INTRODUCTION. The science concerning hip arthroplasty has mainly dealt with total endoprosthesis, whereas tribology measurement values of hemiendoprosthet-

ic implants are rare. The small amount of experimental tribologic data concerning materials of hemiendoprosthetic implants in the form of pendulum trials, animal experiments, *in vivo* measurements on human hip joints and pin on disc studies reported friction coefficients between 0.014-0.57, the friction coefficients measured in fresh human cadaver hip joint were determined between 0.001-0.08.

METHODS. In order to test the friction coefficients of unipolar femur head hemiendoprostheses made of metal (Fe-CrNiMnMo-Steel/Protéma™-90/Centerpulse) and ceramic (A₂O₃ ceramic/Biolox forte™ /CeramTec) against fresh cadaveric acetabula, the HEPFIEx-hip simulator (Hemi-EndoProsthesis Flexion Extension) was constructed. The plane of movement of the apparatus is uniaxial with a flexion-extension movement of +30/-18 degrees. The force is produced pneumatically dynamic with amounts of 2.5 kN. Newborn calf serum serves as a lubricant.

Twenty fresh porcine acetabula and 10 fresh human cadaver acetabula were mounted in the HEPFIEx-hip simulator and the two unipolar femur head hemiendoprostheses (metal vs. ceramic) were tested randomised in comparison.

RESULTS. Against porcine acetabulum the mean friction coefficients were $\mu=0.017-0.082$ for ceramic and $\mu=0.020-0.101$ for metal; against human cadaver acetabula for ceramic $\mu=0.017-0.083$ and $\mu=0.019-0.118$ for metal. The frictional coefficient deltas $\Delta\mu$ (metal-ceramic) of all measurements were $\Delta\mu=0.004$ for the porcine acetabula and $\Delta\mu=0.001$ for the cadaver acetabula. The box-plots documenting significant lower frictional coefficients of the ceramics.

CONCLUSION. The lower frictional coefficients of ceramic compared to metal against fresh cadaveric acetabula might have a clinical impact on the process of the protrusion of the corresponding femoral head through the acetabulum.

P011 EXPERIENCE WITH THE FURLONG BIPOLAR HEMIARTHROPLASTY

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BACKGROUND. We report the use of JRI Furlong bipolar hemiarthroplasty in 54 patients (54 hips) over a 3-year period.

METHODS. There were 14 males (mean age 78) and 40 females (mean age 76) with a range 51 to 86 years. Indications included intracapsular femoral neck fractures with pelvic/acetabular deposits (n=4) and failed DHS fixation with screw protrusion following trochanteric fractures (n=2).

RESULTS. Mortality at one month was 7.4%, at one year 11.1%, and at two years 20.36%. Deep infection occurred in 3 patients, one of whom underwent excision arthroplasty. Dislocation occurred in 5 patients (9.25%) and was recurrent in 2. Intraoperative calcar fractures requiring circlage wiring occurred in 2 cases, and late periprosthetic fractures occurred in 2 (treated by plating).

CONCLUSIONS. Our experience suggests that internal fixation; hemiarthroplasty or hip replacement may be operations of choice for intracapsular hip fractures, the choice depending on age, displacement and activity level. Our relatively high dislocation rate was related to the use of extensive gluteal detachment ('omega approach') in 3 cases and this has been discontinued. The JRI Furlong device does not, however, offer variable offset. Nevertheless, we believe that bipolar devices may have a useful place in management of pathological fractures when metastatic deposits exist on both sides of the joint (a long-stem option is desirable), for failed DHS fixation in elderly patients in whom THR is not considered ideal (provided the acetabulum is free from damage), and for a very narrow medullary cavity, where the traditional monopolar stems may be too large.

ADULT HIP

P012 THE ROLE OF THE JOINT AND BONE DECOMPRESSION IN THE SURGICAL TREATMENT OF THE AVASCULAR NECROSIS OF THE FEMORAL HEAD

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The purpose of this study is to prove that joint and bone decompression are a great success in the surgical treatment of avascular necrosis of the femoral

head. For the period 1982-2001, 227 cases with avascular necrosis of the femoral head had been surgically treated. The mean age was 39 years. The patients had follow-up period of more than 3 years. The surgical treatment included free or non-free bone grafting, curettage of the necrotic area and filling the obtained cavity with cancellous bone graft or hydroxiapatit. The surgical interventions were realized after longitudinal and limited periacetabular incision of the joint capsule and subcapital trepanation of the femoral head. In 218 cases an abnormal amount of synovial liquid was found after opening the joint. The necrotic area was precisely curetted. In 26 patients the obtained cavity was filled with hydroxiapatit, and in other 16 with cancellous bone. The long term follow-up showed very good results in these cases. All of them were at stage III (without collapse of the femoral head), according to Arlet-Ficat staging system. According to us, the very good results in these cases were due to the performed joint and bone decompression, and to the assured stability. We consider that the increased intraarticular pressure leads to compression of the capsular vascular system. The deterioration of the circulation of the femoral head leads to the increase of the pressure in the head. Thus, joint and bone decompression is logically based on surgical intervention.

P013
AVASCULAR NECROSIS AFTER INTERNAL FIXATION OF FEMORAL NECK FRACTURE

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We retrospectively reviewed 84 patients who underwent internal fixation of an intracapsular femoral neck fracture. The mean age was 58 years and the time from injury to operative treatment was 5.3 days. The mean follow-up was 4.7 years (range, 2-8 years). At the latest follow-up, in the 46 patients with undisplaced (Garden I, II) fractures, nonunion occurred in two patients and avascular necrosis of the femoral head in nine. Six of these nine patients had a good or excellent result, one had a fair result, and two had

a poor result. Of 35 patients with no sign of avascular necrosis, 32 patients had a good or excellent result, two a fair and one had a poor result. In the group of 38 patients with displaced (Garden III, IV) fractures, nonunion occurred in six patients and avascular necrosis of the femoral head in 15. Of these 15 patients, 10 had a good or excellent result, two had a fair result, and three had a poor result. Of 17 patients with no sign of avascular necrosis, 14 had an excellent result and three patients a poor result. Overall, only five of the 24 patients who developed avascular necrosis of the femoral head had undergone total hip arthroplasty. Internal fixation remains a simple and safe, method of treatment for both undisplaced and displaced femoral neck fractures in middle-aged patients. Despite the relatively high rate of avascular necrosis after internal fixation of femoral neck fractures, only a few of these patients (20%) required further surgical treatment in the follow-up period of this study.

P014
MR ARTHROGRAPHY OF THE HIP IN PATIENTS WITH NEGATIVE OR UNCERTAIN CONVENTIONAL MRI

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BACKGROUND. The hip joint is becoming increasingly recognized as a source of groin pain in young patients. The purpose of this study is to describe the findings in MR arthrography in 19 patients with a negative or uncertain conventional MR examination.

METHODS. From November 2002 to December 2003 we performed 21 MR arthrographies in 19 patients with a normal or uncertain conventional MRI. Hip puncture was done under CT guidance in all cases.

RESULTS. Two patients showed a normal hip joint. No complications were related to the diagnostic procedure. Findings included 15 anterosuperior labral tears, 1 posterior labral tear, 6 loose bodies, 6 cartilage defects and 3 subchondral lesions, 1 synovitis and 2 rectum femoris reflected head tendonitis.

CONCLUSIONS. Labral tears, osteochondral lesions and loose bodies are often not well demonstrated utilizing conventional MRI. In these cases, MR hip arthrography helped the arthroscopist to preoperatively plan the surgery and to avoid unnecessary diagnostic arthroscopy in 3 patients. This diagnostic tool is a simple procedure that reveals several lesions that are not well recognized with conventional MRI.

P015

DEBRIDEMENT OF THE ADULT HIP FOR FEMORO-ACETABULAR IMPINGEMENT: INDICATIONS AND PRELIMINARY CLINICAL RESULTS

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The current study evaluates the results of surgical dislocation and debridement of the adult hip for the relief of femoro-acetabular impingement. Twenty-one hips treated by debridement for impingement were followed from 2 to more than 10 years. Twenty of 21 were treated by full surgical dislocation. Exposures included the trochanteric slide/peripheral capsulotomy exposure, the modified direct lateral/peripheral capsulotomy exposure, and the limited iliofemoral exposure depending on the location of the impingement. Diagnoses included primary impingement in 10, prior trauma in 5, a combination of dysplasia and impingement in 4, SCFE in 1, and LCPD in 1. Three hips were also treated by intertrochanteric osteotomy and 2 hips by periacetabular osteotomy. Ten hips were in females and 11 were in males. Patients had a mean age of 34.6 ± 8.6 y (17.3-54.0 y). Mean follow-up was 6.0 ± 2.8 y (2.2 to 11.1 y). Fifteen have had no further surgery and 6 have been converted to THA. Two of the failures had both impingement and instability and only the impingement was treated. One had arthritis that was simply too advanced. Three had an extended period of good function and then were converted to THR at 6 years 5 months, 9 years 1 month, and 10 years 6 months from surgery. None developed osteonecrosis. The current study demonstrates that hips affected by primary or secondary femoro-acetabular impingement can be effectively treated by surgical relief of the impingement.

P016

BILATERAL INTERTROCHANTERIC VARUS OSTEOTOMIES IN SYMPTOMATIC SYMMETRIC HIP DEFORMITIES: ARE EARLY INTERVENTIONS REALLY SUPERIOR? - A LONG-TERM FOLLOW-UP

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BACKGROUND. Coxa valga (antetortia) combined with acetabular dysplasia is a well known cause for early secondary osteoarthritis. Many authors have stated that the best result of an osteotomy can be achieved in an early stage of osteoarthritic changes. In this study we present 27 patients with a symmetrical hip deformity (coxa valga and acetabular dysplasia) for which we performed a therapeutic osteotomy on the symptomatic hip. The contralateral hip had the same anatomical predisposition to develop an OA but only minor to no complaints. We advised and performed an early, more prophylactic osteotomy in these hips.

METHODS. Between 1974 and 1987, 27 patients with an intertrochanteric osteotomy for a secondary osteoarthritis due to mild acetabular dysplasia (average sharp-angle 42.8 degrees) and coxa valga (antetortia) (average CCD 141 degrees) also showed radiographically pre-arthrotic changes and mild complaints (average Merle d'Aubigne score 15.8) on the contralateral hip in the presence of the same anatomical variation. These patients were advised to have an early, more prophylactic, osteotomy.

RESULTS. During an average follow-up period of 19.9 years, 14 hips were converted to THR after the first primary osteotomy, whereas only 6 after the early, more prophylactic osteotomy were converted to THR (Chi-square $p < 0.05$). Using a Pearson correlation analysis age, preoperative grade of OA and preoperative Merle d'Aubigne score were significantly correlated with the outcome.

CONCLUSIONS. Our results show that the effect of an early, more prophylactic varus osteotomy in patients with a coxa valga and acetabular dysplasia, can be superior to the results achieved when surgery is postponed until the complaints and arthritis has become more severe.

SOCIOECONOMIC STUDIES

P017 **SOCIOECONOMIC STATUS, POPULATION DENSITY AND PERTHES' DISEASE IN SOUTH WEST SCOTLAND**

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BACKGROUND. Epidemiological studies in Britain have suggested that Perthes' is more prevalent in urban areas and the risk increases with deprivation.

AIM. To calculate the average annual incidence rates of Perthes' in South West Scotland. To analyse the relationship between incidence of Perthes', deprivation and urbanization.

METHODS. A 10-year retrospective study of patients from Dumfries & Galloway Infirmary (1992-2002). The County was divided into 47 electoral wards. The average annual incidence for each ward was ascertained. Socioeconomic status was measured using the Scottish Index for Multiple Deprivation (SIMD). Population density for each ward was derived from the 2001 census. The average annual incidence of Perthes' is compared with the SIMD and population density.

RESULTS. The study included 40 Patients. Male to Female ratio was 3:1. Mean age of diagnosis was 6.4 yrs. 10% were bilateral. 12.5% gave history of trauma. The average annual incidence for the whole region was 15.4 per 100,000. Incidence rates were found to directly correlate with the SIMD scores and living standards. There was no correlation between population density and incidence of Perthes'

CONCLUSIONS. The incidence of Perthes' disease in rural Scotland is almost as high as those reported from highly urban areas like Liverpool (15.6) and Mersey (11.1). It is much higher than reports from other rural areas like Wessex (5.5). The study indicated that in South West Scotland the incidence of Perthes' is more a rural phenomenon than an urban one. This is similar to reports from S.India and N.Ireland. A substantial proportion of deprived households in these regions are located in rural settings.

P018

DIFFERENCES IN EARLY POSTOPERATIVE MORTALITY AFTER INSERTION OF PRIMARY HIP (THA) AND KNEE PROSTHESES (TKA) REPORTED TO THE NORWEGIAN ARTHROPLASTY REGISTER

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BACKGROUND. We have previously shown that there is an increased mortality for the first 20 postoperative days after insertion of total hip prosthesis and that the mortality is normalised after 70 days. In this study we compare the increased early mortality after THA with that after TKA.

METHODS. We studied 53,469 patients with hip and 7,722 patients with knee prostheses (age between 50 and 75 years). Early postoperative mortality (for the first three postoperative months) was studied with smoothed intensity (hazard) curves, and a nonparametric proportional hazards model was applied to study differences in early postoperative mortality between hip and knee prostheses patients.

RESULTS. The long-term survival (8 years) was equal after THA and TKA operations. There was an increased mortality in the early postoperative phase both after hip and knee prostheses operations. This increased mortality was high (3/10,000/day) and fairly equal both after hip (0.26%) and knee (0.16%) operations for the first 20 days. After insertion of a hip prosthesis the mortality was almost normalised after 25 days and completely normalised for knee prostheses patients.

CONCLUSIONS. There is a nearly equal increased early mortality after insertion of primary hip and knee prostheses. This increased mortality persists until 25 days postoperatively for both procedures, and is slightly increased only for hip prostheses patients until the 70th postoperative day.

P019

SOCIO-ECONOMIC ASPECTS OF TOTAL HIP ARTHROPLASTY IN A BELGIAN UNIVERSITY HOSPITAL

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BACKGROUND. Cost and cost-containment are increasingly important in orthopaedics.

METHODS. We analysed, during a one-year period starting in October 2001, the discharge policy, hospitalisation and intra-hospital cost of 102 consecutive total hip arthroplasties.

RESULTS. Prior to surgery 94.1% of patients lived independently, 61.7% with a partner and 28.4% alone. When living with a partner in good health, 88.5% were discharged home compared to 48.3% when living alone. After six weeks and six months, 87.4% and 94.7% of independent patients lived independently again. In total 19.6% used rehabilitation facilities. On average patients stayed in the orthopaedic ward for 14.4 days and 13.6 days if no early "major complication" occurred (86.3%). "Major complications" were identified as cause of prolonged hospitalisation (>16 days) in 3.9%. However, a multiple regression analysis identified 'major complications' as an important factor leading to longer hospitalisation and higher cost. On average the intra-hospital cost of a total hip arthroplasty was 9495.52 Euro. 53.8% is related to hospitalisation, 21.3% implants and material, 7.7% surgery and 4.1% anaesthesia. Intra-hospital cost for patients with the most expensive implant (uncemented hip, alumina-alumina) was 9656.52 Euro compared to 8708.01 Euro for patients with the cheapest combination (cemented hip, metal-polyethylene). Without "major complication", due to lack of rehabilitation units in Brussels, patients in need of such facilities stayed longer and were more expensive than others (16.5 days and 10422.23 Euro compared to 13.4 days and 9056.60 Euro).

CONCLUSIONS. Surgical techniques leading to shorter hospitalisation without increased morbidity and allowing to bypass rehabilitation facilities, could represent a major saving.

P020

THE USE OF ALTERNATIVE BEARING SURFACES AND RESURFACING ARTHROPLASTIES IN UNIVERSITY HOSPITALS OF THE EUROPEAN COMMUNITY

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BACKGROUND. By teaching future generations of orthopaedic surgeons, university hospitals will influence future surgical practice and implant choice.

METHODS. During a one-year period starting in January 2002, a postal survey was conducted amongst university hospitals of the European Community. Out of 253, 125 forms (45 from Southern European, 42 from Scandinavian & Anglo-Saxon and 38 from Benelux & Germanic universities) were available.

RESULTS. Metal-polyethylene as a bearing surface in THA has been abandoned in 15.2% of the university centres. In Benelux & Germanic universities this represents up to 26.3% but none in Scandinavian & Anglo-Saxon countries. Only one university gave up polyethylene completely. Ceramic heads in combination with polyethylene or ceramic cups are in use in 72.8% of participating centres and metal-on-metal in 48.0%. In general, Scandinavian & Anglo-Saxon universities tend to use alternative bearing surfaces less frequently compared to both other regions. Overall, metal-metal hip resurfacings are used in 22.4% of universities. This represents 31.6% in Scandinavian & Anglo-Saxon, 26.2% in Benelux & Germanic and only 11.1% in Southern European universities. Resurfacing arthroplasties are responsible for 30.0% of the use of metal-metal bearing surfaces and even 47.6% in Scandinavian & Anglo-Saxon universities.

CONCLUSIONS. Alternative bearing surfaces in THA have different degrees of penetration in university hospitals of different regions of the European Community. Scandinavian & Anglo-Saxon universities tend to be more conservative regarding their use of alternative bearing surfaces but have adopted resurfacing arthroplasties more eagerly (up to 47.6% in the UK).

P021

THE USE OF CEMENTED AND UNCEMENTED TOTAL HIP ARTHROPLASTY IN UNIVERSITY HOSPITALS OF THE EUROPEAN COMMUNITY

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BACKGROUND. By teaching future generations of orthopaedic surgeons, university hospitals will influence future surgical practice and implant choice.

METHODS. During a one-year period starting in January 2002, a postal survey was conducted amongst university hospitals of the European Community. Out of 253, 125 forms (45 from Southern European, 42 from Scandinavian & Anglo-Saxon and 38 from Benelux & Germanic universities) were available.

RESULTS. 72.0% of responders use both cemented and uncemented stems, 18.3% use cemented stems only and 9.6% uncemented stems exclusively. However, in Scandinavian & Anglo-Saxon universities, 42.9% use cemented stems only and in Southern Europe, 13.3% use uncemented stems exclusively. 68.8% of responders use both cemented and uncemented cups, 8.8% use cemented cups only and 22.4% uncemented cups exclusively. However, in Scandinavian & Anglo-Saxon universities, 16.7% use cemented cups only and in Southern Europe, 31.1% use uncemented cups exclusively. 80.5% of those cementing the stem use pressure lavage and pressurisation while 63.4% do so for the cup. In Scandinavian & Anglo-Saxon universities, this includes all responders for the stem and 82.5% for the cup, compared to 64.1% for the stem and 37.5% for the cup in Southern Europe. Overall, 78.4% report the use of hip registers (95.2% in Scandinavian & Anglo-Saxon universities and 66.7% in Southern Europe).

CONCLUSIONS. In general, Scandinavian & Anglo-Saxon universities tend to use more cemented hips and to teach last generation cementing techniques more often than Southern European universities. Benelux & Germanic universities are in-between in most aspects of their practice.

P022

AUDIT OF RESURFACING HIP REPLACEMENT (RHR) ACTIVITY IN THE UNITED KINGDOM

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BACKGROUND. There has been a rapid increase in the use of RHR in the UK and its use is likely to accelerate both in Europe and the USA. Its current level of use in the UK is not accurately known. It was decided to audit the use of RHR activity in the UK amongst Consultant Orthopaedic Surgeons; to identify training undertaken before offering this procedure, and the relationship with specialisation.

METHODS. A questionnaire was sent to 1600 Consultant Orthopaedic Surgeons in the UK. Surgeons were asked regarding volume of RHR work undertaken, and specific training undertaken in RHR surgery and hip arthroplasty.

RESULTS. 19% had performed RHR in the previous year. 30% had observed RHR surgery and 23% had been on a course. 65% of those who had attended a course subsequently offered surgery. 7.8% of those performing RHR surgery had neither been on a course nor observed surgery. There was an association with membership of the British Hip Society (BHS) and with completion of a previous hip fellowship and this was statistically significant. Only 4% of RHR surgeons do not perform revision hip replacement. Of those performing RHR, the majority perform 6-10 per year. 72% perform less than 20 cases. BHS members and those with previous hip fellowship perform significantly more cases than the others.

CONCLUSIONS. Although interest in RHR is increasing, it is currently performed by the minority of consultants. It is predominantly used by surgeons with a specialist interest in hip arthroplasty and those surgeons perform larger volumes than non-specialists. We believe that given the steep learning curve, lack of knowledge of long-term survival and concerns regarding metal-on-metal bearing surfaces, RHR should continue to be used by surgeons with a specialist interest in hip arthroplasty and those that have undergone specific training in the technique.

P023

SPORT ACTIVITIES AND TOTAL HIP REPLACEMENT

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Our purpose was to investigate whether sport activity is resumed after hip replacement in patients treated with either conventional hip arthroplasty or hip resurfacing. Thirty-one patients (group A, with a mean age of 51 years), were treated with uncemented hydroxyapatite-coated total hip replacement and 45 patients (group B, with a mean age of 48 years), with Birmingham Hip Resurfacing (BHR). Mean follow-up was 29 months in group A and 22 months in group B. A questionnaire describing type and frequency of sport activity before and after surgery was completed. In group A, mean HHS was 90 and in group B was 97 ($p < 0.05$). There were no signs of implant loosening in the x-rays in either group. In group A there was a decrease in all sport activities. Nine patients resumed low-impact activities, such as swimming, cycling and tennis doubles, more than once a week. Twelve patients resumed low-impact activities once a week or less. Ten patients did not resume any sport activity. On the contrary group B patients were able to resume their former level sport activities including high-impact sports such as soccer, body-building and marathon running. These patients reported no difference in hip function between the hip which was treated with resurfacing and the intact controlateral hip. Our study shows that after conventional total hip replacement, there is a decline in all forms of sport activities and, in particular, the high-impact sports are never resumed. Conversely, after BHR, sport activities, even if high-impact, are successfully resumed.

THR: FEMORAL COMPONENTS

P024

MODULARITY OF THE FEMORAL NECK

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BACKGROUND. Modular THA has grown among the

orthopaedic community. The possibility of changing the geometry of the prosthesis enables to choose the best configuration for the articular morphology: leg length, offset, ante-retroversion. Modularity may be applied to the neck, enlarging the range of choice for difficult cases.

METHODS. The prosthesis (AnCA-Fit) has a cementless titanium anatomical stem and a modular neck inserted in the stem by a morse taper. There are 2 lengths of the neck and 5 types: straight, varus-valgus, anteversion-retroversion. The socket is a titanium hemispherical press-fitted cup. From 1994 to 2001, 864 THA were implanted. 52% primary arthritis, 20% CHD. In 80% we used a straight neck. A non-straight neck was used more frequently for revision and CHD cases.

RESULTS. At follow-up, 98.8% of the stems and 99.4% of the cups had bony stability. There were less than 1% of prosthetic dislocation. Leg length discrepancy after the implant decreased from 67.7% to 22.6%. No cases of fracture or disassembly of the components.

CONCLUSIONS. The variable anatomical conditions have induced the development of modular THA. Modularity is useful in difficult cases as in CHD, post-traumatic arthritis and revision. Modular prosthesis has some problems related to the risk of corrosion, fretting, fracture or dislocation of components. We observed no cases of disassembly of components and comparative analysis between retrieved necks and those experimentally studied confirmed the absence of corrosion. In all reviewed cases, no failures were related to the modularity, which facilitated the restoration of normal anatomical joint.

P025

THE EFFECT OF USING A COLLARED FEMORAL STEM ON MEDIAL FEMORAL NECK RESORPTION

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BACKGROUND. The purpose for using a collared femoral stem is to redistribute the loading on the medial femoral neck and reduce proximal cement stress. If the collar has such an effect, there must be a dif-

ference between the cases with or without good contact of the collar on bone. The purpose of this study is to compare the proximal femoral bone resorption and aseptic loosening in cases that had bad or good contact between the collar and the femoral neck

METHODS. A total of 94 patients with 102 hips who had hybrid total hip arthroplasty were included in this study. The mean age was 52.09 (range 17-75). The mean follow-up was 4.86 years. The same implant with the same surgical technique was meticulously performed in all of the patients. The contact of the collar with the femoral medial neck was divided into three groups as described by Kelley et al. Radiolucency between bone-cement and stem-cement interface; radiolucent lines in Gruen Zones, linear polyethylene wear and medial femoral neck resorption was determined.

RESULTS. When the bone resorption in the medial femoral neck was evaluated, we did not find any statistically significant difference among these groups ($p=0.246$). Five year survival using revision as an end point was 86.21% (5 femoral and 7 acetabular revisions). There were no significant differences among the groups ($p=0.632$).

CONCLUSIONS. In conclusion, the collar did not prevent calcar resorption even when ideal contact was achieved between the collar and proximal medial femoral neck.

P026
THE CF-30 CANNULATED CEMENTED FEMORAL STEM - THE INFLUENCE OF STEM POSITION ON 5-YEAR RESULTS

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BACKGROUND. Femoral stem mal-position can lead to sub-optimum long-term results of cemented total hip replacement. A variety of aids have been developed to control stem positioning at implantation. Stem cannulation, with component implantation over a guide wire is used for the polished, tapered, CF30 design (Sulzer). We report our five-year results using this device.

METHODS. We used the CF30 in 115 primary total hip

replacement procedures (113 patients) between 1995 and 1997. All patients were reviewed using the Oxford Hip score (OHS), Clinical and radiological assessment, at five years post surgery. Radiological analysis was performed on anteroposterior and lateral radiographs using Johnston's criteria. The cement mantle was assessed for radiolucent lines, mantle defects or cement mantle fractures. Stem alignment was measured in relation to the medullary axis.

RESULTS. At five years 85 hips were available for complete clinical and radiological analysis. The mean Oxford Hip score (OHS) was 20 points. Radiological analysis revealed that all stems were in a neutral position, within the femoral canal. Thirty-five (41%) hips had non progressive radiolucent lines, all less than 2mm wide, at the cement bone interface. No radiolucent lines were seen at the stem-cement interface. Thirty-eight stems (45%), had subsided within the cement mantle, with a mean subsidence of 1mm. No mantle defects or fractures were noted.

CONCLUSIONS. Our results confirm that the cannulated CF30 stem provides consistent and satisfactory stem positioning. The clinical outcome is comparable to other cemented THR's. The transverse cement fractures reported with the matt finished stem have not been seen with the polished version.

P027
LONG-TERM RESULTS OF THE CEMENTLESS PPF TOTAL HIP ARTHROPLASTY

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Titanium aluminium vanadium alloy is presently the material of choice to be used for cementless fixation of primary total hip replacement. Roentgenographic signs especially radiolucent areas and clinical data were analysed prospectively. We implanted 176 cementless PPF (BIOMET®) hip arthroplasties with ceramic-on-polyethylene articulation into 170 patients and followed 122 of them. Interim results and post-mortem results are available for a total of 175 hips. After a mean of 108 months follow-up four cups showed radiological loosening, two arthroplasties showed large polyethylene granulomas close to the proximal stem, while one infection and two luxations occurred. By

then four cups had already been revised for loosening. Non progressive radiolucency (-2mm) was seen in 12% of the stems. Progressive radiolucency (>2mm) was seen in 6% of the proximal stem area, but none had resulted in stem loosening or thigh pain. In patients where radiolucency was present, it could be clearly seen at the 24-month follow-up but was without clinical relevance after 10 years. 98% of the patients were satisfied with the result, 83% were free of pain, 67% walked without limping and only 15% of the patients used a stick or crutches. Since it is assumed that the principle cause of radiolucency of this type is a reaction to the polyethylene wear debris, it is important the assess of new articulation surfaces, such as ceramic or improved polyethylene. This type of reaction can be assessed clearly even at an early stage after 12 and 24 months.

P028
SURFACE FINISH AFFECTS THE CLINICAL AND RADIOGRAPHIC PERFORMANCE OF A MODERN, CEMENTED FEMORAL STEM FOR TOTAL HIP ARTHROPLASTY

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The role of surface finish on the survivorship of cemented stems is controversial. The purpose of this study is to prospectively evaluate the mid-term clinical and radiographic performance of a cohort of patients who underwent total hip replacement with two identical cemented femoral stems differing only in surface finish (VerSys, Zimmer, Warsaw, IN). Sixty-four total hip replacements with a rough stem (Ra: 70-100 microinches) and 138 total hip replacements with a satin finish stem (Ra: 20-25 microinches) were followed clinically and radiographically for 4 to 7 years. All surgeries were performed by one surgeon during a period of 1 year, utilizing the same surgical technique, acetabular cup, cement type and cementing technique. The groups had similar demographics, diagnosis, preoperative clinical score, cement mantle quality, alignment, and length of follow-up. The preoperative and postoperative Hospital for Special

Surgery Hip Score at last follow-up of the patients with a successful operation was not significantly different among the two groups. Five hips in the rough group and none in the satin group developed aseptic loosening ($p=0.0009$). The femoral bone-cement interface revealed progressive radiolucent lines or osteolysis in 8 out of 64 rough stems and in 3 out of 138 satin stems ($p=0.01$). There were progressive radiolucencies or osteolysis in 44 out of possible 448 Gruen zones in the rough surface group and in 8 out of possible 966 Gruen zones in the satin finish group ($p<0.001$). A rough, textured stem is more likely to fail at intermediate follow-up than a satin surface stem. We recommend that the surface of cemented stems should be satin or polished, with a Ra of less than 20 microinches.

P029
THE TRI-TAPER CEMENTED FEMORAL COMPONENT: 3-YEAR PROSPECTIVE CLINICAL, RADIOLOGICAL AND MIGRATION ANALYSIS OF A NEW TRI-TAPERED, POLISHED, CANNULATED FEMORAL COMPONENT
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BACKGROUND. A 3-year prospective study for a new tri-tapered polished cannulated cemented femoral component is reported.

METHODS. Fifty-three hips were implanted, 11 males (11 hips) and 39 females (39 hips). The mean age at surgery was 73 (65 - 84). The mean weight was 71.76kg (49.3kg - 94.6 kg) with a mean BMI of 28 (20.20 - 40.26). All had a pre-operative diagnosis of osteoarthritis. All stems were implanted via the anterolateral approach. Twenty-six (51%) hips were implanted by a single consultant and 24 (49%) by registrars. The Oxford Hip Score (OHS) was used to assess patients annually. Radiological analysis was performed using Johnston criteria. Stem migration was measured using a technique developed and validated as accurate to 0.61mm.

RESULTS. The mean pre-operative OHS of 47 declined to 19 at 3 years. Mean Stem migration was 1.38mm (sd \pm 1.38) 6 months post implantation. This progressed to 1.71mm (sd \pm 1.18) at one year; 1.61mm (sd \pm 1.17)

at 2 years and 1.55 mm (sd \pm 1.13) at 3 years. Average stem migration implanted by the registrar group and consultant group was not significantly different. 94% of the tri-taper stems implanted had tips within 2mm of central in the femoral canal compared to 78% of Exeter stems implanted with conventional distal stem tip centralisers.

CONCLUSIONS. Our study demonstrated initial component migration, comparable to that of other polished tapered cemented stem designs. The improvement in Oxford hip score parallels other reported series and no adverse radiological signs have been observed at three years.

P030
EARLY PROSPECTIVE BONE MINERAL DENSITY CHANGES IN THE PROXIMAL FEMUR AFTER A TRI-TAPER CEMENTED FEMORAL COMPONENT - 1 AND 2-YEAR RESULTS

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BACKGROUND. The implantation of a cemented femoral stem is known to produce a degree of stress shielding in the proximal femur. The design features of a new polished, tri-tapered, collarless, cemented femoral component, help to minimise this problem. A prospective study was undertaken to define the pattern of bone remodelling using DEXA following implantation of this stem.

METHODS. The stem was implanted in 20 primary THRs. Our subjects comprised 7 male and 13 female patients. At the time of surgery the mean age was 73. The mean weight at surgery was 75.4kg with a mean BMI of 28. All patients had a pre-operative diagnosis of osteoarthritis. All the hips were implanted via the anterolateral approach. Pre-operative and sequential post-operative DEXA evaluations were undertaken at 3 weeks, 6 and 12 months. The mean precision error was 0.78% (range 0.8-3.4% depending on region of interest).

RESULTS. Statistical analysis revealed a significant increase in BMD measured in zones 1, 2, 4, 5, 6 ($p < 0.05$). In zones 3 and 7, the increase in BMD was not significant ($p > 0.05$). We did not see any evidence of

calcar resorption which has been shown in previous cemented femoral component studies.

CONCLUSIONS. Peri-prosthetic bone remodelling has been observed within one year following total hip replacement (THR), which has been demonstrated by an increase in BMD in all zones. The implantation of a tri-tapered cannulated cemented femoral component, thus provides favourable proximal femoral loading at 12 months. This study has now been continued to 2 years, the results of which will be available for the meeting.

P031
THE CPS-PLUS STEM - AN EVOLUTION IN POLISHED STEM DESIGN

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BACKGROUND. The CPS-Plus stem is a polished double-taper with a rectangular cross section for rotational stability. There are 5 stem sizes, 5 neck length options and a unique proximal stem centraliser which has been shown to increase proximal cement pressurisation during insertion, assist with alignment and help create an even mantle. RSA analysis has demonstrated linear subsidence without the posterior head migration and valgus tilt associated with other designs. Data on the CPS-Plus stem has been obtained from a multi-centre prospective clinical trial.

METHODS. 227 patients were recruited by surgeons working at three centres in the UK and two in Norway. Seventy of these have reached 3 years follow-up. Evaluation included recognised hip and quality of life scores recorded pre-operatively and at follow-up (3, 6, 12, 24, 36, 60 months). Radiographic assessment included evaluation of subsidence and the presence of radiolucencies.

RESULTS. Objective and subjective scoring have indicated very satisfactory results. Radiological subsidence is less than 1.5mm in over 95% of cases and only one stem has subsided more than 3mm. There has been one revision for deep sepsis, 7 dislocations and one femoral fracture. None of these complica-

tions were related to the choice of femoral component. Survivorship in relation to revision for aseptic loosening is 100%.

CONCLUSIONS. The CPS-Plus stem represents an attempt to re-examine the issues relating to rotational stability, subsidence, cement pressurisation and hip offset. Earlier laboratory studies have now been supplemented by this clinical evaluation and the evidence is encouraging. The RSA subsidence characteristics, cement pressurisation and rotational stability already associated with this implant *in vitro* have been supported by excellent survivorship analysis. Increasing familiarity with the concepts raised by this implant should result in clinical benefits in relation to polished taper cemented stem longevity.

P032

DIFFERENCES IN STABILITY AND BONE MINERAL DENSITY CHANGES BETWEEN THE SCANDINAVIAN CUSTOMIZED PROSTHESIS (UNIQUE) AND THE CEMENTED ELITE PLUS FEMORAL STEM

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BACKGROUND. New prosthesis designs should be compared to a standard implant in randomized studies evaluated by radiostereometric analysis (RSA) and bone mineral density changes (DXA). The Unique stem is a concept for fitting uncemented prosthesis to the exact internal shape of the proximal femur (1). We evaluated the new UCP design with the null hypothesis that this implant would be no more stable and retain no more bone than a standard cemented implant.

METHODS. Thirty-eight patients, mean age 51.6 years (31-65) were randomized to a Unique HA coated femoral stem or an Elite Plus (DePuy) cemented stem. All patients were implanted with a Duraloc (DePuy) uncemented cup except one patient with a protrusion who was primary impaction grafted with a cemented cup. Most patients received a Zirconium head, and all heads were 28 mm. The femoral stems were fitted with 3 tantalum balls and 4-10 tantalum balls were implanted in

the femur during operation. RSA pictures and DXA were taken postoperatively, after 6, 12 and 24 months.

RESULTS. The Elite+ stem rotated more into retroversion after 6, 12 and 24 months (0.64 vs 0.11 at 6 months, 0.64 vs 0.17 at 12 months, 1.05 vs 0.03 at 24 months, $P=0.01$). Subsidence after 2 years was 0.17 for Elite Plus and 0.13 for Unique, ($P=0.4$). Total BMD loss was 14% for the Unique and 6% for the Elite+ after 24 months ($P=0.4$). In Gruen zone 1 and 7 Unique lost 16% and 29%, and Elite+ 5% and 9% ($P<0.05$).

CONCLUSIONS. The customized Unique was more stable in retrorotation than the cemented Elite+ stem. Bone loss was higher with the Unique stem proximal in the femur. Compared to other results with the Elite Plus rotations and migrations were small in this study (2). The excellent stability of the Unique stem is promising for long-term stem fixation. The bone loss around the Elite+ is the smallest reported for any prosthesis so far.

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P033

UNCEMENTED CUSTOM FEMORAL STEMS IN HIP ARTHROPLASTY. A PROSPECTIVE CLINICAL STUDY

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BACKGROUND. The aim of this paper is to present the preliminary results of a prospective clinical study of a CT-based custom femoral stem (Unique SCP).

METHODS. The prostheses were designed to obtain a femoral neck anteversion of 10 degrees after insertion, optimized medial femoral head offset and correction of leg length discrepancies up to 3 cm. 352 hips have been operated. Mean age of the patients was 51.5 years (24-66). 39.2% of the hips were dysplastic. All patients have been followed radiologically and clinically; 104 for 3 years, 64 for 5 years and 19 for 7 years. Merle d'Aubigné score was used. RSA and DEXA-studies have been performed in some groups of the patients.

RESULTS. We have experienced that the use of this

type of prosthesis offers obvious advantages in abnormal size and geometry of the upper femur. An intraoperative fissure in the proximal femur occurred in 3 patients (0.9%), they were treated successfully with wires. One patient sustained a femoral fracture 3 months postoperatively. A dislocation of the joint occurred by severe injuries in three patients (0.9%), all these joints have been stable after non-operative reduction. Mean total score at 3, 5 and 7 years was 17.04 (preop. 9.33), 17.19 (preop. 8.37) and 17.31 (preop. 9.21), respectively. The pain scores at the corresponding observations were 5.63 (preop. 2.71), 5.75 (preop. 2.79) and 5.84 (preop. 2.58). There have been no radiological signs of loosening. DEXA-studies have shown good preservation of the femoral bone stock in most of the hips. RSA showed no significant migration of the stems.

CONCLUSIONS. Use of custom femoral components enable optimization of the biomechanics of the hip and eliminates the need for highly modular femoral stems. The rate of mechanical complications is relatively low indicating adequate fit of the stem and adequate design of the neck. The clinical results up to 7 years are promising.

P034
AN HELITORSION FEMORAL STEM WITH ROTATORY LOCKING CONCEPT/ADVANTAGE

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Primary fixation methods for an uncemented femoral stem remain very controversial. Actually, the method used affects the features that are evaluated during postoperative radiological and clinical follow-up : instability and thigh pain/stable fixation and bone remodeling. Based on our experience with an anatomically shaped femoral stem - helitorsion stem -, we shall explain the concept of rotatory locking and present its advantages. The stem: forged titanium alloy; roughness 6.5 achieved with corundum treatment; conical proximally, cylindrical distally; double curvature in the sagittal plane; in the horizontal plane, replicates the natural helix of the femur -its main feature- HA coating (200 µm) over its proximal two-thirds. The stem is available in 10 sizes, right and left. Stem insertion: helicoidal motion along the long axis of the femur, and rotation in the horizontal plane. Rotatory

is mandatory. The stem is pushed down until the oval shape of the stem matches the oval shape of the femur - at each metaphyseal level - over a more or less extended height depending on the femoral morphotype; this horizontal locking prevents further downward motion. The absence of subsidence (as measured by Sutherland's method) and thigh pain (MDA; Harris) is documented in a prospective study of 100 consecutive helitorsion implants with one year follow-up, with no exclusion criteria relative to age, gender, morphology of the femur, bone density and aetiology. Fifty cases with a 5-year follow-up and identical tribological and acetabular features, have been analysed according to the criteria defined by Engh and Massin: presence of bony bridges in Gruen zones 3, 4, and 5; absence of dense reactive lines in zone 1 and 7. Radiological remodeling has been studied, based on the femoral morphotype according to Dorr: calcar atrophy, proximal osteopenia, and cortical thickening were less severe than reported in the published series with the same follow-up. This uncemented femoral stem yields remarkable clinical and radiological results. We think that this is attributable to helitorsion which ensures an even distribution of loads; and applies oblique and not perpendicular loads to the bone-implant interface.

THR: ACETABULAR COMPONENTS

P035
THE CAMBRIDGE ACETABULAR CUP - 2-YEAR ACETABULAR PERIPROSTHETIC BONE MINERAL DENSITY CHANGES WITH A NOVEL HORSESHOE SHAPED ACETABULAR CUP

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BACKGROUND. A novel, flexible, horseshoe shaped acetabular cup comprising a 3 mm-thick bearing surface of UHMPE and a 1.5 mm backing of 30% carbon fibre reinforced polybutyleneterephthalate (CFRPBT) was designed to reduce periacetabular stress shielding. The Youngs elastic modulus of CFRPBT is

similar to the natural subchondral bone. The cup deforms, when loaded, with the surrounding acetabular bone, loading the bone in a physiological manner. We measured the Bone Mineral Density (BMD) in the periacetabulum of implanted cups to test the design principle.

METHODS. BMD was analysed for 2 years (n=11, 5 HA coated, 6 non coated). Regions of interest were defined, according to De-Lee and Charnley (ROI I-III), for the acetabulum. BMD was compared with immediate post-operative values. Mean precision error (CV%) was $2.07 \pm 0.003\%$.

RESULTS: By 2 years the mean BMD in the HA coated cups was 0.74 gms/cm^2 representing a decrease of 7.5%. The mean BMD for the non HA coated cups was 0.72 gms/cm^2 , representing a 5.3% decrease. There was no statistically significant difference between the HA and non-HA cups. BMD fell in all zones at 6 months, with zone I and II then recovering to pre-operative values by 2 years. There was a significant decrease in the BMD measured in non-weight bearing zone III by six months which did not recover over the 2 years.

CONCLUSIONS. The results compare favourably with those published for metal backed acetabular cups. Changes in BMD measured reflect a pattern of reduced stress in zone III, with no significant stress reduction in the weight bearing zones I and II. The results support the underlying design principle of a flexible.

P036

LONG-TERM RESULT WITH CEMENTLESS FITEK CUPS

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Press-fit cups have given excellent clinico-radiographical results. The present clinico-radiographical study evaluated the long-term performance of a Ti-Al-V alloy cementless modular press-fit cups (Fitek™) having, on the outer surface, an oriented multilayer titanium mesh (Sulmesh™) with 65% porosity. We have reviewed the first 100 cups implanted in 92 patients with an average FU of 9.7 years (range 9-11 years). Results were evaluated with the Harris score.

We had 86 Excellent, 10 Good, 2 Fair and 2 Poor.

Etiology was not statistically correlated with post-op score.

Dysplastic patients showed inferior results compared to arthritics patients in different parameters, as pain, limp, ROM ($p < 0.05$), putting socks and shoes ($p < 0.05$). Radiographically, our cups were implanted in a fairly horizontal position (36.5° an average).

At the last FU radiolucent lines were present in 14% of the cases, never progressive.

In 6 cases we could calculate an eccentricity of the metal heads proving linear wear of the liner (average 2.7 mm).

In no case we found a change of position of the cup, and in this series no revision was necessary.

Fitek™ cementless cups gave excellent results at 10 years with complete stability and osteo-integration.

P037

TRIDENT CUP: EARLY RESULTS AND EXPERIENCES BASED ON 100 CASES

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The Authors report their experience with the new Trident cup in THR. They chose this particular cup because of its anatomical and hemispherical design that allows an almost anatomical load transfer to the pelvis, the material (rough large-grained surface titanium with HA coating), the great initial stability (peripheral fit of 1.8 mm), and intra-operative multiple options (polyethylene or ceramic bearings). From January 2002 to January 2004, 170 Trident cups have been implanted both in degenerative hips and in fractures. Clinical and radiological follow-up was obtained in the first 100 implants with at least one year follow-up in order to assess: 1) bone stock saving; 2) initial stability; 3) flexibility of the system. The results of the revision have underlined: 1) good bone-stock saving: the average diameter of the cup implanted was only 6 mm. greater than the removed femoral head; 2) good initial stability; no evidence of loosening; immediate postoperative weight-bearing in all patients; a further fixation with screws has been necessary only in 3 cas-

es out of 100; good bone ingrowth also in cases of coxa protrusa in which bony grafts were incorporated in the bottom of the acetabulum. 3) the couplings were: CoCr-polyethylene in 82/100, ceramic-polyethylene in 9/100 and ceramic-ceramic in 9/100. Only one patient needed revision surgery, 8 months after the first implant, for recurrent dislocations and was treated with the implant of a constrained bi-articular liner.

P038

CLINICAL AND RADIOGRAPHIC RESULTS OF A MODERN, CEMENTLESS MODULAR CUP DESIGN FOR TOTAL HIP ARTHROPLASTY. 4-TO 7-YEAR FOLLOW-UP

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First generation uncemented modular cups reproducibly fixed to bone but they were associated with unacceptable rates of pelvic osteolysis and mechanical failure. Consequently, second generation cups were developed with shells having a limited number of holes or no holes, and improved conformity and locking mechanisms with the liner. The purpose of this study is to report the clinical and radiographic results of a second generation acetabular component for primary total hip arthroplasty. 297 patients who underwent 335 consecutive primary total hip arthroplasties by a single surgeon with the Trilogy modular acetabular component were followed clinically with the Hospital for Special Surgery Hip Scoring System and radiographs, for 4 to 7 years. All cups were implanted with a press-fit technique. Ten patients were lost to follow-up and 16 died for reasons unrelated to the surgery, leaving 271 patients (with 308 hips) for analysis. One patient developed aseptic loosening of the cup and required revision (0.3%). There were 4 additional revisions: 2 for aseptic loosening of the stem, and 2 for deep infection. Among 271 living patients, 265 (98%) retained their prosthesis with a good or excellent clinical result. Complete radiographic follow up in 229 patients (with 292 hips), revealed that 259 cups were radiographically well fixed, and the wear of these cups aver-

aged 0.09 millimeters per year. Osteolysis was detected in 12 hips (4%) and was associated with male gender ($p=0.001$), and the annual wear rate. The extent of calcar resorption was associated with annual wear ($p<0.001$). This second generation acetabular cup design achieved predictable fixation and was associated with a low prevalence of revision for loosening and low prevalence of osteolysis at an intermediate follow-up.

P039

RADIOGRAPHIC FIXATION AND POLYETHYLENE WEAR IN TWO DIFFERENT GENERATIONS OF THE HARRIS-GALANTE CEMENTLESS ACETABULAR CUP

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BACKGROUND. Radiographic fixation and polyethylene (PE) wear performance of two different generations of the same cementless cup are compared.

METHODS. Eighty-three Harris-Galante I (HGI) (32 mm femoral head) and 93 Harris-Galante II (HGII) (28 mm) cups were analyzed. The average follow-up was 12.5±2.52 years for HGI and 7.8±1.53 for HGII cups. Radiographs were scanned and wear was estimated using a software package.

RESULTS. There were 2 loosened cups in the HGI (Kaplan-Meier: 96.9%) and one in the HGII group (98.3%) ($p=0.7107$); Four PE exchanges in the HGI cups (90.7%); and 3 PE dislodgments in the HGI (79.7%) and one in the HGII cups (97.9%) ($p=0.883$). Osteolysis occurred in 5 HGI and in 2 HGII cups, and was related with bedding-in (zero position) ($p=0.0062$), mean wear ($p=0.001$), and wear at the end of follow-up ($p=0.002$). Postoperative zero position was: 0.15±0.04 mm for HGI and 0.11±0.02 for HGII cups ($p<0.001$). Mean wear was: 0.13±0.23 mm/year for HGI and 0.11±0.09 for HGII ($p=0.740$). The mean time to the appearance of PE dislodgment (4 cases) was 117±60.3 months. The zero position was 0.15 mm for PE dislodgment and 0.13 mm for PE without dislodgment. The respective mean wears were 0.94 mm and 0.10 mm ($p=0.001$).

CONCLUSIONS. Radiographic stable fixation was found in most cups of both generations. Osteolysis was re-

lated with greater wear. The second generation cups show a decrease in the bedding-in process that led to less wear at the end of the follow-up, but they did not have a lower wear rate.

P040

NO MECHANICAL FAILURE OF A HA-COATED PRESS-FIT CUP IN PRIMARY TOTAL HIP ARTHROPLASTY FOR OSTEOARTHRITIS AND RHEUMATOID ARTHRITIS

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BACKGROUND. To evaluate the results of a novel modular press-fit acetabular cup in primary total hip arthroplasty (THA) for osteoarthritis and rheumatoid arthritis (RA). **METHODS.** From February 1996 to December 1999 in 381 patients (292 women, 89 men) 423 primary THA using a novel cup were carried out. The titanium shell is non-hemispherical on cross-section and has a hydroxyapatite coating on porous titanium for osseointegration. Diagnosis was: primary osteoarthritis (OA) 282, developmental dysplasia 26, posttraumatic arthrosis 33, avascular necrosis 6, inflammatory arthritis (mainly RA) 76. Average age at operation was 66 years (range 15-89). The patients were studied prospectively using Harris Hip Score (HHS), by measuring any radiolucency around the cup and by looking for signs of migration.

RESULTS. Median follow-up was 5.5 years. At follow-up, 35 patients had died and 4 were lost to follow-up. Revision for infection was carried out in 5 hips (3 low-grade infections). No loosening occurred with low-grade infection. Recurrent dislocations required revision of 2 cups. Only 1 cup in a RA patient with severe superior bone loss became unstable after a fall 4 months postoperatively. Survival with aseptic loosening of the cup as endpoint was 1 in OA and 0.98 in RA. In all 376 THA in follow-up the cup was functioning well, both clinically and radiographically. HHS increased from 44.5 preoperatively to 89.9 at follow-up.

CONCLUSIONS. Press-fit fixation using a modern acetabular component is an excellent treatment option in primary total hip arthroplasty both for osteoarthritis and rheumatoid arthritis.

P041

THE FIRST 145 UNCEMENTED TANTALUM ACETABULAR CUPS - SHORT-TERM CLINICAL OUTCOME AND PATIENT SATISFACTION FROM A SINGLE CENTRE

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BACKGROUND. Uncemented acetabular components are associated with significant incidence of polyethylene wear and secondary osteolysis. The new Tantalum/polyethylene composite (Hedrocel) acetabular component is designed to reduce the polyethylene wear and to increase the longevity of the acetabular cups. We report our short-term clinical outcome and patient satisfaction following uncemented Tantalum acetabular component.

METHODS. During 1999 to 2003, 145 uncemented Tantalum acetabular cups were implanted in 140 patients in our institution. The average age at operation was 58 years. All patients were assessed pre- and post-operatively with Oxford 12 item hip questionnaire and standard radiograph of the pelvis. At a mean follow-up of 27 months (range 12 - 48 months) 143 Hedrocel cups were assessed in 138 patients. Subjective patient's satisfaction was also assessed.

RESULTS. At the time of evaluation, 1 had died due to unrelated cause and 1 was excluded because of cerebral palsy. Five patients had bilateral acetabular cups implanted. The mean Oxford hip score improved from 45 preoperatively to 18 postoperatively. Radiologically, there were no signs of cup loosening or wear. Subjectively 98% were very satisfied or satisfied. Only 2 patients expressed dissatisfaction about the outcome of this surgery.

CONCLUSIONS. This study shows that at short-term, the new uncemented Tantalum/polyethylene composite (Hedrocel) acetabular component can yield a satisfactory clinical and radiological outcome and has a high patient's satisfaction. Although the short-term result from our centre is very encouraging, similar results from other centres and longer follow-up are required.

LONG-TERM SURVIVAL OF THR

P042

LONG-TERM RESULTS OF THE MEM STRAIGHT STEM PROSTHESES

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In 1991/1992 198 straight stem prostheses were implanted in our hospital. In 2003 we could evaluate 158 patients (e.g. 80%), 20% were died or lost for follow-up. The examination was done by a questionnaire sent to the patients, if necessary the interview was done by phone (80%). N=6 (4%) of the hips had become loose, the loosening seemed to be aseptic loosening. 96% were still functioning well 11, e.g. 12 years after the operation. The patients were more than 75 years old on average at the time of examination and of course had concomitant problems, restricting mobility caused by cardiac or neurological diseases or had disabling problems of other joints; nevertheless most of the patients had no or only slight problems with the operated hip. We found no difference between hybrid or fully cemented hips. The straight stem system provides excellent long-term results. It is a very versatile system with an excellent handling. The results show that greater length discrepancies can be avoided. Our results are comparable to those found in the literature, especially to the Swedish Hip Register.

P043

COMPARISON OF 10-YEAR SURVIVORSHIP IN TOTAL HIP ARTHROPLASTY USING ROUGH AND POLISHED CEMENTED STEMS WITH ESSENTIALLY THE SAME GEOMETRY

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OBJECTIVE. To review the 10-year results of 269, cemented total hip arthroplasties performed using matte surface finish Harvard femoral stem that is almost

similar to Charnley femoral stem.

DESIGN. Retrospective cross sectional survivorship study.
PATIENTS AND METHODS. We retrospectively reviewed the results of 269 cemented total hip arthroplasties performed using Harvard femoral stem in 257 patients (M:F, 93:164. Mean age 71.2 years) between 1990-1994. We also reviewed a group of 51 patients who had hip arthroplasty performed on the contralateral side using cemented Charnley femoral stem. Radiographs were reviewed to evaluate following parameters: type of osteoarthritis, cement mantle thickness, alignment of the components, presence of aseptic loosening and radiolucent lines. Kaplan-Meier survival analysis was performed to calculate the survival of Harvard and Charnley femoral stem using various end points. Cox proportional-hazard analysis was performed to evaluate the impact of various radiological parameters on the prosthesis survival.

RESULTS. Out of the 248 eligible patients (260 hips), 6 patients (7 hips) were lost to follow-up and 67 patients were dead at the time of the study. Thirty-six hips (35 patients) underwent revision surgery for aseptic failure (Median duration: 60 months, range: 12-125 months) and 11 hips were revised for septic failure (Median duration: 24 months, range: 10-53 months) from the index procedure. Femoral component was revised in all patients whereas acetabular component was revised in 27 patients. 10-year survival for the femoral and acetabular components using aseptic loosening (with and without revision surgery) as an end point was 77.5% (71.5%-83.5%) and 91.1% (87.2%-95%) respectively. Cox regression analysis did not reveal statistically significant ($p>0.05$) impact of various radiological parameters on survival rate.

The 10-year survival in the bilateral hip arthroplasty group for the Charnley femoral component (Median follow-up 138 months) and Harvard femoral component (Median follow-up 120 months) using aseptic loosening as an end point was 95.2% (92.4%-98%) and 77.2% (69.2%-85.2%) respectively.

CONCLUSIONS. Our results suggest that the matte surface finish femoral component has less satisfactory long-term survival rate compared to smooth surface femoral stem with similar geometry.

MINIMAL INVASIVE THR

P044

MINIMAL INVASIVE HIP REPLACEMENT WITH THE MAYO HIP SYSTEM

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BACKGROUND. In the last years increasingly younger patients need Primary-Hip-Replacement. Specially for these patients the so called Calcar-Prosthesis has been developed. By using these new systems we hope that in case of the first stem revision, we can use our so called standard hip prosthesis for these first revisions.

METHODS. In our hospital we have till now experience in more than 300 cases with the Mayo-Hip-Endoprosthesis-System. All these cases have been reported postoperatively in our hospital or with the help of our orthopaedic colleagues in the area. When using this new hip-endoprosthesis-system we have no problems with the implantation; in none of these cases was it necessary to change the prosthesis-system intraoperatively. The postoperative treatment of these cases is similar to our other hip endoprosthesis patients. We allowed all patients half weight bearing with using of two crutches. Postoperatively we have no problems with any migration of the stem component also in none of our cases we saw bone defects in the area of the calcar.

RESULTS. We reported all our cases according to the Harris-Hip-Score and we saw in all of the Mayo-cases good and very good results, maybe in some cases even better results than by using the so called standard hip prosthesis systems. The mean length of the skin incision is less than 8cm; in 95% of the cases no incision at the gluteal muscles was been necessary.

CONCLUSIONS. In conclusion, the Mayo-Hip-System is a good alternative being used on younger patients for the primary hip replacement. From our point of view there should be the possibility of some more prosthesis sizes and there can be some problems by using this systems in cases of coxa vara.

P045

MEDIUM-TERM RESULTS OF THE ACA HIP ARTHROPLASTY SYSTEM WITH A MINIMAL INVASIVE APPROACH

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BACKGROUND. Since 1994 the cementless AlloClassic-Additional (ACA) total hip replacement system is used in our department. The system consists of a spherical acetabular component with a self cutting thread and a conically straight stem with a rectangular cross-section. Both are made of titanium with a microporous surface. We have checked the medium-term results of our primary total hip arthroplasties in a prospective study.

METHODS. The ACA prosthesis has been used as a complete system through a minimal posterolateral approach in 1531 primary total hip replacements. We were able to follow 1337 cases clinically and radiologically. To receive the medium-term results we have included 874 cases with a minimum follow-up of five years.

RESULTS. The Harris-Hip-Score improved from 41 points preoperatively, to 92 points postoperatively in a follow-up time between 60 to 115 months. Clinical results were graded 94% as excellent and good, fair in 5% and poor in 1%. Revision with change of prosthesis components was necessary in two septic cases, one recurrent instability, one aseptic loosening of the stem and six of the acetabular cup.

CONCLUSIONS. The medium-term results of the ACA total hip replacement system show encouraging results with good osteointegration and low complication rate.

P046

MINI INCISION VERSUS POSTEROLATERAL APPROACH IN TOTAL HIP ARTHROPLASTY. PRELIMINARY REPORT

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BACKGROUND. Mini incision total hip arthroplasty (THA) has been used progressively to diminish morbidity and

improve recuperation without new complications.

METHODS. The purpose of this prospective study is to present our preliminary results in a series of 60 patients operated through a mini incision posterolateral approach (G I = 34 patients) and compare it with a control group of patients of similar conditions operated through a standard posterolateral approach (G II = 26 patients).

RESULTS. The length of the incision was 8 cm average in G I and 20 cm average in G II. There was no statistical difference between both groups in blood loss and complications. The center of rotation was lateralized 4.4 mm in GI compared to 2.1mm in GII ($p = 0.01$). Operating time was shorter in the mini incision group (G I = 88.3 min., G II = 101.1 min., $p = 0.01$). Hospital stay was shorter in the mini incision group (G I = 2.8 days, G II = 3.9 days, $p = 0.05$).

CONCLUSIONS. In this study, THA through mini incision proved to be a safe procedure that diminished operating time and hospitalization days.

RESURFACING ARTHROPLASTY

P047

THE EARLY RESULTS OF THE BIRMINGHAM HIP RESURFACING ARTHROPLASTY

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BACKGROUND. The incidence of younger people requiring arthroplasty is on the rise. Metal-on-metal Hybrid hip resurfacing arthroplasty is an exciting alternative to conventional arthroplasty in young active patients where preserving bone stock is important.

METHODS. All patients with a hybrid Birmingham hip resurfacing arthroplasty (cemented femoral component and a hydroxyapatite coated press fit acetabulum) from 1997-2001, operated by the senior surgeon between 1997-2000 were followed up with serial. The pre- and post-op Harris hip scores, patient satisfaction and radiological changes were recorded.

RESULTS. There were 36 patients, aver. follow-up 17.2 months, the aver. age was 52. Except for 2 patients with femoral neck fractures which required revision there were no other significant complications. Both

these patients had a notched femoral neck intra operatively. There were no revisions for aseptic loosening. The average preop and postop Harris hip scores were 45.5 and 92.1 respectively. There were no radiological signs of loosening. Ninety-three % said they would recommend it to others, 93% rated the surgery as being excellent to good and 96% returned to normal or near normal level of activity.

CONCLUSIONS. We feel that Conservative Hip arthroplasty with resurfacing of the femoral head is an attractive concept particularly in younger patients. The advantages are preservation of bone stock, non violation of the proximal femur, reduction of stress shielding in the proximal femur and it is quite physiological. The implant is less forgiving and the learning curve is steep. The ultimate usefulness can only be gauged once longer follow-ups are available.

P048

REHABILITATION AFTER HIP RESURFACING? IT IS SLOWER THAN IT LOOKS

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BACKGROUND. It is said that hip resurfacing arthroplasty (RA) is an operation that is suitable for the younger osteoarthritic population, allowing them to rehabilitate more rapidly and to be more functionally active than an older population for whom a total hip replacement (THR) might be advised. Yet is this true?

METHODS. We thus compared 34 consecutive resurfacing arthroplasties (33 patients) with 34 consecutive total hip replacements (34 patients) and looked specifically at postoperative pain levels, speed of rehabilitation and length of hospital stay. Data were gathered prospectively but analysed retrospectively. A rehabilitation score (maximum 20 points) was used.

RESULTS. In keeping with standard practice we found that RA patients were significantly younger than THR patients (mean 53 years for RA, 62.5 years for THR; $p < 0.0001$). However, there was no significant difference in the rehabilitation score at any stage during the postoperative recovery between the two groups and the mean rehabilitation score on discharge was identical (19.5). Neither postoperative pain, nor the

length of hospitalisation were significantly different between the two groups.

CONCLUSIONS. We thus conclude that, although RA may have advantages in terms of the preservation of bone stock, it has no advantage over total hip replacement in speed of postoperative rehabilitation. This is despite the younger mean age of patients who underwent RA in our study, individuals who might reasonably be expected to mobilise most rapidly. Speed of rehabilitation should therefore not be given as one reason for undertaking hip resurfacing arthroplasty.

P049

COMPARISON OF OFFSET IN BIRMINGHAM HIP RESURFACING AND HYBRID TOTAL HIP REPLACEMENT

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BACKGROUND. Hip resurfacing is being performed with increasing frequency in the UK, in patients who would otherwise undergo total hip replacement. Possible benefits of resurfacing include more accurate restoration of hip biomechanics, as assessed by leg length, femoral offset and femoral anteversion. This study tests the hypothesis that hip resurfacing does not restore normal hip biomechanics more accurately than hybrid total hip replacement.

METHODS. We have analysed AP radiographs from a cohort of 26 patients undergoing hybrid total hip arthroplasty (uncemented cup/cemented stem), and 28 patients undergoing Birmingham Hip Resurfacing (Midland Medical Technology). All operations were performed by the same experienced resurfacing surgeon using an identical posterior approach. We have measured post-operative femoral offset, femoral length, acetabular offset and acetabular height, referencing off the normal contra-lateral hip. In order to assess intra-observer and inter-observer variation, 10 randomly selected sets of radiographs were measured independently on two occasions by two of the researchers. Pearson correlation coefficients were between 0.77 and 0.99 representing good and excellent correlation. Further analysis was therefore appropriate.

RESULTS. Statistical analysis was performed using an unpaired t-test. The results show significant reduction in femoral offset in the resurfacing group ($p=0.018$) and a trend towards femoral lengthening ($p=0.06$). In the total hip arthroplasty group, there was significant reduction in the acetabular offset ($p=0.012$), but with accurate restoration of femoral offset and overall leg length.

CONCLUSIONS. This study does not support the claims that resurfacing more accurately restores hip biomechanics, when compared with hybrid total hip arthroplasty.

P050

DEVELOPMENT OF THE BIRMINGHAM HIP RESURFACING 'IS THIS AS GOOD AS IT GETS?'

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In young and active patients with end-stage arthritis, the Birmingham Hip Resurfacing Device is proving to be very successful. The return to high levels of activity made possible after this procedure reflects the restoration of the biomechanics and physiology around the hip joint. The Birmingham Hip Resurfacing is based on the cumulative evidence of historic metal-on-metal replacements from the 60s, and the lessons learned from experiences with hip resurfacing in the 80s. A better understanding of the mechanisms of lubrication from the 90s provided the scientific basis that confirmed our beliefs. Advances in precision component manufacturer have added the finesse that was needed to make it a success. Finally the results of patients who continue to be satisfied with metal-metal resurfacings nearly 10 years on provide the proof. Will the device outlive the patients or will they fail at a later stage with some hitherto unknown failure pattern? If and when and how the device will fail - only time will tell ... But as one young patient with an early prototype resurfacing put it at his 10-year follow-up, "Even if the resurfacing fails at some stage in the future, the 10 quality years that I have had, are reasons enough to justify my operations and I can still have a replacement if it fails".

NAVIGATION IN THR

P051

ACCURACY OF IMAGE-FREE CUP NAVIGATION - AN ANATOMICAL STUDY

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INTRODUCTION. The position of the acetabular cup is decisive for the function of a total hip replacement (THR). Correct placement of the cup in THR with the conventional surgical technique often fails due to lacking information about pelvic tilt. With CT-based and fluoroscopically-assisted navigation procedures the accuracy of implantation has significantly been improved. However, the acceptance of these techniques is poor owing to the additional exposure to radiation, high costs and the increased time involved.

METHODS. An alternative navigation procedure, image-free navigation, was evaluated concerning its accuracy in an anatomical study. This method requires only a few additional steps, does not cause substantial delay of surgery and does not need additional imaging.

RESULTS. Press-fit-cups were implanted in 10 human cadaver hips using the image-free navigation system and the positioning of the cups was intraoperatively checked by a CT-based navigation system and post operatively checked by computed tomography of the hips. All cups were implanted within the aimed safe zone (45 ± 10 for inclination and 15 ± 10 for anteversion) with an average inclination of 44 (range 40 - 48, SABW 2.7) and an average anteversion of 18 (range 12-24, SABW 4.1). Analysis of precision of the image-free navigation software showed only a small deviation in terms of cup anteversion and cup inclination when compared with the CT-based navigation system and the cup position measured using post-operative ct-scans.

CONCLUSION. The evaluated image-free navigation system appears practicable in clinical routine and, in particular, a reliable alternative for the computer-assisted implantation of cups in THR.

P052

ARTICULAR STABILITY CONTROL WITH COMPUTER NAVIGATION IN HIP SURGERY: CT-LESS NEW STRATEGIES

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BACKGROUND. The advantages brought about by computer assisted surgery are, from a theoretical viewpoint, undisputed. The high cost-benefits of navigation based on CT scan for T.H.A. have affected, in our experience, the chance for this method to be used in ordinary, standard surgical activity. However it has enriched our knowledge of biomechanics and 3D hip planning by representing a useful support-device in complicated cases of prosthetic surgery. CT-less navigation obviously inverts the cost-benefits relation, not only in economical terms, as it is virtually cost-free, but above all by generating further information which benefits the surgeon in an easy, direct and efficient way.

METHODS. At our centre we have therefore started a clinical experiment using the method carried out by the company ORTHOSOFT and substantially based on similar principles to those already used in CT-less knee navigation. This method enables us to gather landmarks for the orientation of femoral and acetabular components and to juxtapose them by respecting or clearly modifying the centre of rotation with intra-operative re-planning. In addition this results in a chance to carefully check the limb's dysmetria matter.

RESULTS. Preliminary results are encouraging, the goals as planned have been achieved. Software refining and standardisation of surgical manoeuvres will enable surgical time to be contained.

CONCLUSIONS. Looking towards the future, CT-less navigation could constitute an effective device to further elevate the qualitative standards of prosthetic hip surgery.

P053

EXPERIENCE WITH CT AND FLUORO-BASED SURGICAL NAVIGATION FOR THR

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The incidences of wear, dislocation, and impingement following total hip arthroplasty are directly related to component positioning. Surgical navigation offers the opportunity to improve component position. The current study reviews the experience of computer-assisted acetabular component insertion in 163 THA. Eighty-one were navigated using fluoroscopy and 82 using CT. Using fluoroscopy, only cup abduction was navigated since obtaining multiplanar fluoroscopic images was felt to be too time consuming. Two AP fluoroscopic images were obtained and a horizontal line was drawn between the teardrops. Cup abduction was navigated during insertion, aiming for 41 degrees. With CT-based navigation, intraoperative registration was achieved using two fixed points and 12 surface points. Cup position was aimed for 41 degrees of abduction and 28 degrees of anteversion. Post-operatively, cup abduction was measured on the AP pelvis view. Cup position was compared to a series of patients with the same surgeon and same implants without navigation. In the navigated hips, cup abduction averaged 40.9° (35-49°, SD 2.2°). In the non-navigated hips, cup abduction averaged 42.8° (26-55°, SD 4.7°). There was no statistical difference in cup abduction between the fluoroscopic and CT-based procedures. None of the 248 hips dislocated. The use of image-based navigation during total hip arthroplasty improves acetabular component position. Improved component positioning offers the potential to improve the incidences of wear, instability, and prosthetic impingement.

SPECIAL INDICATIONS FOR THR

P054

TOTAL HIP REPLACEMENT IN SEVERE HIP DYSPLASIA AND DISLOCATION OF THE HIP. COMPARISON OF TWO GENERATIONS OF SPECIAL CDH HIPS (MEM-CDH VS. WAGNER-CONE-PROSTHESIS)

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Between 1991 and 2003 we implanted 85 MEM CDH and 79 Wagner-cone-prostheses. In the follow-up we rated the hips in patients with severe hip dysplasia or congenital dislocation. Forty-nine of a total of 56 hips with a mean follow up of about 7 years (range 5.5 to 11y) got a MEM CDH type - fully cemented or in hybrid combination. Fifty-eight of a total of 65 with a mean follow-up of 3 years (range 1-4.5 y) got a Wagner-cone prosthesis which had a cementless fixation. All hips pre-operative had a Efthekar type 1 up to type 5 dysplasia or dislocation. All patients with the MEM CDH-prostheses as well as those with the cone-prostheses rated the results as good or excellent. In none of the two groups we found a loosening; in both groups previous operations in the acetabulum and/or proximal femur did not influence the results. The good or excellent clinical results in both groups mainly seemed to be influenced by the low mean age of the patients. Both systems are highly adapted to the special shape of the proximal femur in CDH, dislocated hips and previous surgery hips. The cone stem and its special design seems even to be more versatile than the CDH stem. Mid- or long-term results of the cone stem in CDH are missing up to now.

P055

TOTAL HIP ARTHROPLASTY USING MEDIAL PROTRUSION TECHNIQUE FOR RECONSTRUCTION OF ACETABULAR DYSPLASIA: PRELIMINARY RESULTS

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BACKGROUND. Thirty-two hip replacements were per-

formed in thirty consecutive cases with dysplastic osteoarthritis between 2001 and 2003.

METHODS. In none of the patients an augmentation with bone or cement of the superolateral aspect of the acetabulum was made. According to Crowe's criteria the dysplasia was evaluated as type I (19); type II (11); type III (3). The size and localization of the true acetabulum were evaluated using Ranawat's triangle on a weight-bearing preoperative X-ray. Clinical appraisal of the joint was done preoperatively, at the sixth, twelfth and thirty-six month postoperatively by the scheme of Merle d'Aubigne and Postel modified by Charnley. In 29 cases the surgery was performed via lateral transgluteal approach of Hardinge-Mülliken. In all cases the medial wall was perforated with reaming and the medial periosteum was torn to visualize the iliacus muscle.

RESULTS. One to three-year postoperatively clinical results showed significant improvement: in 28 joints excellent and very good results; in 5 joints good results. The medialization of the acetabular component is found to be 5.7 ± 2.8 mm average values. X-ray evidences for medial migration of the acetabular component and early loosening were not found. One joint dislocated 24 days after the replacement despite the resection of anterior inferior iliac spine.

CONCLUSIONS. When precisely planned the medial protrusion technique without cement fixation of the acetabular component is a good alternative for arthroplasty in dysplastic hip joint. Particular attention must be paid in preserving enough thickness of the anterior and posterior acetabular walls during the reaming process. The perforation of the medial wall must not exceed 25-30% from the surface, because of plain risk of protrusion of the component beyond the teardrop figure of Köhler.

P056

TOTAL HIP REPLACEMENT AFTER A PREVIOUS INTERTROCHANTERIC OSTEOTOMY, A LONG-TERM FOLLOW-UP

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BACKGROUND. The multidirectional intertrochanteric

osteotomy (ITO) remains a valid surgical treatment option for the relatively young patient. Failure of the osteotomy or progression of the OA may eventually necessitate a Total Hip Replacement (THR). We present the long term results of a group of 121 THR, performed after a previous ITO and used a control group of 290 primary THR.

METHODS. Between 1974 and 1993, the senior author (RKM) implanted 121 THR after a previous ITO, in 108 patients at an average age of 62.7 years. The average time between the ITO and THR was 9.5 years. Osteoarthritis secondary to acetabular dysplasia was the most frequent indication in this group (77 patients, 64%). During the same period 290 primary THR (253 patients) were done at an average age of 68.9 years. There were no statistical differences between the two groups apart from a higher percentage of OA caused by acetabular dysplasia in the THR after ITO group.

RESULTS. For THR after a previous ITO, a 10 year survival of 93% and a 15 year survival of 86% was reached. In the control group, a 10 year survival of 92% was reached, with 83% survival at 15 years. In the group that received THR after an ITO, we found a significantly higher number of greater trochanter osteotomies, femoral cracks and fractures of the greater trochanter. All these complications resolved completely. No statistically significant difference was present in the overall complication rate.

CONCLUSIONS. Although THR after previous intertrochanteric osteotomy can be a more challenging procedure, our study shows that the long-term results are comparable to the results of a primary THR.

P057

CEMENTLESS THP IN ELDERLY PEOPLE

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A series of 30 total hip arthroplasties was performed using a non cemented press-fit prosthesis in 1999 and 2000. The mean age was 78.5 years; 8 patients affected by femoral medial neck fractures and the other by arthrosis or revision. All the patients were available for clinical and radiological examination at minimum follow-up of 3 years. The mean Harris hip score

at final follow-up was 85.5. During the rehabilitation two patients had a dislocation (2 months after surgery), one a superficial infection and two a TVP. Radiological analysis showed that 28 stems had no measurable subsidence, 2 had less than 2 mm. In two cases we used a femoral circle wire and in all the cases we have a good mechanical stability.

P058

TREATING HIGH DISLOCATION IN ADULT HIP. CASE REPORT

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BACKGROUND. Young woman with a dislocated hip and a gross limb-length discrepancy who wishes to improve her appearance.

METHODS. Treated in her 25th year with a custom-made THR in a two-step procedure.

RESULTS. Today, 31 years old (she got married meanwhile) with a job and a family to care about, we assess the clinical and radiological outcome.

CONCLUSIONS. A gratifying improvement in her self-regard and life-style.

P059

DOES DEGREE OF DYSPLASIA AFFECT OUTCOME FOLLOWING HIP ARTHROPLASTY FOR DEVELOPMENTAL DYSPLASIA OF THE HIP?

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BACKGROUND. Developmental dysplasia of the hip (DDH) is a recognised cause of degenerative arthritis in young adults. Degree of complexity of surgery is related to the degree of dysplasia. This study was designed to investigate whether degree of dysplasia, and therefore complexity of surgery, effects outcomes of hip arthroplasty.

METHODS. Fifty primary hip arthroplasties in 45 patients with DDH were reviewed. Follow-up ranged from 1 to 8 years, with the mean length of time being 2.8 years. Hips were graded according to pre-operative x-ray appearance into three grades, grade I (dysplastic,

n=22) grade II (subluxed, n=23) and grade III (dislocated, n=5). Pain and function were assessed using a simple scoring method in all patients both pre-operatively and annually at follow-up.

RESULTS. We demonstrate a significant improvement in function score ($p < 0.01$), and significant reduction in pain score ($p < 0.01$) following arthroplasty. Importantly, we show that level of clinical improvement is not related to the degree of pre-operative dysplasia. This is maintained in the medium-to-long-term post-operative period.

CONCLUSIONS. We conclude that despite the increased complexity of surgery needed for increased grade of dysplasia, outcomes from arthroplasty are not affected.

P060

SURGICAL TREATMENT OF CONGENITAL ILIAC DISLOCATION OF THE HIP WITH TWO-STAGE PROGRESSIVE LOWERING AND THR

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BACKGROUND. Nowadays Iliac Congenital dislocation of the Hip (Grade IV of CROWE) is luckily a very rare condition. In these cases, Total Hip Replacement for degenerative arthritis can be technically very difficult.

METHODS. In the last 9 years, in dysplastic cases we have used the following protocol: 1) in CROWE Grade I and II we perform a single-stage THR in a routine manner; 2) in CROWE Grade III we perform a single-stage operation with intra-operative "wake-up" test to control sciatic nerve function; 3) in CROWE Grade IV we use an original two-stage procedure with progressive lowering of femoral epiphysis followed by THR. The first stage consists in a fascio-mio-arthrolysis (Adductor's tenotomy, gluteal fasciotomy, psoas' Z-lengthening, capsulectomy, femoral head resection) and application of an external fixator (3 pins in the ilium and 3 in the femur). Then we start a progressive lowering of the femoral epiphysis (about 1.5-2 mm/day) until the femoral neck is in the right position to allow a THR (usually after 2-3 weeks). We have used this technique in 7 cases (2 females and 4 males, 1 bilateral).

RESULTS. The average limb lengthening was 6.1 cm. In all cases the cup was placed in the paleo-acetabulum. Excellent and good results were 86%. No major complications were observed.

CONCLUSIONS. Two-stage progressive lowering and THR seems a valid option in the treatment of severe congenital high dislocation of the hip.

P061
CUSTOM FEMORAL STEMS IN OSTEOPETROSIS. DEVELOPMENT OF A GUIDING SYSTEM FOR PREPARATION OF AN INTRAMEDULLARY CAVITY. A CASE REPORT

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BACKGROUND. Insertion of femoral stems in hip replacement in patients suffering from osteopetrosis has been reported to be extremely difficult since obliteration of the intramedullary cavity of the femur and increased hardness of the bone prevent a well controlled reaming of the cavity. Hence we developed a method that could secure a safe insertion of a femoral component in such patients.

METHODS. A 32-year-old woman affected by benign autosomal dominant osteopetrosis presented with severe complains due to osteoarthritis of both hips. CT revealed an extreme density of the bone of both femurs, and almost complete obliteration of the intramedullary cavity. Free-hand reaming of a cavity suiting a standard prosthesis would carry a considerable risk of penetration and fracture of the femur. Hence we developed a CT-based uncemented custom component and a guiding device for preparation of a suitable cavity. Clamps fitting exactly to the circumference of the proximal femur at defined levels were made by CNC-machining to secure a correct position of the device. A block with channels for various drill bits guided the preparation of the cavity for the prosthesis. A custom broach was then used. The two hips were operated within a period of 6 months.

RESULTS. In both hips the method enabled uncomplicated insertion of a prosthesis with an accurate fit.

One year following the first operation the patient had an excellent clinical result. X-rays showed no signs of loosening.

CONCLUSIONS. The presented method secures a safe insertion of a femoral component of adequate size and geometry in femurs with an obliterated intramedullary cavity.

COMPLICATIONS OF THR

P062
PENETRATION OF THE HEAD OF A FEMORAL PROSTHESIS THROUGH THE METAL ACETABULAR SHELL IN HARRIS-GALANTE TYPE-1 PROSTHESIS

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CASE REPORT. A 33-year-old male underwent bilateral total hip replacements for ankylosing spondylitis at a hospital in Pakistan. Porous coated uncemented Harris-Galante Type-1 acetabular and femoral prostheses were used. Five years after the primary arthroplasty, the patient complained of increasing pain in the right hip and inability to weight bear. Clinical and radiological assessments of the right hip showed confirmed protrusion of the femoral head from the acetabular shell and attempts at closed reduction were unsuccessful.

The prosthetic femoral head had penetrated the metal acetabular shell through a 28mm diameter hole and the soft tissues and the cancellous bone were heavily stained with blackish metallic debris. The liner had dissociated from the shell. Acetabular floor was successfully reconstructed using bovine bone (Tutoboneä, Wescott-Medical).

DISCUSSION & CONCLUSIONS. Liner dislodgement in the Harris-Galante Type-I and the Type-II modular acetabular component has been attributed to an inadequate locking mechanism. But such a complication has not been reported.

The absence of a radiographic marker in the polyethylene liner of the Harris-Galante cup makes radiological detection of displacement difficult. Broken tines are not always seen on plain radiographs. Ear-

ly diagnosis of liner dislocation is important. Younger and more active patients may be prone to this complication. We recommend that patients with Harris-Galante cups or other modular designs should have long-term follow-up with regular clinical and radiological assessments. Modular acetabular components should have secure locking mechanisms and radiographic markers in the liner to make early detection of liner dislocation straightforward.

P063
ASYMPTOMATIC HIP DISLOCATION DISCOVERED INCIDENTALLY

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CASE 1. A 63-year-old lady had an uncemented primary total hip replacement of the left hip for osteoarthritis in 1993. She made an uneventful recovery post-operatively. This lady had no neurological abnormality and was mobilising independently. Eight years later, dislocated hip prosthesis was discovered on plain pelvic radiograph, which was carried out in investigation of lower abdominal pain.

CASE 2. This 75-year-old lady, had right hip arthroplasty carried out in July 1990 for osteo-arthritis and made an uneventful recovery. She too did not have any neurological abnormality and was mobilising independently. Dislocated prosthesis was discovered on plain pelvic film 11 years later, during a routine pre-operative work-up for the left hip (the other hip) arthroplasty.

DISCUSSION. Late dislocation is more common than was thought previously. It can occur in association with a long-standing problem with the prosthesis that manifests late (such as malposition of the implant or recurrent subluxation), it can occur in association with a new problem (such as neurological abnormality, trauma or polyethylene wear), or it can occur in association with combination of these factors.

Both these patients were mobilising independently and did not suffer from any neurological abnormality. They had not experienced any problem with the hip replacement and discharged. The hip dislocations were discovered incidentally.

These cases emphasise the need for long-term clinical and radiological follow-up in hip arthroplasty pa-

tients as hip dislocations can be asymptomatic and not detected by clinical examination. Radiological review alongside evaluation using scoring systems is recommended.

P064
REDUCED DISLOCATION RISK USING THE LATERALIZED SL-PLUS TOTAL HIP FEMORAL COMPONENT

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Restoration of femoral offset is essential for successful total hip arthroplasty. Due to variations in anatomy, femoral components with a single offset or with offset proportional to component size do not always restore the patient's pre-surgical femoral offset, often leading to instability, dislocation, or the need to excessively lengthen the leg to achieve stability.

On April 1, 2002, the lateralized SL-Plus femoral stem became available for use by the author. Between April 1, 2002 and July 30, 2003, 216 consecutive primary total hip arthroplasties were performed using the SL-Plus stem through a posterior mini-incision surgical approach. Seventy-nine of these arthroplasties utilized the lateralized stem (37%). Indications for use of the lateralized stem were: 1) varus femoral neck, 2) narrow, funnel-shaped canal requiring use of a small prosthesis, and 3) intra-operative instability due to soft tissue laxity.

After a minimum 6-month follow-up period, 1 patient receiving a standard offset SL-Plus stem dislocated anteriorly (0.5%), but was treated successfully without surgery. There were no posterior dislocations. None of the lateralized stems dislocated. All post-operative leg lengths were within 5mm of the unoperated hip based on radiographic measurements.

In the 6 years preceding April 1, 2002, the author implanted 441 consecutive standard offset SL-Plus femoral components. Twenty-four patients dislocated (5.4%, $p < 0.01$).

More than half of these patients had inadequate restoration of femoral offset based on post-operative radiographic measurements.

Restoration of femoral offset using the lateralized SL-Plus femoral component reduces the risk of dislocation after total hip arthroplasty.

P065

ANALYSIS OF MECHANICAL COMPLICATIONS IN NONCEMENTED HIP REPLACEMENTS

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At the Department of Orthopaedics in Osijek Clinical Hospital more than 1450 replacements have been performed since 1981. In this study our experiences with the noncemented hip replacements (type Duroloc-Corail) is presented. In the last three years we carried out 102 implantations of noncemented hip endoprostheses in 62 women and 40 men of average age 56.80 ± 10.13 . On the radiographs of total hip endoprostheses the positions of acetabular and femoral components of implanted endoprostheses were measured. The decline of implanted acetabulum was on average 46.92 ± 8.63 degrees (from 29 to 85). In 73.5% of patients the angle of acetabular decline ranged from 36 to 55 degrees. Primary fixation with cancellous screws was performed in 28.4% patients. The position of endoprosthetic shaft was neutral in 69.6% of patients, in 21.6% of patients it had varus position, while 9.8% of them had valgus position of the stem. The acetabulum was covered completely in 64.7% of subjects, while it is uncovered in 35.3% of subjects. The uncovered region in these cases was on average 7.53 ± 3.64 mm (range, 2 to 14 mm). Although the follow-up time of our patients is relatively short, it may be concluded that the type of noncemented hip endoprosthesis we have used yield quite satisfactory results.

P066

MALIGNANT TUMOURS AT THE SITE OF TOTAL HIP PROSTHESIS. ANALYTIC REVIEW OF 46 CASES

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AIM. The aim of this study was to characterize malignant tumours at the site of total hip arthroplasty (THA) and find out possible risk factors.

MATERIAL AND METHODS. In 1974-2003 total of 46 cas-

es of malignant tumours at the site of THA; 41 sarcomas, 4 lymphomas and 1 epidermoid carcinoma has been reported in the Western literature.

Local sarcoma incidence of THA patients (2.5/100 000 person years) was estimated from Nordic cohorts of THA and from the Scandinavian Sarcoma Group Registry (33.7% of sarcomas at the site of thigh and femur). Total number of person years for THA patients in Finland in 1974-2003 (620,000 years) was calculated from the Finnish Endoprosthesis Registry.

Demographic data of the 46 cases were compared to those in Finnish and Swedish Endoprosthesis registries. **RESULTS.** The size of a population to produce these sarcomas in Finland 1974-2003 is 2.7 fold (13 million) compared to the population of Finland. The true population behind the cases is probably much bigger. One local sarcoma was noted in three Nordic cohorts of cancer and THA with 268,189 person years (over 6 sarcomas expected).

The age of cancer patients (mean 60.3) was significantly lower ($p=0.000$) than that in Nordic registries, but gender, preoperative diagnosis and number of revisions had no significant differences. Four cases were preceded by a precondition of cancer. The mean latent period was 6 (0.5-20) years from the first operation.

CONCLUSIONS. Number of the reported cases is low compared to that expected. The risk of local cancer after THA is insignificant.

P067

PUMPING OF FLUID IN HIPS WITH ACETABULAR COMPONENTS AND HOLES

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BACKGROUND. Retroacetabular osteolysis is a common cause of failure of total hip replacements. Transportation of fluid and particles from the joint is evidenced by the presence of polyethylene debris in retroacetabular osteolytic lesions. We investigate three theories that describe how fluid and debris could be pumped

from the joint space through the holes in the shell to the retroacetabular bone.

METHODS. We report 3 experiments that investigate this question. An *in vivo* study where we measured an increase in pressures in contained osteolytic lesions with loading of the hip; a biomechanical study, where we model piston pumping and diaphragm pumping of the polyethylene liner within the metal shell; and a finite element analysis of a pelvic osteolytic lesion showing how the fluid pressure changes with loading.

RESULTS. The *in vivo* study demonstrates that there is a pumping mechanism that is independent of hip joint pressure. In the diaphragm pumping experiment, the pressure produced by the non-congruent liners (4030 ± 1250 mmHg) was 6 times the pressure produced by the congruent liners (670 ± 240 mmHg). In the piston pumping experiment, the pressure produced by the pistoning liners (5140 ± 330 mmHg) was 8 times the pressure produced without pistoning (650 ± 300 mmHg). FEA demonstrates that loading of the hip may change the volume (and pressure) in an osteolytic lesion.

CONCLUSIONS. The prosthetic hip contains a complex system of pumps transporting fluid and particles and generating pressures. The importance of each pumping mechanism varies with patient activity and with implant design features. These pumping mechanisms may contribute to the pathogenesis of osteolysis.

P068
EARLY CEMENT EXTRUSION AFTER PRIMARY TOTAL HIP ARTHROPLASTY

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CASE. A 58-year-old man underwent a primary cemented total hip replacement (THR) for Osteoarthritis of his left hip. Routine postoperative x-rays after surgery showed a tortuous radio-opaque tubular shadow within the soft-tissue, posterior and medial to the femur, near to the tip of the prosthesis. This was the posterior distal cement extrusion (PDCE). PDCE is not associated with intra-operative or post-operative complications, even though there are certain theoretical risks. It is suggestive of escape of low-viscosity cement out of the vascular channel, more than, as it appears to be, too-successful pressurization.

SIGNIFICANCE. It is important to distinguish this complication from the more serious femoral cortical defect, which can be created during surgery. With cortical disruption, either by perforation with a broach or by spiral fracture of the femur, the volume of cement extruded is relatively massive and located broadly along the femur. In broach perforation, the cement is usually seen anteriorly because of the anterior bow of the femur.

PDCE, by contrast, is a tortuous small volume of cement located in the posterior soft tissues on the lateral radiographs.

CONCLUSION. To date, PDCE has been a benign process from the patient's perspective, but its main importance lies in distinguishing it from an iatrogenic femoral cortical defect.

BONE CEMENT

P069
THE INFLUENCE OF THE INSERTION TECHNIQUE ON THE CEMENT MANTLE AROUND A HIP STEM

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PURPOSE. The aim of this experimental study was to evaluate whether a centralizer or overreaming improves the thickness of the cement mantle around a hip stem.

METHODS. Three different insertion techniques were used:

Technique 1:

The reamer had the same size as the planned prosthesis. Depending on the stem size an overreaming of 0.9 to 1.1 mm per side was achieved.

Technique 2:

The reamer was chosen one size bigger than the planned stem. Depending on the stem size an overreaming of 1.9 to 2.3 mm anteriorly and posteriorly and 1.5 to 1.8 mm medially and laterally was achieved.

Technique 3:

The hip stem was prepared with 1 mm thick, hemispherical centralizers at three levels of the stem on each side. The femur was prepared similar to tech-

nique 2. A total of 9 human cadaver femurs were implanted a cemented, straight hip stem with a 3rd generation cementing technique. Three femurs were used for each insertion technique.

After the stems were cemented each femur was cut into 6 slices rectangularly to the stem's longitudinal axis. The thickness of the cement mantle of each slice was measured at 72 locations around the prosthesis. RESULTS: Insertion technique 3 was superior compared to technique 1 and 2. With technique 1, 49% of the measured cement mantle was less than 2 mm thick, with technique 2, 33% and with technique 3, 26%.

CONCLUSIONS. A sufficient cement mantle around a stem seems to be achieved by centralizers. Overreaming the femoral canal seems not to be that efficient compared to the application of centralizers.

P070
TEMPERATURE AT THE CEMENT BONE INTERFACE AND VARIATION WITH STEM PRE-HEATING

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BACKGROUND. Component heating was first proposed as a method to reduce the curing time of bone cement (1). This practice has been found to reduce the porosity at the stem-cement interface (2) and, consequently, to improve its strength (3).

METHODS. This *in vitro* study investigated the effect of component heating on the temperature gradients generated within a 2mm Simplex P (Howmedica) cement mantle surrounding a size 3 Exeter stem (Howmedica). The model femora used for this study were maintained at a constant temperature of 37 °C while the stem temperature varied between 23, 37 and 44 °C. The temperature gradients were recorded in real time as the cement was curing by means of six thermocouples: two of which were mounted proximally, one on the stem and one on the femur, two were in the mid stem position and two were mounted distally. The room temperature remained constant at 23 °C throughout the tests.

RESULTS. Pre-heating the stem increased the maxi-

mum curing temperature of the cement at the stem-cement interface by 7 °C in the case of components heated to 37 °C and by 10 °C if the component was heated to 44 °C. Both these results were found to be statistically significant. A significant increase in the maximum temperature, by 8 and 10 °C, respectively, was also noticed at the bone-cement interface. No significant changes in the porosity within the mantles were noticed.

CONCLUSIONS. This study has demonstrated that component heating significantly increases the maximum temperature reached by the cement-bone interface. No significant changes in the porosity distribution were noticed across the thin mantles surrounding the stems.

P071
KNOW YOUR CEMENT: A REVIEW OF CURRENT CEMENTING PRACTICE IN THE UK

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BACKGROUND. Acrylic bone cements have been in use in total hip arthroplasty for more than 40 years and have been a popular topic of research for the last 30 years. There are literally hundreds of papers discussing, among others, the mechanical and chemical properties of PMMA, precautions for mixing and handling the material. Forty years on it is still quite common among the orthopaedic community to experience inconsistencies with the behaviour of the cement during arthroplasty. This study set out to investigate to what extent surgeons in the UK were aware of the situations that might contribute to these inconsistencies. METHODS. In 2003 a questionnaire on cementing practice was sent to each of the 1620 members of the British Orthopaedic Association. 568 respondents indicated that they performed THA and were included in the study.

RESULTS. This survey identifies a national preference of high viscosity cements and an increase in the use of antibiotic laden cements in comparison with a survey carried out in 1998 (1). Over two-thirds of the respondents identified inconsistencies with the setting time of the cement, these could mostly be attributed to variations in the storage and theater temperatures.

Nowadays mixing is mostly carried out under vacuum and there is a distinct preference for the use of cement guns (95%) for the delivery.

CONCLUSIONS. Given that viscosity is one of the most important variables influencing the quality of cementation it is surprising that 80% of the surgeons used the time elapsed since mixing as a guide to the timing of cement delivery, rather than the consistency of the dough.

METAL-ON-METAL BEARINGS

P072

BLOOD ANALYSIS FOR TRACE METALS IN METAL-ON-METAL, CERAMIC-ON-CERAMIC AND METAL-ON-CROSS-LINKED PE BEARINGS IN TOTAL HIP ARTHROPLASTY

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We obtained postoperative blood concentrations of Co, Cr, Mo, Ti, Al, Ni and Nb in 75 patients undergoing primary THA at our institution between January 1998 and December 2000. All patients were treated with the same prosthetic device (VARIALL™, Zimmer, Winterthur, Switzerland) using three types of articulations: metal-on-metal (METASUL™), ceramic-on-ceramic (CERASUL™) and metal-on-cross-linked polyethylene (DURASUL™). Twenty-five patients out of each articulation-group were evaluated by blood analysis 24-38 months after surgery to avoid the so called running-in-period. The patients had to be healthy and were submitted to strict criteria of inclusion. The Al, Ti-, Ni- and Nb-blood levels were all below their detection limit. The median Co blood concentration in the ceramic group was 0.19 ng/mL, 0.69 ng/mL in the metal group and 0.19 ng/mL in the cross-linked PE group. The difference between the metal and ceramic group and between the metal and polyethylene group is statistically significant ($p=0.001$ in both comparisons). The median blood concentration of Cr was 0.19 ng/mL in the ceramic and in the cross-linked PE group, and 0.47 ng/mL in the metal group, the difference being statistically significant ($p=0.003$ and

$p=0.0002$). Regarding the median blood concentrations of Mo, we found no statistically significant differences comparing the three articulations ($p>0.05$). Further, there was no significant difference in the age, follow-up time and preoperative blood level of creatinine categories.

Although the blood concentrations of Co and Cr were significantly higher in patients with a metal-on-metal THA they were far from reaching toxic levels.

P073

METAL ION SERUM CONCENTRATIONS AFTER METASUL-THR AND BIRMINGHAM HIP RESURFACING METAL-ON-METAL HIP ARTHROPLASTY

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QUESTION. Are there differences in the metal ion serum concentrations after implantation of a MetaSUL-THR or a Birmingham Hip Resurfacing in comparison to implant free subjects? Are the metal ion concentrations related to factors like demography or implant position?

METHODS. The serum levels of cobalt, chromium and molybdenum in 74 patients after implantation of a MetaSUL-THR and in 111 patients who had undergone a Birmingham Hip Resurfacing arthroplasty were compared with the levels found in 130 normal patients without implants using atom absorption spectrophotometry. The influence of demographic factors, time after implantation and implant size and position was studied statistically.

RESULTS. Both types of implants lead to an increase of the metal ion serum concentrations in comparison to implant free normal patients. Patients who had undergone a Birmingham Hip Resurfacing arthroplasty showed the highest levels. The chromium serum concentrations differed significantly between the 3 groups (implant-free subjects: 0.38 µg/L, MetaSUL-THR: 1.16 µg/L, Birmingham Hip Resurfacing: 4.06 µg/L). Age, Sex, BMI and cup inclination had no influence on the metal ion levels but the concentrations were significant depending on the time after implantation. **DISCUSSION.** Metal-on-metal bearings of large diameter result in a greater systemic exposure of

cobalt, chromium and molybdenum ions than bearings of smaller diameter. The time after implantation has a significant influence on the concentration. It is not known to what extent the different levels are due to corrosion of the surfaces of the components or of the wear particles produced.

P074
IN VITRO TRIBOLOGY OF LARGE METAL-ON-METAL IMPLANTS

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BACKGROUND. Tribology of large metal-on-metal (MoM) articulations is promising for their lubrication mode. Studies have shown that fluid film lubrication behaviour is possible for large MoM articulations. In such a lubrication, the amount of wear is theoretically nil and independent of the articulation diameter. The goal of the present study was to investigate the influence of diameter and clearance on a hip resurfacing prosthesis using a hip simulator.

METHODS. All tested components were manufactured from a high carbon (0.20% - 0.25% C) wrought cobalt alloy. Six combinations of diameters (from 38 to 56 mm) and diametral clearances (from 95 to 280 µm) were investigated on an AMTI hip simulator operated according to ISO standard 14.242-1 characteristics. The wear tests were lubricated with a stabilised mixture of Ringer solution with 33 per cent calf serum.

RESULTS. For all wear tests, a similar behaviour was observed with a running-in period followed by a period where the wear rate was negligible, indication that fluid film lubrication behaviour was reached. A first linear relationship was observed between the clearance and the amount of linear wear and a second linear relationship was observed between the clearance and number of cycles of the running-in period.

CONCLUSIONS. This analysis of the wear behaviour

shows that all the investigated bearings reach a fluid film lubrication mode, independent of their initial diameter or initial clearance. The initial clearance should be as small as possible to minimise the running-in wear period, but large enough to eliminate any risk of clamping.

P075
MID-TERM RESULTS OF THE HOFER-IMHOF LUBRIMET® METAL-ON-METAL ARTICULATION

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BACKGROUND. A polyethylene-free, metal-on-metal acetabular system (Hofer-Imhof cup; Lubrimet® metal-on-metal articulation made of CoCr-forge alloy) was designed in an effort to improve total hip arthroplasty longevity. This study was undertaken to review the clinical performance of this implant and to determine if early acetabular loosening or revision and wear and osteolysis were prevalent. The mid-term results (mean follow-up period 62.7 months) are presented in this study. **METHODS.** In this prospective, randomized study a minimum of 55 months follow-up results involving the first 150 implanted metal liner total hip arthroplasties are presented. The mean follow-up was 62.7 months.

RESULTS. Between April 1995 and November 1996 146 patients (150 hips) had a total hip replacement consisting of a titanium cementless self-reaming, parabolic cup, a cementless titanium stem and the Lubrimet® metal-on-metal articulation. 145 hips had complete clinical and radiographic data 55 to 89 months after the operation. Three acetabular and one femoral component had to be revised due to aseptic loosening.

CONCLUSIONS. The mid-term results of the Hofer-Imhof Lubrimet® metal-on-metal articulation are encouraging and so the system may represent a viable alternative for total hip arthroplasty in younger, higher-demand patients.

CLINICAL STUDIES ON BEARINGS AND HEADS

P076 CERAMIC-on-CERAMIC HIP REPLACEMENT USING A 32 mm HEAD

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From January 1994 to December 2003, 129 consecutive alumina-alumina hip replacements in 79 females and 50 males were performed. The median age of patients at the time of surgery was 58 (range 25-74 years). The initial diseases inducing hip replacement were: primary coxarthrosis in 73 (56.7%) hips, atraumatic avascular necrosis in 27 (20.9%), fracture of the upper femur in 18 (13.9%), coxarthrosis after hip dysplasia in 9 (7%), rheumatoid arthritis in 2 (1.5%). All the operations were primary procedures, performed or supervised by the senior author (G.B.S.). Two additional screws have been used in 20 cases (15.7%). Three different stems were used: a cemented collared smooth anodized Ti stem in 44 cases (34.1%), two cementless (one anatomical and one HA-coated straight) Ti stems in 85 cases (65.9%). 103 hips (79.8%) have been reviewed at an average follow-up of 41 months: 97 (94.2%) have showed no clinical and/or radiological signs of impending failure, 6 (5.8%) had undergone a revision (2 infections, 2 sinking of the anatomical cementless stems, 1 stem fracture, 1 recurrent dislocation). None of the implants have been revised due to mechanical failure of the ceramic components. Worries in the use of alumina-alumina replacement in hip arthroplasty have to be considered over-passed considering studies that suggest us better and better results for mechanical quality and longevity of implants. According to this, it is reasonable to admit that alumina-on-alumina bearing surface seems to be a valid alternative in the hip replacement surgery.

P077 INFLUENCE OF CUP ORIENTATION AND FEMORAL HEAD DIAMETER ON THE RANGE OF MOTION OF THE HIP JOINT

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Dislocation is one of the most frequent complications of hip arthroplasty. However, little is known on the influence of different cup orientation and large femoral head on the range of motion of artificial hip joint.

METHODS. A geometric 3-dimensional model of hip prosthesis was designed using a computer assisted-designed program (Autocad). The ROM in flexion-extension, abduction-adduction and external-internal rotation was evaluated until the femoral neck impinged on the liner. The acetabular component was positioned with an abduction angle of 35, 45 and 55 degrees and with an antiversions of 5, 15, 25 degrees. A femoral stem antiversions of 15 degrees was maintained during the tests. Femoral head diameter of 28, 32, 36 and 38 mm were used. Results were compared to mean values reported in previous studies in age-matched subjects (ReferenceValues or RV).

RESULTS. Increasing cup abduction (from 45 to 55) increased flexion and decreased adduction but not below RV. Decreasing cup abduction (from 45 to 35) decreased flexion below RV and abduction close to RV. Increasing cup antiversions (from 15 to 25), increased flexion and decreases external rotation and abduction but not below RV. Decreasing cup antiversions (from 15 to 5) decreased flexion below RV. In the presence of reduced cup abduction (35) increasing cup antiversions increased flexion without compromise ROM in remaining planes of motion. In the presence of increased cup abduction (55), increasing cup antiversions (25) led to external rotation below RV while decreasing cup antiversions (5) increased ROM in all planes of motion above RV. In the presence of cup positioning associated with a ROM below RV with a 28 mm femoral head, the use of 36 and 38 mm caused an increase in the ROM at levels above RV.

CONCLUSIONS. Changes in the cup orientation causes opposite results in term of ROM in the different planes of motion. A reduced ROM caused by a poor positioning of the cup may be partially compensated by using large femoral heads.

P078

PRELIMINARY RESULTS OF A HYBRID, CONTEMPORARY, METAL-ON-METAL HIP REPLACEMENT ARTHROPLASTY

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BACKGROUND. Periprosthetic Osteolysis causing Aseptic loosening is the leading problem in contemporary total hip replacement. Particulate wear debris has been implicated as the causes. Debris produced in a metal-on-metal articulation is less. With better metallurgical techniques, metal on metal bearing arthroplasty is becoming popular once again.

METHODS. Patients with the Metasul (Sulzer) metal-on-metal arthroplasty, using a press fit coated acetabulum and cemented stem, done between 1997 to 2001 by the senior surgeon were followed up with serial X-rays. Pre- and post-op Harris Hip scores, patient satisfaction and X-ray changes were recorded.

RESULTS. There were 44 patients, the age range was 54-78 years, average 62, average follow up was 22 months. One hip was revised for dislocation and one for a type-3 periprosthetic fracture. No hip was revised for aseptic loosening. There was no radiological evidence of loosening in any patient. The Harris Hip scores pre-op and at last follow-up were on average 42.8 and 89.9 respectively; 92.1% patients said they would recommend it to others, 94.6% rated the results as excellent to fair.

CONCLUSIONS. These early results are comparable to any other type of contemporary arthroplasty. We feel that the metal-on-metal bearing arthroplasty appears to be a viable alternative option. Whether it can solve problem of wear debris, aseptic loosening can only be said after longer follow-up results are available. Results of studies on local and systemic tolerance are also needed though there does not seem to be any reports or hypersensitivity or malignant change.

P079

28 mm CERAMIC HEAD

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BACKGROUND. In the 1970's alumina was introduced because of its resistance to wear and biocompatibility.

Volumetric wear increases with the increased radius of the head. This is important for the metal-polyethylene, but less so for the ceramic-ceramic coupling (C-C), which has a lower wear rate and can be used with less risk of dislocation also in heads of greater diameters. A medium-sized head, such as the 28 mm, can provide the best wear characteristics and good joint stability with a wide range of movement (ROM).

METHODS. From 1987 to 1994, 674 THAs were performed at the Rizzoli Institute using C-C with 32 mm (Biolox) second generation ceramic heads. Since 1994 we passed to a 28 mm ceramic heads (Biolox), and since 1995 to a 28 mm third-generation ceramic heads (Biolox Forte). Up to 2002, 1714 THAs were performed.

RESULTS. Periprosthetic osteolysis were absent. Compared to the 32 mm head series, no changes in the dislocation rate (less than 1%) were noted. In 3 cases the Biolox head broke, one of which had been inserted to a neck of a previous implant. No ceramic fractures in the Biolox Forte heads.

CONCLUSIONS. The C-C is biologically and mechanically reliable; 28 mm heads allowed press-fit cups as small as 46 mm. Using 28 mm heads risk of dislocation and decreased ROM, due to the low head and neck ratio, remain a problem. We are in favour of using small heads with small cups, and bigger heads with bigger cups.

P080

CLINICAL TRIAL OF A NEW CF-PEEK ACETABULAR INSERT IN HIP ARTHROPLASTY

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In the present work authors have done a clinical study about the ABG cementless prosthesis with the utilisation of an acetabular insert made of PEEK (polyether ether Ketone) which is reinforced with carbon fibre (CF) to form the composite material CF-PEEK. The patients were enrolled after the Jesi Hospital Ethics Committee gave the permission for the study with a specific working protocol including:

Age between 18 and 65;

Pathologies: primary arthritis, femoral head necrosis and post-traumatic arthritis;

Clinical and radiographics evaluations obligatory

performed 6/12 weeks, 1 year, 3 years, 5 years post-operatively;
Results' evaluation made with the 'Oxford hip outcome score'.

From April 2001 to February 2002, 30 CF-PEEK acetabular inserts were implanted in 30 patients. Surgery was performed by the same surgeon (N.P.) with the same surgical technique.

The updating follow-up is 30 months mean duration (range 23 to 37 months). Up today we have not had material intolerance complications.

P081

ALUMINA CERAMIC-CERAMIC TOTAL HIP ARTHROPLASTY

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Wear, particulate debris, and resulting osteolysis are common problems following THA. Alumina ceramic-ceramic bearings have demonstrated low wear, both *in vitro* and *in vivo*. The current study documents clinical results of alumina ceramic-ceramic bearings. Beginning in June, 1997 261 consecutive alumina-alumina total hip arthroplasties were studied prospectively.

The first 179 patients were participants in an FDA/IDE study (Wright Medical Technology, Memphis, TN).

The acetabulum consisted of an alumina liner joined to a titanium shell with an 18 o taper. The liner is positioned flush with the shell, with no additional metal sleeve adapter. The mean age at surgery was 49.8 years, range 17 to 74. 139 patients were evaluated clinically at more than 12 mo and 75 at more than 24 mo.

One patient was revised to failure of osseointegration of a femoral component inserted into necrotic bone. One patient had acute revision to secure a displaced acetabular component. There were no dislocations, bearing fractures, or radiographically visible osteolysis.

Data demonstrate Kaplan-Meier survivorship of 99% at 6 years.

These results demonstrate that alumina ceramic-ceramic bearings appear to function well in a group of

largely young, very active patients without evidence of bearing fracture, impingement, or instability.

P082

CLINICAL EXPERIENCE WITH THE BA-STANDARD AND CORRECTIVE BALL HEAD FOR THP

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The new BA - Standard and Corrective Ball Head has been used between 1983 and the end of 2001 in 2732 cases. It is a 28 mm or 32 mm ball head for total hip prosthesis with an eccentric taper bore and three different neck lengths (S, M, and L). This eccentric bore permits an angular deviation of the axis of the head from that of the stem taper of 7.5° in any direction, such as e.g. valgus, varus, ante- or retrotorsion (or standard position).

MATERIALS AND METHODS. The BA-Standard and Corrective Ball Head has been yet combined with the following stems:

- ° Weber stems in 62.5%,
- ° Zweymüller stems in 36.5%,
- ° Müller straight stems in 0.3%,
- ° Wagner revision stems in 0.9%.

Among the cementless Zweymüller stems (Alloclassic), which were implanted in 632 cases, i.e. 36.5%, the best fitting stem size has been used and the proximal part has been filled and locked up with Spongiosa, in order to avoid the ongrowth of surrounding fibrous tissues. In combination with the Wagner revision stem, the BA-Standard and Corrective Ball Head has been always used as a rule to reduce of 7.5° the given large CCD-angle. The taper of this stem is the same and is fully compatible with the BA-Standard and Corrective Ball Head taper bore.

The BA-Standard and Corrective Ball Head has been implanted in all these cases in the following positions:

- ° Standard or retrotorsion in 64.8%
- ° Valgus in 31.3%
- ° Varus in 3%, actually only by revision cases or existing coax vara
- ° Antetorsion in 0.8%, because of retroversion of the cup, also by revision cases.

RESULTS. 206 patient data have been processed. Thir-

ty-eight patients (18.4%) 8 to 10 years after surgery, 53 patients (25.7%) 6 to 8 years after surgery, 54 patients (26.2%) 4 to 6 years after surgery, and 61 patients (29.6%) 2 to 4 years after surgery.

Postoperative luxation occurred in 7 patients (2.3%). Meanwhile periarticular ossification appeared in 12 patients (3.3%) and 6 patients have undergone revision surgery for the same reason after 1 year. Infection has been observed also in 2 patients (0.6%).

P083

BACKSIDE WEAR IN RETRIEVED MODULAR AND NON-MODULAR UNCEMENTED ACETABULAR CUPS

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We compared the backside wear of retrieved cementless non-modular cups, with modular cups of first and second generation designs. Nine retrieved non-modular cups (Implex) were matched for time in situ, patient age and weight, with 9 retrieved Trilogy cups, 9 Harris-Galante 1, and 9 Harris-Galante 2. The average time *in situ* was 2.5 years (1 to 7). The backside was divided in quadrants and each rated utilizing a score with a value from 0 (absence of wear) to 3 (severe backside wear) for a total ranging from 0 to 12. Among 36 quadrants in the HG1 group there were 3 rated 1, 23 rated 2, and 10 rated 3. In the HG2 group, there was 1 quadrant rated 0, 16 rated 1, 14 rated 2, and 5 rated 3. In the Trilogy group, there were 6 quadrants rated 0, 27 rated 1, and 3 rated 2. In the Implex group, there were 15 quadrants rated 0, 21 rated 1. The average total backside wear score and 95% CI were 8.4 (7.6-9.3); 7.3 (5.5-9.1); 3.7 (3.2-4.1); and 2.3 (1.3-3.4) respectively. The HG1 and HG2 groups demonstrated similar backside wear scores ($p=0.3$). The HG designs demonstrated significantly more severe backside wear than the Trilogy and Implex ($p<0.01$). The differences between the Trilogy and the Implex were not significant in this cohort. Despite the limitations imposed by the small sample studied, the presence of multiple screw holes in the Harris-Galante retrievals, and sub-optimal matching for sex, height, and varied indication for revision, we detected sig-

nificant reduction in the backside wear of modern modular and non-modular acetabular cups when compared to first generation modular designs.

MIGRATION

P084

EBRA-FCA FOR MEASUREMENT OF MIGRATION OF THE FEMORAL COMPONENT IN SURFACE ARTHROPLASTY OF THE HIP

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BACKGROUND. Implant migration studies may represent the only way to monitor early performance of metal-on-metal hip prosthesis.

METHODS. The EBRA-FCA (Ein Bild Roentgen Analyse - Femoral Component Analysis) method was adapted to measure femoral component migration in a metal-on-metal surface arthroplasty of the hip using standard anterior posterior radiographs. For determination of accuracy and precision of this adapted method, a prosthesis was implanted into a cadaver femur and hemi-pelvis.

Eleven series of X-rays, with 7 radiographs each, were made to perform a zero-migration study. With the same conditions, another 11 series of X-rays, with a simulation of a 3mm migration of the femoral component, were taken. All X-rays were measured independently by 3 different observers. Clinical validation was tested on 26 hips post surface arthroplasty with a minimum follow-up of 3.5 years.

RESULTS. Accuracy of the method was found to be ± 1.6 mm for the x-direction and ± 2 mm for the y-direction (95% percentile). Seventeen hips were free of any clinical or radiographic signs of loosening and nine hips had failed secondary to femoral component aseptic loosening. The well functioning group differed

significantly in migration patterns comparatively to the failure group: time to migration 29.2 months versus 19.0 months ($p=0.030$); in the failure group, the average time to first migration was significantly sooner than the appearance of clinical (29.5 months, $p=0.003$) or radiological signs of failure (24.3 months, $p=0.028$).

CONCLUSIONS. EBRA-FCA is a reliable and valid tool to measure femoral component migration post surface arthroplasty and can be used to predict early implant failure. This instrument can be critical in determining the long-term success of surface arthroplasty.

P085

EBRA-DIGITAL RELEASE 2003 VERSUS 1998: A COMPARISON OF INSTRUMENT REPEATABILITY AND SYSTEMATIC BIAS FOR IMPLANT MIGRATION AND WEAR

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BACKGROUND. We compared the repeatability (expressed as 95% confidence interval [95%CI]) and radiograph analysis time of the EBRA-Digital 2003 release to that of the previous 1998 release.

METHODS. Twenty-nine patients who had previously had hybrid total hip arthroplasty underwent consecutive, standardized, plain radiographic examinations on the same day after repositioning. The resultant radiograph pairs were digitized and analyzed by a single, trained, observer using both the 1998 and 2003 releases, and the time taken for each analysis measured.

RESULTS. The 95%CI for migration of the acetabular cup was 1.62mm for the 2003 release versus 1.00mm for the 1998 release ($P>0.05$). The 95%CI for wear measurements was 0.40mm for release 2003 versus 0.27mm for release 1998 (F-test, $P>0.05$). The 95%CI for femoral stem migration was 0.84mm for release 2003 versus 0.82mm for release 1998 (F-test, $P>0.05$). The 95%CI of cup inclination/anteversion and femoral stem angle was $\pm 2.3^\circ$ for release 2003 and $\pm 2.7^\circ$ for release 1998 (F-test, $P>0.05$). No significant systematic bias was found for measurements made using either software version (t-test, $P>0.05$). Com-

pression of digital images was not associated with reduced precision at compression factors of 15 and 30 ($P>0.05$). The mean time taken to analyse a single cup radiograph using release 2003 was 7.9 minutes, versus 9.5 minutes for release 1998 (t-test, $P=0.01$). The analysis times for femoral implant radiographs were 4.1 and 5.4 minutes, respectively (t-test, $P<0.001$).

CONCLUSIONS. The 1998 and 2003 releases of the EBRA software have similar precision, but the analysis time for the 2003 release is faster.

REVISION OF THE ACETABULAR COMPONENT

P086

ACETABULAR REVISION USING EPF CEMENTLESS CUP

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BACKGROUND. Cementless acetabular revision is becoming increasingly widespread. Suggested features of cementless cups have included a minimum of screw-holes, less than hemispherical profile, equatorial expansion to assist with press-fit, porous coating, hydroxyapatite coating, polished interior to limit back surface wear and a satisfactory liner locking mechanism. In this context the EPF-plus cup (Endoplus UK) was considered of possible use in revision arthroplasty.

METHODS. We report the use of EPF cup in 20 patients over a 2-year period (follow-up 6-23 months, mean 12.6 months). There were 14 females and 6 males aged 58-87 years (mean age 74.05) at surgery. Preoperative radiolucency was observed in at least 2 zones in all cases (de Lee /Charnley). Most acetabular defects were simple, 7 were type II a, 3 were type II b and 1 was type III (Bradford and Paprowski). Screw fixation was used in 18, morsellised bone graft in 4, and "collografts" in 1 case. Aseptic loosening was the indication for revision in 19 cases and 1 was a 2 stage procedure for sepsis.

RESULTS. Early weight bearing was allowed, and osseointegration was visible on X-ray at 6 weeks in all

cases. In 4 cases with osteolytic defects adjacent to the margins of the cup there was osteogenesis and bone ingrowth within 3 months. In 2 cases with deficient medial wall there was evidence of osteogenesis around the medial margin of the cup. Although initial fixation was dependent on screws in most cases (unlike primary arthroplasty), incorporation was rapid. Serial X-rays showed no evidence of radioluscent lines, cup migration or wear.

CONCLUSIONS. Modern generation cementless acetabular components has design characteristics which makes such implants suitable for revision arthroplasty.

P087

MANAGEMENT OF LARGE ACETABULUM BONE DEFECTS

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Nineteen patients with large bone defects in the acetabulum (Paprosky IIIA and IIIB), as a result of aseptic loosening of the components, were subjected to revision of the prosthesis and reconstruction of the gap by using grafts and reinforcing rings or cups of great diameter. There were thirteen women with an average age of 71.3 years (59-81 years) and six men with an average age of 74.7 years (62-83 years).

Two patients had been subjected to three previous revisions, four to two revisions and five to one. The time from the initial prosthesis implantation to the revision was from 6 to 15 years. The average preoperative Harris Hip Score was 42 points. In fifteen patients with type IIIB defect fragmented bone grafts were used, as well as reinforced Muller rings with cemented acetabular prostheses. In four patients with type IIIA defects, morselised bone grafts and cementless jumbo hydroxyapatite coated cups were used. The mean follow-up was 5.2 years (3-8 years). The post-operative Harris Hip Score was 88 points.

There was no material failure and no obvious loosening at the last examination. There was one superficial vein thrombosis and one dislocation that was treated with closed reduction. The surgical technique, the difficulties and the possible risks are discussed in detail.

P088

RECONSTRUCTION OF EXTENSIVE ACETABULAR DEFECTS BY BIOACTIVE GLASS CERAMICS IN REVISION TOTAL HIP ARTHROPLASTY

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The authors made 52 revisions on account of aseptic loosening of total endoprostheses of the hip joint using bioactive glass ceramics BAS-O of Lasak Co. Prague. For reconstruction of large defects of the acetabulum they used a combination of different types of anti-protrusion metal baskets and granules from this material. In some instances the glass ceramic material was combined with autologous spongiosa. The longest follow-up period is over 7 years. In no instance loosening of the glass ceramic material occurred or its expulsion. All reconstructed sockets of hip joints were burdened by the patients from the third month after surgery. Harris Hip Score before operation was on average 52.3. During the last checkups of the patients it reached the level of 83.7. The authors mention complications associated with the procedure. The advantages and disadvantages of the procedure are discussed.

P089

WITHDRAWN

P090

RECONSTRUCTION OF ACETABULAR BONE DEFECTS IN REVISION TOTAL HIP REPLACEMENT

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BACKGROUND. Revision surgery of the acetabulum in case of total hip exchange poses various problems for the surgeon. The most important and difficult problem is the bone defect which sometimes is extensive, even leading to a pelvic discontinuity. Additionally bone quality is frequently compromised. There are various options to deal with these problems ranging from fill-

ing the defects with cement to restoring bone stock with allografts.

METHODS. From our experience of 800 primary total hips and more than 150 hip revisions per year we have developed a reconstruction algorithm to help the surgeon to decide which reconstruction method to use. Specific problems of hip revision surgery and potential solutions are discussed in detail.

RESULTS. Based on the classification system developed by the German Orthopedics and Traumatology Society solutions for each type of acetabular defect are presented schematically and corresponding clinical cases are demonstrated.

CONCLUSIONS. With this reconstruction algorithm a reliable restoration of bone stock of the acetabulum and secure fixation of the new acetabular component is possible. Intraoperative hesitation about which method to choose will be avoided. International long-term results confirm our strategy.

P091

ANALYSIS OF FIFTY-FOUR REVISED CLS CUPS

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BACKGROUND. Cementless acetabular components may have to be revised for different reasons. Revision of a stable cementless may be troublesome surgery with the danger of acetabular bone loss and difficult fixation of the new implant. Due to its design the CLS cup should pose fewer problems in the case of revision.

METHODS. We analysed the reason for revision of 54 CLS cups out of a series of 3371 CLS cups, which had been implanted between 1988 and 2002, with emphasis on the difficulties experienced by the surgeon, the quality of bone stock and the new implant.

RESULTS. The reason for revision was aseptic loosening in 14 cases, recurrent dislocation in 11 cases, infection in 6 cases, a fracture of the implant in 3 cases, an irritation of the tendon of the iliopsoas muscle in another 3 cases. Two cups were revised together with the stem after a periprosthetic fracture. Fifteen CLS cups had been combined with a cemented titanium-alloy stem with a known high rate of aseptic loosening and were revised together with the stem. Twenty-three cups were considered stable at surgery but

due to the design of the cup nonetheless easy to remove without bone loss. In all cases the new implants could be fixed without difficulties.

CONCLUSIONS. We conclude that the CLS cup is very easy to revise, without bone loss or compromise of the stability of the new implant.

REVISION OF THE FEMORAL COMPONENT

P092

CEMENTLESS REVISION WITH T3 CONICAL STEM FOR SEVERE BONE STOCK LOSS

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BACKGROUND. Mid-term results obtained with the conical tapered stem designed by Wagner for cementless hip revision were on the whole very encouraging. Nevertheless we have identified some defects of the stem such as an excessive valgus neck, an insufficient offset for larger stems and a lack of modularity, making soft tissues tension sometimes difficult.

METHODS. The T3 stem was designed with the purpose of correcting these defects, maintaining the principles of Wagner's stem. In this study we have analyzed the preliminary results obtained with the T3 stem. The T3 stem is made of Titanium alloy with a textured surface finish and is modular. The lateral offset has been increased to 42 mm (34 mm for Wagner's stem) and the cervico-diaphyseal angle has been reduced from 145 to 138 degrees. We reviewed the first 37 consecutive cases having an average FU of 30 months (range 6-60). In all cases the stem was implanted without cement. We have always used a trans-femoral approach with 'prophylactic' distal cable cir-clage. In no case an homologous bone graft was used. **RESULTS.** 90% of the cases were rated Excellent or Good. No re-revision was necessary. 87% of the femurs showed good bone reconstruction and 13% some subsidence (only one >1cm) without clinical symptoms.

CONCLUSIONS. Distal fixation stems like T3 are the implants of choice for severe bone stock loss (Paprosky

2C-3) for their immediate mechanical stability allowing early weight bearing. Transfemoral approach allows complete removal of debris and scar tissue, enhancing bone reconstruction.

P093
RESULTS OF A DISTAL PROXIMAL MODULAR (DPM) HIP REVISION SYSTEM

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AIMS. A hip implant was designed for femoral revision, based on the requirements to attain a secure Distal stem fixation with Proximal Modularity (through different sizes of HA-coated sleeves) to restore proximally deficient femur.

METHODS. In 35 patients (24 females, 11 males) with a mean age of 77 yrs (range 56-93) the aseptic loosened stem was revised with this DPM implant. It was 7x the 2nd revision, 5x the 3rd and once the 4th revision. The approach was straight lateral without trochanter or femoral osteotomy.

PAPROSKY STAGING. 4xType 1, 22xType 2 and 9xType 3 of which there were 5 periprosthetic fractures. The removed stem was 30x cemented and 5x uncemented. Cement was removed with ultrasonor devices under radiographic control. In 20 cases also the cup was revised at the same time. The large sleeve was used in most cases (51.6%). Immediate weightbearing was allowed.

RESULTS. Complications were sparse: one fausse route and only two dislocations. Discharge was at 18 days (mean) (5-50). Mean follow-up was 2.2 yrs (1.1-4.4). Harris Hip Score rose from 42 to 74 and pain score from 21 to 42. Leg discrepancy could be fully restored in 29 cases. Radiologic subsidence > 10 mm was noted twice, once because of insufficient cement removal, which needed revision of the component; over > 5 mm three times. All other stems were immediately stable. No subsidence after three months. Bone ongrowth to the sleeve was seen in all stable cases.

CONCLUSION. The DPM stem revision hip system completely fulfilled the design goals. It leads to a low complication rate and showed rebuilding of the proximal deficient femoral bone.

P094

THE CLINICAL AND RADIOLOGICAL ANALYSIS OF AN UNCEMENTED, MODULAR, REVISION FEMORAL COMPONENT

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BACKGROUND. To measure migration of an uncemented modular revision stem in an attempt to identify factors influencing migration and clinical outcome.

METHODS. The Profemur revision stem (Wright-Cremascoli) was implanted in 80 patients between between May 1995 and December 2001. Of the 80 cases, radiological follow-up was incomplete in ten cases. Migration analysis of 70 sequential cases has been undertaken (44 female, 26 male). The mean age at surgery was 71 years, (range 37.3 to 93.2 years). Indications for surgery were loosening, infection, hip fracture, component fracture, recurrent dislocation and intractable pain. The stem was implanted with McMinn stemmed cups, LOR oval cups, Allofit/Metasul cups, Ancafit/Ceramic cups, Support ring/cemented polyethylene cups and Osteonics capture cups.

RESULTS. Mean follow-up was 42 months, (range 9-90 months). The mean pre-operative Oxford hip score of 43 fell to 28 by 5 years. Migration of greater than 5mm was observed in 22 cases, with 4 cases migrating more than 15mm. Migration curves demonstrated that stem subsidence usually ends within twelve months of implantation. Stems that migrated more than 15mm were found to have either inadequate fixation of a per-operative femoral fracture, a post-operative peri-prosthetic fracture or a deep infection. Lower degrees of migration were not related to surgical experience, indication for revision, proximal stem dimension or the use of circlage cables. Migration of less than 5mm was related to patient sex, patient age, stem length, stem diameter, and the use of bone graft.

CONCLUSIONS. Identification of factors influencing stem migration and failure has allowed us to optimise our revision technique with this stem.

P095

TRANSFEMORAL APPROACH IN REVISION THA: RESTORATION DLS CONCEPT, EARLY RESULTS

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Various studies on femoral revision THA showed that spontaneous bone reconstruction is possible around a stable cementless stem. The Restoration DLS concept is the association of an HA-coated, anatomical and distally-locked stem, with a transfemoral approach and synthesis of the proximal femoral flap around the implant.

Fifty-four such revision cases at a minimum 1-year follow-up were reviewed. Most cases showed bone defects graded type 2 and 21% were graded type 3 and 4 according to SOFCOT classification. The transfemoral approach was often performed with a long flap (average length: 153 mm).

Clinical results show a significant increase in the PMA score. Mechanical complications include dislocations (9.7%) and in one case, a septic loosening requiring revision. Radiological analyses show a consistent synthesis of the flap. Spontaneous cortical reconstruction is seen and is maximum in zones 2, 6, 9 and 13 of Gruen. A radiolucent line is frequently seen in the metaphyseal area. In 12% of the cases, a secondary fracture of the trochanteric tuberosities. Cortical thickening around the distal locking was seen in 34% of the cases and 15% of the cases had thigh pain. In 4 cases the distal screws were removed secondarily.

These results confirm the benefits of the transfemoral approach when used in femoral revision THA. It secures the revision surgery and enhances spontaneous reconstruction. The initial implant stability is ensured through distal locking. Radiological analysis demonstrates the need for a tight synthesis of the proximal flap around the stem, to help proximal osseo-integration and improve the long-term tolerance of distal locking.

P096

A MODULAR HIP REVISION SYSTEM IN CASES OF FEMORAL BONE-DEFECTS

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BACKGROUND. In cases of hip endoprosthesis revisions we very often have problems with greater or fewer bone-defects, especially in the area of the calcar. In our hospital we have much experience in the use of autologous or homologous bone-arthroplasty with cemented or cementfree hip-stems. Especially regarding the femur the discussions of the last few years show the benefit of a proximal fixation also in cases of hip revision stems.

METHODS. In our hospital we have now been experiencing the modular ZMR-Hip-System for about four years. From our point of view with this system, we have a good possibility to achieve a stable proximal pressfit of the new prosthesis using the modular-proximal-prosthesis-bodies. In more than fifty cases, up to now, we have used this system. In eighteen of these cases we used this system in combination with homologous bone-plasty.

RESULTS. In all cases we saw in the X-rays good integration of the prosthesis-stem and also of the bone-plasty. By using different prosthesis offsets in all cases we have good security against luxation of the hip-prosthesis and in all our cases there have been no luxations postoperatively.

CONCLUSIONS. In conclusion, from our point of view, we prefer using a modular prosthesis-system in all cases of endoprosthesis hip revision. By combination of these systems with bone-plasty we have a secure management of bone defect situations as especially in the area of the calcar.

P097

FEMORAL REVISION WITH THE ECHELON EXTENSIVELY POROUS-COATED CHROME COBALT STEM

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BACKGROUND. Deficient bone stock compromises the

fixation of the uncemented porous-coated stems in femoral revision.

METHODS. Between may 1999 and may 2001, 50 Echelon revision stems (Smith & Nephew, USA) were implanted in 49 patients (21 women, 28 men). One patient died, with 49 cases available for follow-up. The mean age of the patients was 67 years (range, 41 to 80). The indication for revision was aseptic loosening in forty-six hips, periprosthetic fracture in two, and femoral stem fracture in one. Femoral defects were classified according to Paprosky. There were 2 type I, 7 type II, 30 type IIIA, 7 type IIIB and 3 type IV.

RESULTS. The mean follow-up was 2.6 years (range, 18 months to 4 years). One stem required repeat revision. With radiographic loosening or removal of the stem as the end point, cumulative survival at 4 years was 81.63% in the Kaplan-Meier analysis (mean, 43 months; 95% CI 40-46). Using the Engh radiographic criteria, femoral stems were judged to have achieved bone ingrowth in 13 cases, stable fibrous ingrowth in 27, and were unstable in 9 cases. A mean subsidence of 5.29 mm (range, 0-24) was measured. Radiographic stem loosening was clearly related to an endosteal canal fill < 87 % ($p < 0.001$, chi-square=42.99). The mean Merlé d'Aubigne score improved from 6.9 points preoperatively to 16 points. Five patients had postoperative dislocation.

CONCLUSIONS. Better results were found when the femoral canal fill was complete and with lesser degrees of bone stock deficiency. If a scratch fit cannot be obtained, as in a type IV defects, alternative techniques are preferred.

P098
HYDROXYPATITE COATED FEMORAL STEMS IN REVISION HIP SURGERY

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BACKGROUND. We describe the clinical and radiological results of 131 consecutive revision hip arthroplasties in 118 patients, using a titanium alloy femoral component fully coated with Hydroxyapatite (HA).

METHODS. All patients receiving a JRI Furlong HA coat-

ed femoral component were included regardless of their primary aetiology. These included patients on whom previous revision hip joint surgery had taken place. Patients were independently reviewed and scored using the Charnley modification of the Merle d'Aubigne and Postel Score (MDP), Harris Hip Score (HHS) and The Western Ontario and McMaster Universities Osteoarthritis index (WOMAC). Radiographs were assessed by three reviewers (blinded to clinical details) for new bone formation, osteolysis and radiolucent lines in each Gruen Zone.

RESULTS. The mean age at the time of operation was 72 years (range 36 to 92). The average length of follow-up was 8 years (range 3 to 12.4). The mean Harris hip score was 85.8 (range 42 to 100) at the latest post-operative review. The mean WOMAC and MDP scores were 34.5 and 14.8 respectively. The mean pain visual analogue score (range 0 to 10) was 1.2 overall and 0.5 specifically for mid-thigh pain. There were no revisions of any femoral component for aseptic loosening. There were only three stem re-revisions (2 cases of infection, 1 recurrent dislocation). Radiological review of all femoral components, including the three mentioned, revealed stable bone ingrowth with no continuous or progressive radiolucent lines in any zone. Using revision or impending revision for aseptic loosening as the end point, at 10 years the cumulative survival for the stem was 100% (95% CI 94 to 100).

CONCLUSIONS. We present excellent medium-to-long-term clinical, radiological and survivorship results with the use of a fully HA coated titanium stem in revision hip surgery.

P099
RESULTS OF FEMORAL REVISION IN THR USING THE UNCEMENTED SL, SLR STEM

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A different type of femoral shaft osteotomy is sometimes required for cement removal or in other circumstances. This approach will condition the choice of femoral implant. As a matter of fact, the choice of implant should be related to the femoral bone loss. The aim is to remove the stem and the cement man-

tle through a routine approach or femoral fenestration. This exposure will allow a standard implant SL or longer stem SLR (Plus Endoprothetik AG), limiting a modular revision stem in cases of large distal bony defects or extended osteotomy. The femoral revision with SL-SLR does not compromise a future revision. From 1996 to 2001, 42 femoral revisions using the SL (11), SLR stem (31) were performed. Of these 40 were available for retrospective review in the 2 years minimum follow-up period. Fenestration of the femur for cement removal at the tip of the stem or other special circumstances was performed in 28 patients. Radiographs were evaluated for changes in stem position, radiolucent line formation and remodelling of cortical bone. No cases of fracture were observed at the fenestration sites. Radiographically the position of the stem was unchanged in 38/40. There were 2 cases of stem subsidence (< 5 mm) and subsequent stabilization. Increased bone stock was noted in almost all cases. The SLR stem has the advantage of being able to bridge large bony defects distal to the lesser trochanter and still maintain adequate rotational and vertical control.

P100
INITIAL EXPERIENCE WITH THE CABLE-GRIP PLATING AND CERCLAGE SYSTEM IN REVISION AND RECONSTRUCTIVE TOTAL HIP ARTHROPLASTY

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INTRODUCTION. We report an initial experience with a cable-plate system that has been used to treat complex primary and revision hip replacements. The device offers advantages over other systems due to its ability to be combined with trochanteric fixation devices and plates. A unique tensioning device allows intra-operative adjustments.

MATERIALS AND METHODS. Over four years we have used the system in twenty-eight cases: in sixteen peri-prosthetic fractures; to secure a transfemoral approach in seven cases; to attach strut allografts in three cases; to repair a cortical window or a trochanteric osteotomy in the final two. There were seventeen males and eleven females with a mean age of seventy-three. A retrospective review of the patients' notes and

X-rays form the basis of our study.

RESULTS. In all cases the femoral fractures or osteotomies healed.

One patient had a sciatic nerve palsy and one had displacement of the initial fixation. There have been no cases of dislocation or non-union.

One cable broke and a trochanteric fixation plate was removed as a planned procedure.

DISCUSSION. Our early experience with this type of fixation system is encouraging. Biomechanically, the system is stronger than others, such as the Dall-Miles or Biomet systems.

We have not had any subsequent fractures with the Cable-Grip system as has been reported with Dall-Miles wires. The simplicity and ease of the tensioning device is an advance over other systems. We now routinely use this system in complex primary and revision hip surgery, especially peri-prosthetic fracture cases.

P101
LONG-TERM FOLLOW-UP FOLLOWING FEMORAL IMPACTION GRAFTING WITH MORCELISED ALLOGRAFT AND CEMENT IN REVISION HIP ARTHROPLASTY

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AIM. The aim was to objectively assess outcome following femoral impaction grafting in revision arthroplasty with morcelised allograft bone and cement with emphasis on femoral stem subsidence.

METHODS. Prospective analysis of a single surgeon consecutive series of revision THR's with a minimum of 5 years follow-up was undertaken. Cemented Charnley stems were used. Assessment involved radiographic analysis of femoral stem position and measurement of relative subsidence. Related complications were recorded. Subsequent femoral revision and late subsidence were taken as clinical end points.

RESULTS. Thirty-four individuals (35 femora) were included. There were 4 deaths with <5 year follow-up and 10 cases were lost to follow-up. There were 2 revision procedures for deep infection, 2 dislocations and no peri-prosthetic fractures. There were 4 patients with progressive stem subsidence (range 14 to

17 mm, mean 15 mm), of which only one requires re-revision. There was only one case of progressive endosteal lysis. Twenty-one individuals (22 femora) were eligible for final analysis with > 5 year follow-up (range 5.0 to 11.1 years, mean 7.8).

CONCLUSION. Our results demonstrate that impaction grafting with morcelised allograft in revision hip arthroplasty is a useful and reliable surgical technique. The incidence of stem subsidence and re-revision is low. The incidence of complications is favourable when compared with published series. The incidence of stem subsidence is much lower than that of socket migration in acetabular revision using allograft. This may be related to the thinner mantle of graft bone in the femur or the greater vascularity of the host bone.

REVISION OF THE INFECTED THR

P102

REVISION-SURGERY OF THE INFECTED TOTAL HIP ARTHROPLASTY

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BACKGROUND. The infection-situation in total hip arthroplasty requires, in most of the cases, explanation of the artificial hip.

There are questions of treatment, concerning reimplantation (one-stage, two-stage), antibiotics (local, systemic), soft-tissue-treatment and types of revision-implants.

METHODS. We do in all patients two-stage-revision which means: explantation, debridements, finally in clinical and microbiological clean up-situs reimplantation, mostly cementless. The interval between these procedures lasts about 2 weeks. We do the antibiotic treatment in a local and systemic way. The reimplantation takes place, when we have clinically and microbiologically clean conditions. Until now we found local bacteria or clinical signs of infection, so long we do debridement without reimplantation. When we do the first step, means explantation, we remove all artificial material, means even all rests of cement.

RESULTS. In hard cases we need a lot of debridements, till we can do reimplantation (10 and more operations).

The cementless way of reimplantation is a good way, when there should be a new infection in the following time, because there is not the necessity to remove cement then. Especially multi-resistance needs a lot of special treatment, concerning the logistics (isolation, cleaning procedures in the operation-theatre...).
CONCLUSIONS. Revision surgery of infected hip-arthroplasty is a very long-lasting and expensive procedure. Perfect hygienic methods are necessary to reach success. Special departments for infected arthroplasties would bring a lot of advantages.

P103

CANNULATED ARTICULATING SPACER IN THE TREATMENT OF TOTAL HIP ARTHROPLASTY USING A DEEP INFECTION OF TWO-STAGE REIMPLANTATION

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BACKGROUND. Two-stage reimplantation is the most effective solution for the treatment deep infection of arthroplasty

METHODS. Cement spacer is an optimal method not only for ensuring stability of limb, but also for providing enough space for the future implantation of the new prosthesis in the period of time, which is necessary for treatment of infection. Spacer can also be used for local application of antibiotics, which are releasing from the bone cement, so that spacer guarantees a space for an application of drainage.

The main advantage lies in drainage system's access into femoral canal, i.e. the disadvantage of classic spacer where femoral cavity is obstructed with spacer like a bottle with a cork plug.

RESULTS. In the 1st Orthopaedic Clinic of Charles University we used spacer in treatment of 29 patients with infection of THA. The period between spacer implantation and reimplantation procedure was on average 11.6 weeks (6-28 weeks). Success rate of two-stage reimplantation using spacer was 96.5%. The result of Harris hip score is excellent reaching on average 90.1 points (79-99 points). Fracture of spacer was observed in two cases, luxation occurred in 5

cases but had no negative effect on the result of the treatment.

CONCLUSIONS. By using drainage system we developed canulated articulating spacer, which is helping in femur drainage with functional temporary implant. This method improves the quality of life before new endoprosthesis reimplantation.

P104

TWO-STAGE REIMPLANTATION USING A SPACER - A METHOD OF CHOICE IN SOLUTION OF HIP REPLACEMENT INFECTION. OUR RESULTS BETWEEN 1981 AND 2000 IN 184 PATIENTS

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BACKGROUND. A therapy of this replacement infection often presents a number of organizational demands. Owing to the complicated and difficult treatment of deep arthroplasty infection several ways of treatment were suggested: pure antibiotic therapy, revision and lavage, replacement extraction, two-stage reimplantation with skeletal traction or using a spacer.

METHODS. We have evaluated a treatment of total hip replacement infection in 184 patients treated by surgery in our department between 1981-2000. We have evaluated the success rate of the treatment according to Tsukayama. An average follow-up after the final procedure was 58.9 months (ranging from 25 to 253 months).

RESULTS. Pure extraction of the implant was performed in 80 patients. Success rate was 92.5%, Harris hip score 62.1 points, increase of HHS 9.9 points. A second group of 53 patients was treated by two-stage reimplantation without spacer using skeletal traction. Success rate was 94.3%, HHS after reimplantation was 85.3 points, increase of HHS 20.8 points. A spacer was used in 46 patients. Success rate was 95.6%, HHS after reimplantation 89.7 points and increase of HHS 29.7 points.

CONCLUSIONS. The rate of success in eradicating the infection is virtually the same regardless of the method used. It is obvious that two-stage reimplantation pro-

vides significantly better functional results than pure extraction of the implant. Using a spacer provides much better comfort during treatment as well as better functional results compared with two-stage reimplantations without a spacer, which uses resection arthroplasty between the operations.

REVISION, MISCELLANEOUS

P105

PERFORMANCE OF PRIMARY HIP PROSTHESES IN TOTAL HIP REVISION SURGERY

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INTRODUCTION. Preferably for primary implantation designed hip stems and acetabular cups, such as the Bicontact -system can be successfully implanted in revision situations, where only mild bony defects are obvious. Defect classifications have addressed this possibility and provide anatomical details suggesting proper usage of non-cemented primary stems and cups. However, assessment of a defect situation in revision arthroplasty pre-operative from X-rays is highly complicated and connected with great variability. The goal of this study was, to assess the performance of primary hip implants in revision cases and establish guidelines for pre-operative estimation of proper usage of primary implants.

METHODS. X-ray and clinical performance of 134 patients, treated with Bicontact-primary hip stem and/or threaded cup München/SC were evaluated. X-ray parameters describing bone defect situations of anterior, posterior rim and inner pelvic wall were analyzed. Implant migration was assessed as were Harris-hip scores and SF36 scores. Statistical comparisons were performed using ANOVA.

RESULTS. Mean postoperative treatment time was 6.5 years. There were no significant differences between bone defect parameters, migration and clinical performance. As a tendency, x-large cups show early migration and failure.

CONCLUSION. This study demonstrates the difficulty to

establish guidelines up to which defect size and location, a proper use of primary implants can be predicted. To give the surgeon additional information about the prognosis of his intraoperative situation, biomechanical studies have to be conducted, addressing a fine-differentiation of Paprosky Type-II hips.

P106
CLINICAL CHARACTERISTICS OF OSTEOCONDUCTIVE BONE GRAFT MATERIALS IN REVISION ARTHROPLASTY AND DEFORMITY CORRECTION

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INTRODUCTION. Large bone defects in revision arthroplasty can be treated with classic grafts (allograft, autografts) or artificial bone substitutes. The usage of bone substitutes is rapidly increasing indicating a shortage in the availability of musculoskeletal donor tissue available. This reality has stimulated an increased development of bone substitutes. These materials, however, have varying degrees of regulatory scrutiny and thus, their true

safety and effectiveness in patients may not be known prior to their use by orthopaedic surgeons. It is, thus, important to gain insight into this emerging class of bone substitutes and compare clinical results with science perspectives based on animal experiments or *in vitro* studies.

METHODS. In 18 patients bone substitutes were either used for acetabular cup support or open wedge osteotomies. During revision surgery in hips or during metal implant removal bone probes were taken *in vivo* and analyzed histologically. Also, X-rays were quantitatively analyzed.

Compared were bone substitutes based on calcium cements, bovine collagen and autograft.

RESULTS. Histology and Radiology demonstrated remodeling of the substitutes and material resorption. However, compared to data from animals studies the resorption rate has a much slower tendency. Several probes exhibited inclusion of substitute material with minor osteoclastic response.

CONCLUSION. This is one of the first studies demonstrating the *in vivo* human performance of bone substitutes. Further analyses have to be undertaken to gain insight into the characteristics of bone substitutes in human physiologic conditions.