

THE INFLUENCE OF POSTERIOR CRUCIATE LIGAMENT TREATMENT IN MEDIAL PIVOT TOTAL KNEE ARTHROPLASTIES

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Medial pivot total knee arthroplasty is designed to permit posterior rolling and sliding of the lateral femoral condyle around a stable medial femoral condyle. The purpose of the current study was to analyze the weight-bearing kinematics of medial pivot TKA's with three different treatments of the posterior cruciate ligament: PCL resected, PCL partially released and PCL retained, to determine if the PCL status had a significant effect on tibiofemoral translations or rotations in a medial pivot TKA design.

In vivo kinematics were determined for 17 clinically successful total knee arthroplasties during a stair-climbing activity using lateral fluoroscopy and shape matching techniques.

All three groups showed similar medial pivot motions. PCL retained knees showed significantly greater tibial internal rotation than PCL resected knees for flexion of 30° and greater. Rotation of the PCL released knees was midway between PCL resected and PCL retained knees.

Regardless of PCL treatment, patients with medial pivot total knee arthroplasties had medial pivot motion patterns during stair climbing activities. This study showed a clear and intuitive trend in motions with PCL treatment, such that knees with partially released PCL's had kinematics midway between those where the PCL was either fully maintained or fully resected.

MID-TERM RESULTS OF A LATERAL FLARE CEMENTLESS FEMORAL STEM. A CLINICAL, RADIOGRAPHIC AND PERIPROSTHETIC DENSITOMETRY STUDY.

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Background: Over the past decade, several modifications have been introduced to uncemented femoral stems. The design of the stems, however, still classically fall under two categories: anatomical and straight. The purpose of this paper is to report the first clinical, radiographic and periprosthetic densitometry results of a cementless total hip arthroplasty performed with an off-the-shelf extended metaphyseal loading device.

Fifty-eight consecutive patients who received a proximally loading non-cemented hip prosthesis were followed for an average of 4.4 years. Patients were clinically and radiographically followed at 3 weeks, 3 months, 6 months, 1 year and yearly thereafter. In addition, a group of 8 consecutive patients were studied with Dual X-Ray Absorptiometry Scans (DEXA) at the same intervals during the first year and at 18 months after surgery.

The extended proximal geometry of the device allowed for initial and secondary stability reflected by the low subsidence values over time. The maintenance of periprosthetic bone stock over time and the absence of stress shielding can be explained by the proximal loading pattern of the stem.

PRESERVATION OF PERIPROSTHETIC BONE MASS AFTER THR WITH A LATERAL FLARE STEM. A PROSPECTIVE STUDY USING DEXA SCANNING.

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Uncemented porous coated femoral implants rely on bone ingrowth to achieve stable, long lasting fixation. The loss of proximal femoral bone mass around hip stems has been traditionally termed 'stress shielding' and has been linked to the transfer of loads to the diaphysis and the relative unloading of the proximal femur. Proximally loading devices should then minimize or avert stress shielding altogether. We prospectively evaluated

the changes in the periprosthetic bone mass density after insertion of an off-the-shelf non-cemented stem designed to engage both cortices at the metaphyseal level.

A total of 10 total hip arthroplasties with a proximally coated lateral flare device were evaluated with dual-energy x-ray absorptiometry and qualitative radiographic changes 3 weeks after surgery and at 12, 24 and 52 weeks thereafter. The regions of interest (ROI) used in this study corresponded to the zones described by Gruen.

All hips were radiologically stable. The DEXA measurements revealed an overall increase in the BMD at 52 weeks of 4%. Greater gains were observed at or below the lateral flare of the stem in the metaphyseal femur.

The use of an extended proximally loading device proved to have a beneficial effect in the periprosthetic bone mass density due to its geometry and inherent primary stability evidenced by the DEXA and subsidence values.

PREVENTION OF VENOUS THROMBOEMBOLISM FOLLOWING TOTAL HIP REPLACEMENTS. THE VIEW FROM THE OPERATING ROOM.

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Thromboembolism following total hip arthroplasty is a common complication that may result in significant morbidity and mortality. Despite this, optimal prophylactic regimen is controversial. According to the literature, the prevalence of deep venous thrombosis during the early post-operative period ranges from 13% in patients utilizing low molecular weight heparin to 18% in patients treated with sequential compression devices alone.

We investigated the efficacy of a comprehensive approach encompassing the use of aspirin, intermittent compression devices ('foot pumps'), and early mobilization in a cohort of 290 consecutive patients after non-cemented total hip replacements. The surgical procedures were carried out under epidural anesthesia in most cases (91%). All patients were allowed full weight bearing and received ambulation training starting on the first post-operative day. Ankle-high pneumatic boots ('foot pumps') were used early immediately surgery. Aspirin (325 mg po/qd) was used as a pharmacological measure to prevent thromboembolism. The presence of deep vein thrombosis was determined with the routine use of venous duplex scans on post-operative day number 5 to 10 (mean 6.8). The duration of the follow-up was 3 months. No patients were lost to follow-up.

Four distal DVT and two proximal DVT were detected in five patients (3%). None of the patients developed symptomatic pulmonary embolism during the follow-up period. There were no major wound complications.

Venous thromboembolic disease after hip replacement surgery is largely associated with postoperative immobilization and venous stasis. It is the authors' opinion that a prevention strategy should include mechanical as well as pharmacological measures. The concomitant use of epidural anesthesia, "foot pumps", aspirin and early full weight bearing ambulation may be effective in further reducing the incidence of DVT after surgery.

CAP PROSTHESIS: A CEMENTLESS RESURFACING CONCEPT WITH METAL ON METAL BEARING

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The pathologies of the hip (epiphysiolysis, Perthes, congenital dysplasia) cause invalidating outcomes in young patients. In the years many authors searched for the golden standard if total hip arthroplasty is necessary. From Smith-Petersen to McKee, to Amstutz the saving of the femoral neck has been the main objective, with the longevity of the system. Therefore the combination metal-metal has been used for articular components, because the friction of metallic components creates sub-

micron metallic particles causing only minimal foreign body reactions and very low wear rates.

Our study group (Arthro Surgery Group) has implanted, from April 2003, 28 cementless resurfacing hip prostheses with metal-metal articular components.

The average follow-up has been of 6 months (from 3 months to 1 year). In all cases, the Harris Hip Score has been good or excellent (from 77 to 100), and radiographic exams didn't show signs of radiolucence or resorption.

This type of prosthesis allows moreover a minimum-invasive approach to the hip and a second line of defense in case of revision.

PROXIMAL IMPACTION BONE GRAFTING IN REVISION HIP SURGERY.

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Significant proximal femoral bone deficiency in revision hip surgery poses a considerable challenge, especially as revision hip surgery is increasing in prevalence. Many femoral prosthetic devices, which compensate for this bone loss, are available to surgeons but ideally one wants to restore viable proximal bone stock. The Oxford Universal Hip (OUH) has been designed and modified with these challenges in mind. This is atri-modular, non-locking device that allows for some rotation and subsidence in the cement. Load transfer occurs at the proximal wedge, thus avoiding proximal stress shielding. The OUH has been used extensively in both primary and revision hip surgery and is particularly useful when used in conjunction with proximal impaction bone grafting. The main aim of this study was to determine the clinical outcome of the patients. The viability and survivorship of the impacted bone graft was assessed in order to give some indication of adequate perfusion of the incorporated bone grafting.

Between 1999 and 2002 the OUH, in combination with proximal impaction bone grafting, was implanted in 72 hip revisions in 69 patients. All patients were clinically evaluated using the Oxford Hip score. Histological samples of impacted bone grafting were analysed by a pathologist 2 years after implantation to assess viability and perfusion of the impacted bone graft.

The Oxford Hip Score improved from a pre-operative to a post-operative score of 45 (26-58) to 24.3 (12-43) respectively (p<0.001). The mean follow up time was 32.7 months and in that time there were no re-revisions for aseptic loosening. Histology demonstrated viable bone stock in the proximal femur where bone grafting had been impacted 2 years previously.

The OUH is a versatile hip prosthesis for use in revision hip arthroplasty and is especially well suited to proximal impaction bone grafting where it is possible to restore viable bone stock

CERAMIC ON CERAMIC: WHY TO INCREASE THE DIAMETER

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Volumetric wear study in metal-polyethylene bearing couple, has demonstrated that the wear rate is reduced by the decrease of the diameter of the ball-heads. On the other hand, small ball-heads introduce some limitations: the stability, the sub-luxation and the dislocation of the prostheses are directly correlated with the diameter and are often cause of failure.

The crosslinked polyethylene, promising lower wear rates, seems to have higher Function Biological Activity (FBA) because of its smaller but more aggressive particles[1]. In '70s, the alumina ceramics has been introduced in the hip prostheses due to its high wear resistance and its bulk material and debris biocompatibility. Laboratory test and long terms clinical experience confirmed that the BIOLOX@forte/ BIOLOX@forte bearing couple offers a reduction of two orders of magnitude of the linear wear rate (in vivo results 0.005 mm/year) if compared with metal-polyethylene (0,2 mm/year), it does not produce reaction[2] and it has a high reliability (fracture rate =

DESIGN AND LABORATORY EVALUATION OF HARD-ON-HARD BEARING COUPLES
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Design of hard-on-hard bearing couples has traditionally been characterized by the material of the bearing couple, clearance between the bearing surfaces, sphericity of the components, surface roughness, and the radii of the components. All of these factors play a role in the lambda ratio and fluid film thickness calculations. However, the fluid film for hard on hard bearings can be interrupted by issues like the presence of 3rd body particles, intermittent walking, jogging, and subluxation. Only recently have researchers begun to simulate some of these disruptions in the fluid film for hard on hard bearings.

Recent laboratory testing has looked at the effects of utilizing different materials and methodologies to evaluate hard-on-hard bearings. Ceramic-on-metal is a unique combination of components that is currently available. Several authors have shown that this combination can reduce the amount of metal wear generated during the test by a factor of 4-100. However, an occasional anomaly has shown up in some of these tests where a wear couple in a steady state wear mode will have a several-fold increase in wear for a short duration.

For bearing couples that have a metal component, ion analysis of the serum lubricant can be utilized to monitor the amount of wear. This technique can provide real-time data on the amount of wear seen in simulator testing without removing the specimens from the machine. Further, there are some designs of metal cups that cannot be removed from the simulator without causing damage to the component. Data from a ceramic-on-metal simulator test confirmed that the short-term anomaly in gravimetric wear correlated with an increase in metal ion levels.

Distraction testing evaluates the change in wear due to the unintended subluxation of the hip. This may occur during a standard walking gait if the hip is loose, during impingement, or during deep-knee bends, squatting, or rising from a chair. Distraction testing has various effects on wear depending on the material of the bearing couple. UHMWPE is insensitive to this additional mode of simulator testing. Metal-on-metal and ceramic-on-ceramic can increase in wear by up to an order of magnitude. The utilization of BioloX-delta rather than BioloX-forte can reduce the amount of wear seen during distraction testing. Diamond-on-diamond is insensitive to this wear mode and showed immeasurable wear.

Other issues during testing of hard-on-hard bearings are still being explored. It is well known that 3rd body particles will disrupt fluid films and can increase wear. But the results from adding particles is variable. Metal-on-metal tests can have one specimen with very little increase while another specimen has an order of magnitude increase. Deformation of the shell caused by insertion during surgery has been shown to occur. Currently, this deformation has not been able to be replicated in a simulator, therefore, its effects are unknown.

The design and laboratory testing of hard-on-hard bearings has improved significantly over the past decade. Further research is still needed to evaluate designs that may potentially increase resistance to failure modes other than standard walking gait cycles.

MINIMUM 10 YEAR CLINICAL, RADIOGRAPHIC AND DENSITOMETRIC FOLLOW UP OF AN OFF THE SHELF "LATERAL FLARE" THR FEMORAL COMPONENT DESIGN

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This is a report on the first 100 THR patients treated with an off the shelf version of a novel "Lateral Flare" femoral component. A prior published report has documented the up to 19 year follow up of custom fabricated stems of an identical design concept as being successful in patients <55 years of age.

HHS, radiographic measure of bone morphology, implant stability and densitometric measure of bone response after THR with an off the shelf version, "Revelation Lateral Flare", femoral component, confirm excellent bone preservation and implant stability with this design concept. DEXA analysis of a 20 consecutive patient subset of these 100 patients, documented preservation of more than 95% of proximal femoral bone stock in Gruen zone 1 and 102% of total bone stock in Gruen zones 1-7. Implant stability measurement documented <0.5mm of subsidence in spite of patients being permitted immediate post-operative full weight bearing activity.

These findings support reasonable optimism for expectation of successful long term results being achievable with the use of an off the shelf version of the "Lateral Flare" design concept, in young, high demand patients suffering with early onset osteoarthritis of the hip.

A NEW APPROACH TO NECK SPARING THA STEM

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Introduction: Architectural changes in the proximal femur after THA continue to be a problem. In an attempted, to reduce these changes some surgeon designers have advocated the concept of neck sparing stem designs.

To-date neck-sparing stems have been disappointing in their ability to maintain the calcar. A new approach was undertaken to improve load transfer and to create a tissue-sparing stem that would be simple in design, reproducible in technique and provide for fine-tuning joint mechanics while maintaining compressive loads to the calcar.

Methods: Review of previous published work was evaluated along with FEA modeling in creating a new approach to neck sparing stems for THA. The MSA™ Stem is a simple curved stem with a unique lateral T-back designed for torsional stability, ease of preparation and insertion. The proximal design has a novel proximal conical shape designed to transfer compressive forces to the calcar.

A modular neck provides for fine-tuning joint mechanics.

Results: FEA modeling will be reviewed. Strain patterns for the MSA™ stem demonstrated better patterns vs. long stems or the short Biodynamic stem.

Discussion: In theory neck retaining devices provide or:

- Bone and Tissue sparing
- Restoration of joint mechanics
- Minimal blood loss
- Potential reduction in rehabilitation
- Ease of revision
- Simple surgical technique
- Options for bearing surface
- Selection of femoral head diameter
- Standard surgical approach to the hip

We are encouraged and believe there are advantages in the concept of neck sparing stems. Clinical/surgical evaluation is now underway and will be reported on in the future.

ULTRA-SHORT ANATOMIC NECK SPARING CEMENTLESS FEMORAL STEM: EARLY OUTCOME IS PREDICTABLY SUCCESSFUL

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Architectural changes in occurring in the proximal femur (resorption) after total hip arthroplasty (due to stress shielding) continues to be a problem. In an attempt to reduce these bony changes the concept of short and femoral neck sparing stem designs have been

advocated. The purpose of this study was to evaluate the early clinical and radiological results, especially stem fixation and bone remodeling of proximal femur after total hip arthroplasty.

A total of forty-five patients (fifty-four hips) were included in the study. There were twenty men and twenty-five women. The mean age at the time of operation was 53.9 years (range, twenty-six to seventy-five years). Clinical and radiological evaluation were performed at each follow-up. Bone densitometry was carried out on all patients one week after operation and at the final follow-up examination. The mean follow-up was 1.3 years (range, one to two years).

The mean preoperative Harris hip score was 45 points (range, 15 to 48 points), which improved to a mean of 96 points (range, 85 to 100 points) at the final follow-up. No patient complained of thigh pain at any stage. No acetabular or femoral osteolysis was observed and no hip required revision for aseptic loosening of either component. One hip (2%) required open reduction and fixation with a cable for calcar femorale fracture. Bone mineral densitometry revealed a minimal bone remodeling in the acetabulum and proximal femur.

The geometry of this ultra-short anatomic neck sparing cementless femoral stem has proved to provide effective initial stability even without the diaphyseal portion of the stem. We believe that femoral neck preservation and lateral flare of the stem provide an axial and torsional stability and more natural loading of the proximal femur.

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

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18 years ago laboratory studies were started to develop a CT-based uncemented customised femoral stem in order to optimise the fixation and strain distribution to the proximal femur in uncemented femoral components. An individual design also aimed to optimise the biomechanics of the joint and to enable use of uncemented stems in femurs with abnormal shape and dimension. The developed prosthesis has now been in clinical use for 13 years. The aim of this paper is to present the preliminary results of a prospective clinical study of this prosthesis.

Patients and methods: 685 hips have been operated. 58.8 % of the patients were women. Mean age was 51 years (20-69). 42.3 % of the hips were dysplastic. A high number of hips without major anatomic abnormality of the upper femur were included. The prostheses were designed to obtain a neck anteversion of 10 degrees after insertion, optimised medial femoral head offset and correction of leg length discrepancies up to 3 cm. All patients were followed with radiological and clinical examination. Merle d'Aubigné score was used. RSA and DEXA-studies have been performed in some groups of the patients. Finally, study of the gluteal muscular function in hips with optimised medial femoral head offset after insertion of custom stems was compared to hips where optimisation had not been achieved with use of standard stems.

Results: We experienced that use of this type of prosthesis is very simple and offers obvious advantages in abnormal size and geometry of the upper femur. Nine patients sustained a peroperative fissure in the proximal femur (1.3 %). These fissures were treated successfully with cerclage wires. Eight patients sustained a femoral fracture by a fall accident. Four fractures healed after osteosynthesis without loosening of the prosthesis. A long stem prosthesis had to be used in the other four. No stem loosening was seen except in one case where a non-union after subtrochanteric osteotomy prevented stem fixation. Dislocation occurred in ten hips (1.5%). In four of these the acetabular component had to be replaced. Average total score at 7 years (125 hips) was 17.1 (preop 9.4), at 10 years (56 hips) 17.0 (preop 9.4). The pain scores at the corresponding observations were 5.7 (preop 2.7) and 5.6 (preop 2.8). DEXA-studies showed comparable

remains highly successful since its inception in 1979. We have performed primary cementless THA with the Profemur Z system (Wright Medical Technology, Inc.) mainly for dysplastic hip. The concept of Profemur Z stem with a modular neck system is the same as the Zweymuller grit-blasted titanium femoral stem. Traditional templating for dysplastic hips often led to errors in sizing, cup positioning and femoral stem direction. A CT-based surgical planning system called Hip-Op is a three dimensional planning software program that uses DICOM images to represent the relevant anatomical objects by means of multiple views. The purpose of this study was to evaluate the utility of the Hip-Op system to accurately predict implant size, insertion angle and the fixation manner of the femoral stem.

Materials and methods: One hundred and three non-selected, consecutive THA in 96 patients were performed as primary cementless THA with the Profemur Z system by the same surgeon. There were 81 women and 15 men in this group, with a mean age at surgery of 63 years (range 35 to 87 years). Postoperatively, the predicted implant sizes planned with Hip-Op system and with standard X-ray templates were compared to the actual components selected at the time of surgery. Clinical evaluation was done by using Harris Hip Score (HHS). The femoral stem was evaluated in both the anterior posterior and lateral projections of the radiographs. Insertion angle and the fixation manner of the femoral stem were also examined postoperatively using X-ray and CT.

Results: 3D templating with Hip-Op system accurately predicted the exact size of the femoral component 65% of the time, was within 1size 96% of the time and within 2 sizes 100% of the time. Acetabuli were correctly predicted 80% of the time, within 1 size 98% and within 2 sizes 100% of the time. Conventional templating predicted the exact size 48% of the time in femoral components, and 66% in acetabuli, within 1 size 76% and 82%, within 2 sizes 89% and 92%, respectively. The average preoperative HHS was 46.3 points and the latest HHS was 83.2 points on average. Three patients required slow physiotherapy due to greater trochanteric fractures. Two patients were suffering from anterior dislocation. There was no femoral component subsidence. The insertion angle from neutral position of the stem was 0.4 degree in A-P view, and 1.6 degree in profile view. The fixation manner of the Zweymuller stem in the canal was obtained by contact with the four corners of the stem in 6.7%, three corners in 16.7%, two corners in 70%, respectively.

Discussion: The Zweymuller stem design provides primary axial stability through its dual longitudinal taper and primary rotational stability through contact with the corners of the stem to cortical bone in the canal. This study clearly shows the advantages of CT-based 3D templating over conventional X-ray templates. The surgical planning performed with Hip-Op system is accurate and useful, especially for dysplastic hip.

PREOPERATIVE THREE-DIMENSIONAL PLANNING FOR FEMORAL COMPONENT – CORTEX/STEM RATIO MAPPING ON STEM SURFACE

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Introduction: Three dimensional preoperative planning for each patient has been done in our institution. Anatomical designs of prosthesis are necessary to realize primary stability. The purpose of this study is to visualize the area which concerns about initial stability and load transfer post-operatively.

Methods: A preoperative three-dimensional planning based on CT-scan data was performed. Two different contour prostheses (Versys and Revelation) were studied for each patient.

Distance from central axis of the stem to inside wall of the femoral cortex (A) and distance from central axis of the stem to the surface of the stem (B) were measured.

We defined B/A as cortex-stem ratio and mapped it on the surface of the stem like contour lines.

Results: Cortex-stem ratio of Versys stem of proximal femur indicated over 90% at medial, but no more than 70% at anterior, posterior and lateral. In a circumference of distal stem, that ratio was high. On the contrary, cortex-stem ratio of Revelation represented 90~100% at medial and lateral, 85~95% at anterior portion.

Discussion: High rate region of cortex-stem ratio represent a great difference between Versys stem and Revelation stem. These region participate in primary fixation and load transport to femoral cortex. Preoperative three-dimensional mapping is useful technique to better understand the relative position between the stem and the femur, to evaluate which regions were concerned in initial stability after operation and load transfer later. The visualized result can also suggest the surgeons where and how to prepare the canal efficiently for each design of the stems.

SELECTION OF REVELATION STEM USING 3-D PREOPERATIVE COMPUTER PLANNING SYSTEM

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Introduction: The success of cementless THA (total hip arthroplasty) mainly depends on the choices of stem, its size and accuracy of stem orientation. Selection of the optimal stem judging only by plain X-ray is not so easy. Because deformity varies in each case and it is impossible to obtain profile view of the hip. As osteoarthritic patients tend to develop external rotation contractures, radiographic position of the patients with correct rotation is very difficult. To override these problems, we have been using 3-D preoperative planning system. As for the stem selection, we have been mainly using Revelation stem, because it has a structure called lateral flare that provide proximal physiological load transfer. In the present study, the usefulness of our preoperative planning system especially for the determination of the size and stem orientation with Revelation stem.

Materials and Method: Pre-operative planning was performed in 55 osteoarthritic hips in 50 patients (10 male and 40 females), and the mean age at the operation was 64.05 years old. The 3-dimensional geometries of the femora femora were reconstructed from the CAT scan DICOM data. The geometry of femur and components were placed on the same coordinate. Cross-sectional images from many directions were observed, and the optimal location and the size of the stem were selected. According to the result, actual operations were done. Planned sizes and selected sizes at the surgeries were compared. For several patients, post-operative CAT scans were performed, then planned stem position and actual stem position were compared.

Result: Stems preoperatively defined were used in 50hips (90.9%), 1 size large ones were used in 2 hips (3.6%) and 1size large ones were used in 3 hips (5.5%).

Discussion: As Revelation stems have very high proximal fit-and-fill, the end point of the stem insertion is very definite. The characteristics made the accuracy of the preoperative planning. So it was not so difficult to perform THA according to the preoperative planning as it had been imagined.

PER-OPERATIVE VIBRATION ANALYSIS: A VALUABLE TOOL FOR DEFINING CORRECT STEM INSERTION

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The operation technique and prosthetic materials for total hip replacement (THR) have continuously improved. Still, defining the end-point of the prosthetic stem insertion into the femur canal relies on the feeling of the orthopaedic surgeon. This consists of a sense of

mechanical stability when exerting torque forces on the prosthesis as well as a feeling of the prosthesis being well fixed and not displaceable along the axis of the femur. Stability and survival of the implant is directly related to the long term fixation stability of the prosthesis stem. But, excessive press-fitting of a THR femoral component can cause intra-operative fractures.

In our centre custom made stem prostheses are commonly used to increase the optimal fit in the femoral canal. We report the first per-operative use of a non invasive vibration analysis technique for the mechanical characterization of the primary bone-prosthesis stability.

From in vitro studies a protocol has been derived for per-operative use. The prosthesis neck is attached to a shaker using a stinger provided with a clamping system. The excitation is realized through white noise in the range 0-12.5 kHz, introducing a power of approximately 0.5W into the femur-prosthesis system. The input force and the response acceleration are measured in the same point with an impedance head mounted between the shaker and the stinger. The Frequency Response Function (FRF) is measured and recorded by a Pimento vibration analyzer connected to a portable computer provided with the appropriate software. All equipment is installed in the surgical theatre but outside the so-called laminar flow area.

The surgeon inserts the implant in the femoral canal through repetitive controlled hammer blows. After each blow, the FRF of the implant-bone structure is measured directly on the prosthesis neck. The hammering is stopped when the FRF graph does not change noticeably anymore.

The amount of FRF change between insertion steps is quantified by the Pearson's correlation coefficient R between successive FRFs. A correlation between the FRFs of successive stages of R=(0.99 +/- 0.01) over the range 0-10000 Hz is proposed as an endpoint criterion.

Non-cemented custom made stem insertion was studied in 30 patients. In 26/30 cases (86.7%), the correlation coefficient between the last two FRFs was >0.99 when the surgeon stopped the insertion. In 4 cases, the surgeon decided to stop the insertion because of suspected bone fragility, the final correlation coefficient was lower.

In one case an abnormal change in the FRF graph triggered inspection of the femur bone. A small fracture was observed and insertion was stopped.

In a second case FRF graph showed an oscillating behaviour, while the stem was visibly not completely inserted. After withdrawal of the stem and readjustment of the femoral canal, the stem could be reinserted and the Pearson's correlation index at end of insertion was 0.998.

The use of custom made stem prosthesis, made exactly to fit into the femoral canal increases the risk of excessive press fit and intra-operative fractures. Vibration analysis showed to be a useful tool to define end of the stem insertion.

WHAT IS ANTEVERSION, WHERE IS IT LOCATED, HOW DOES IT EFFECT TO THE STEM DESIGN AND HIP ARTHROPLASTY?

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One of the most important characteristic of the developmental dysplastic hip (DDH) is high anteversion in femoral neck. Neck-shaft angle is also understood to be higher (i.e. coxa-valga) in DDH femora. From this understanding many DDH intended stems were designed having larger neck shaft angle.

According to the result of our prior study; reported in ISTA 2005 etc.; using computer 3-D virtual surgery of high fit-and-fill lateral flare stem into high anteversion patients, it was revealed that the geometry of proximal femur itself does not have big difference from normal femora but they are only rotated low lesser trochanter.

It is very important to know what anteversion is, and where anteversion is located, to design a better stem and to decide more proper surgical procedures for DDH cases with high anteversion.

graphically. The presence of radiolucent lines, vertical or horizontal migration of acetabular cup (> 2 mm), and osteolysis were also evaluated.

Results: At final follow-up evaluation after revision, the average Harris Hip Score was 91.3. There were no revised hips during follow-up period. In 6 hips (14.3%), minor complications were observed: 3 heterotopic ossifications, 2 dislocations, 1 infection. No revision was necessary for the treatment of these complications. There were no hips with radiolucent lines, vertical or horizontal acetabular cup migration or osteolysis during the follow-up period. In 21 hips with bone graft, incorporation of bone graft was observed radiographically at final follow-up examination.

Conclusions: Our data showed that clinical and radiographical outcomes after revision THA using third generation ceramic-on-ceramic bearing were favorable. Revision THA with the use of ceramic-on-ceramic bearing surfaces can be preferentially considered especially in young patients. Further studies with long-term follow-up data are warranted.

PRIMARY FIXATION OF FINITE ELEMENT MODEL OF IMC STEM EVALUATED BY MICROMOTION

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The primary fixation of cementless hip prostheses is related to the shape of the stem. When there is a complication of loading in several directions, the mechanical fixation of a hip stem is considered to provide good primary fixation. The purpose of this study was to evaluate whether the IMC stem with its characteristic fixation method, which was developed by a group at Kitasato University, contributes to primary fixation by finite element analysis.

Analysis was performed at a friction coefficient of 0.1 with automatic contact, under the restriction of the distal femoral end. The following three loading conditions were applied: i) step loading of the joint resultant force in the region around the hip stem, ii) loading in the rotational direction, simulating torsion, and iii) loading of the femoral head equivalent to that during walking. Micromotion of the IMC stem along the x-, y-, and z-axes direction was calculated by simulation, and the stress distributed on the stem and femur was determined.

Micromotion along the z-axis, which is a clinical problem in hip prosthesis stems, was lower in the IMC stem than in other stems reported. Micromotion of the stem along the x-axis was low, indicating a low risk of sinking. The interlocking mechanism, which is a characteristic of the IMC stem, functioned to suppress its micromotion, indicating that the locking method of this stem contributed to the stability. Since no stress concentration was detected, it was considered that there are no risks of breakage of the IMC stem and femur.

It was suggested that effective fixation of the finite element model of the IMC stem can be achieved because the micromotion and stress level are appropriate for primary fixation.

JOINT FORCE GENERATES DISLOCATING COMPONENT INFLUENCED BY ACETABULAR LINER HEAD CENTER INSET

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Previous studies suggested that the shallow Ultra High Molecular Weight Polyethylene (UHMWPE) acetabular socket liner or the liner with no head centre inset can significantly increase the risk of hip joint dislocation. Independent to the traditional neck impingement models, the purpose of this study was to investigate an additional dislocation force pushing the femoral head

out of UHMWPE acetabular liner bearing under direct hip joint loading and the factors including the head centre inset affecting the magnitude of this force. The 3 D Finite Element Analysis (FEA) models were constructed by (30) 10 mm thick UHMWPE liners with six inner bearing diameters ranging from 22 mm to 44 mm and five head centre insets in each bearing size from 0 mm to 2 mm. A load of 2 446 N was applied through the corresponding CoCr femoral head to the rim of the liner. The DF was recorded as a function of head centre inset and head diameter. The results were verified by the physical tests of two 28 mm head bearing liners with 0 and 1.5 mm head centre insets respectively.

The results showed that the highest DF was 1 269N in 0 mm head centre inset and 22 mm head. The lowest DF was 171 N in 2 mm head centre inset and 44 mm head. The DF decreased as the head centre inset and head size increased. When head centre inset increased from 0 mm to 1 mm, the DF was reduced more than 50%. Two experimental data points were consistent with the trend of DF curve found in the FEA.

We concluded that the new intrinsic dislocating force DF can be induced by the rim directed joint loading force alone and can reach as high as 51% of the femoral loading force. This can be the addition to the dislocating moment generated by the neck impingement. A head inset above 1mm can effectively reduce DF to less than 25% of the joint force. Furthermore, the larger head diameter generates less DF. The DF is likely caused by the wedge effect between the deformed polyethylene bearing and the femoral head. The inset allows the femoral head to be separated from the spherical bearing surface, thus reducing the wedge effect. Our observation of the stabilizing effect trend of the head centre inset was consistent with reported clinical data. However, the increased height of the capture wall also reduces the range of motion. It is therefore necessary to minimize the inset height with the maximum benefit of the stabilize effect. This study suggested the larger femoral head has the advantage of reducing the DF and the stabilizing effect is more effective when combining with the inset wall. The result of this study should provide the guidance to improve acetabular poly liner design for better joint stability.

INVESTIGATION OF BUFFERED IMPLANT FIXATION IN RAT MODEL: MEASUREMENT OF INTERFACE STRENGTH IN COMPARISON WITH CEMENTED IMPLANT FIXATION

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We suggested a new concept of buffered implant fixation. It is a cementless fixation using a buffer instead of the cement between the bone and the implant. We investigated the feasibility of the buffered implant fixation using a rat model. In our previous study, we measured the amount of bone around the implant to compare the buffered implant fixation with the cemented fixation. The results showed the difference in change of Bone Volume/Total Volume (BV/TV) with time between the buffered fixation and the cemented fixation. Now, in this study, we are comparing the mechanical interface strength between two fixations.

After micro CT scanning, the specimens were used for mechanical push-out test to measure the interface shear strength at the buffer-bone or cement-bone interface. The distal side of the femur was carefully removed to expose the whole distal region of the implant while the proximal side of femur was cut carefully with diamond saw (Metsaw, R&B Inc., Korea) until the proximal end of cement or buffer is exposed. The femur was embedded into a push-out jig with a plaster. The push-out jig was mounted in a material testing machine (KSU-10M, Kyungsoong testing machine, Korea) and loaded at a rate of 0.01mm/s. The apparent interface strength was calculated by dividing the peak force by the surface area of the buffer or cement.

After 2 weeks, the apparent interface strength is 217.0 ± 280.0 (average \pm standard deviation) for buffer and 472.4 ± 381.1 for cement; after 4 weeks, $92.9 \pm$

67.6 and 268.1 ± 197.9 ; after 12 weeks, 441.9 ± 467.1 and 201.8 ± 132.3 , respectively. The buffered fixation showed gain in strength with time while the cemented fixation showed reverse tendency but the interaction by ANOVA was not significant ($p=0.125$). Even though the excellence of buffer fixation was not clearly confirmed because of small sample size and high variance, the feasibility of the buffer fixation was shown.

However, further studies are necessary to improve the buffered implant fixation. To enhance the cell adhesion and biocompatibility, it is necessary to modify the surface of polyetheretherketone (PEEK) such as by plasma treatment or biological coating. Also, an animal test using a higher level animal such as dog or pig is necessary.

COMPARISON OF 2-D VS 3-D FILL OF THE HIP STEM MEASUREMENT - TOWARDS THE NEW METHOD

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Objective: Establishment of the new method to evaluate fill of the hip stem.

Background: The fill of the hip stem is one of the important parameters to estimate the quality of planning or positioning of the cementless stem. It has been defined as a stem-canal width ratio on the A-P plain of X-ray images so far. However, it is quite a problem to get the correct AP images on basis so that positional difference may affect the measurement. According to our data, the fill was measured significantly different in 15, 30, 45, 60 degrees erroneous direction. First, we tried to figure out the fill of the hip stem three-dimensionally rather 2-dimensionally. Next, our new method was compared to conventional method.

Material and Methods: Leg CAT scans were performed on 32 hips of 20 patients (2 male, 18 female). Images of the canal of femora were reconstructed using CAD software. We made 2-types of canal model with or without lesser trochanter. The geometries of our lateral flare stems with different sizes were compared to each canal geometry in the CAD software and proper size was decided. Then images were observed from an accurate vertical direction of the coronal plain of the stem. We measured the 2-D fill on this plane and the 3-D fill of every 5 mm slice from the 5mm above to the 100mm below the head of lesser trochanter line (reference line). We also examined the stems 1-size smaller or larger than the appropriate ones.

Results: The mean age was 61.114 (range 24-82). The average of "3-D fill of Lateral flare stem was 51%/59% with/without lesser trochanter, and 2-D one was 74%/77%. The numerical and distributional results by these two methods to measure fill were alike but different. For example, in case without lesser trochanter, the 3-D fill showed the maximum value in the area just below the reference line. The maximum 2-D fill was recorded in 10mm caudal from the reference line. In general, this stem occupied much space in the distal area and around the lesser trochanter.

Future Plan: Extension of this evaluation method into various kinds of stems.

THE UTILITY OF PRE-OPERATIVE CT BASED SURGICAL PLANNING IN THA USING THE PROFEMUR Z

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Introduction: 'Fit and fill' of the femoral component was originally thought essential for stability of cementless stems. However, the Zweymuller stem was designed for 'fit without fill', (particularly flat tapered stem) and

heads. And also, the surface roughness increased in the order of XSG-alumina < SG-alumina < metallic head. The alumina ceramic femoral head showed the reentrant surface whereas the metallic head showed the protruding surface. When third-body wear occurs during the clinical use, generally reentrant form may occur on the ceramic surface whereas protrusion form may occur on the metallic surface. We have good clinical results more than 20 years using the SG-alumina, and clinical results for a long term will be expected with XSG-alumina of improved microstructure.

MID-TERM PERFORMANCE OF THE THIRD GENERATION CERAMIC ON CERAMIC ARTHROPLASTY

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The purpose of this study is to analyze clinical and radiological results of total hip arthroplasty using the 3rd generation ceramic on ceramic articular surface.

Between July 1999 and May 2005, 339 hips of 250 patients had primary cementless total hip arthroplasty with the 3rd generation ceramic on ceramic bearing implants. And 325 hips of 236 patients were followed up over 3 years. Male were 168 patients (237 hips) and female were 68 patients (88 hips). The mean age at the time of operation was 47.3 (range, 25-76) years old and the mean follow up period was 62.4 (range, 36-107.6) months. The preoperative diagnoses were osteonecrosis of the femoral head (ONFH) in 250 hips, secondary osteoarthritis in 55 hips (dysplasia in 35, infection sequelae in 12, LCP in 2, CDH in 2), hemophilic arthropathy in 9 hips, ankylosing spondylitis in 7 hips etc.

We used Bicontact system (Aesculap, Germany) in 65 hips, Secur-FitTM (Stryker Howmedica Osteonics, USA) in 206 hips, Trilogy ABTM (Zimmer, USA) in 54 hips. Clinically, Harris Hip Score, thigh pain, squeaking and other complications were evaluated. Radiologically, the serial radiographs were analyzed.

Clinically, the Harris hip score was improved from preoperative 66.0 (19-91) to 96.2 (58-100) at the last follow-up. Radiologically, there was no loosening of implants and visible wear and osteolysis. Heterotopic ossifications were noted in 5 cases. In complications, there was dislocation in one case, periprosthetic fracture in 2 cases and thigh pain in 9 cases. Intermittent squeaking sound has occurred in 8 cases (2.5%). Among these, one case of loud squeaking which happened after fall down had revision surgery. There was no infection and fracture of ceramic implant.

Our midterm results of THA with the 3rd generation ceramic bearing system were very satisfactory and demonstrated that the 3rd generation ceramic bearings remain as an excellent bearing choice because of their superior wear characteristics. However, the results of this study suggests that the squeaking would be one of strong potential risk factors for failure of ceramic on ceramic total hip arthroplasty and we must be very cautious to prevent squeaking.

DESIGN CONSIDERATIONS AND RESULTS FOR A MODULAR NECK IN CEMENTED THA

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Introduction: Cemented stems are still widely used in THA; however, there remain concerns with hip dislocation and wear debris. Restoring joint mechanics is essential for soft tissue balance and reduction of mechanical impingement. These concerns have led to the development of a modular neck for cemented THA.

Material and methods: 200 R-120™ cemented stems were implanted in 190 patients since 2001. The shape of the stem is trapezoidal with a large collar that provides for impaction and compression of the cement. The stem collar is made with a cavity where a self-locking taper and a positive indexing mechanism provide 12 different positions to ensure proper restoration of joint mechanics.

One to five years follow up with a mean of 2.8 years. Two-thirds were female and one-third male. Age ranged from 39 to 87 with a mean of 73. Majority was treated for OA. A c.c. head (28mm or 32mm) and poly bearing in a cementless cup were used for all patients. Selection of neck position was recorded for all patients.

Results: 635 of all head-neck positions were other than neutral. There were 0 dislocations, no significant leg length discrepancies (+/- 5mm), and 0 infections. There was one stem removed due to a post-op peri-prosthetic fracture at 3 years that was treated with a long cementless stem. 1 death due to a PE ten days post-op. 1 intra-operative calcar fracture wired and healed uneventfully. 1 intra-op greater trochanter fracture that was treated with screws. 2 neck fractures revised to cementless stems.

Conclusions: Modular neck design aids in fine tuning joint mechanics after stem insertion, and allows for ease and access in case of revisions. This modular neck design has eliminated (to date) hip dislocations and we remain optimistic about its long-term potential to improve outcomes. Fatigue properties have been significantly improved and no additional neck fractures have occurred.

SELF CENTERING MECHANISM IN BIPOLAR ENDOPROSTHESIS – IS IT EFFECTIVE?

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Bipolar hip arthroplasty was introduced to alleviate the problems of hip pain, acetabular protrusion and femoral stem loosening associated with unipolar prosthesis. Earlier generation bipolar endoprosthesis used to cause varus fixation of outer head which led to the unacceptably high incidence of dislocation, component disassembly and fractures of the polyethylene bearing insert. Second generation endoprosthesis with a self centering mechanism were introduced to overcome these problems. This new design incorporates a polar offset by setting the center of rotation of the inner head proximal to the center of rotation of the outer head, which generates a valgus producing moment at the outer cup. There is a controversy whether this mechanism works in vivo, more so in indigenous prosthesis.

A retrospective observational study was done on 37 subjects, which included 21 males and 16 females. The first radiograph was taken with the patient standing and bearing full weight over the endoprosthetic leg and abducting the contra lateral limb as much as possible. The second radiograph was taken with the patient standing neutral and bearing weight on both the legs. Abduction and adduction views were then taken in supine position. The radiographs were analyzed using the method similar to that of Drinker and Murray. The adductive motion from abduction to neutral position is within the range of inner bearing oscillation. Modified Harris Hip Score was used to evaluate the patients clinically. Results were analyzed using Wilcoxon Matched-Pairs Signed-Ranks Test, Students t-test and Karl Pearson correlation statistics.

The mean outer head alignment changed from 42.46 degrees ±13.62 (range 10 to 72 degrees) to 31.93 degrees ± 10.59 (range 8 to 50 degrees) in moving from abduction to neutral position in weight bearing position. The analysis showed that 68.66% of the total motion occurred at the outer bearing in weight bearing position whereas 73.86% of the total motion occurred at the outer bearing in supine position. The difference between distribution of motion between supine and weight bearing position was not found to be statistically different using Wilcoxon Matched-Pairs Signed-Ranks Test (p = 0.3164) and unpaired students t test (p = 0.35). No correlation was found between weight of the patient and time of follow up with outer head alignment and differential distribution of motion.

Self centering mechanism of bipolar endoprosthesis works in vivo under physiological loads and aligns the cup in neutral or valgus position till an average follow up of 10 months. Though the motion occurs at both the bearing surfaces outer bearing motion clearly predominated in both weight bearing as well as supine position.

RESTORATION OF FEMORAL OFFSET IN TOTAL HIP ARTHROPLASTY: IS IT POSSIBLE?

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Femoral off-set is the perpendicular distance between femur longitudinal axle and the femoral head's rotation's centre. Femoral off-set influences following yardsticks: stability of the joint, range of movement (ROM), muscular forcibleness, solicitations on the femoral component and acetabular component's usury. From numerous radiographies studies, is shown as off-set is not an infeasible measure, but an average with a range of variability. Offset is one of the most important yardsticks to consider during the pre-operative planning since, as is broadly documented, it has a positive effect on the functionality of the prosthesis; difficulty remains to individualize the optimal offset value in patient with bilateral coxofemoral pathology or carriers of opposite side total hip prosthesis. Modular necks act independently in three spatial variables allowing to reach 27 points in the space, disposing of heads with three lengths the real disposibility become of 81 points.

Usually we estimate the sizes and the orientation of the components manually and through a radiographic intra-operative control in order to choose the best match head-neck.

If we make a minimum mistake in cup position, the use of modular necks allow to correct this failure to obtain the most correct anatomic position producing negligible debris and the reduction of the mechanic stress.

Basing on our experience we think that the possibility to change length and version independently and sequentially is the unique technique available to correct the implant's orientation, even if in our series we have choose neutral neck in most cases. To obtain better functional outcome we are studing a device based on gait analysis and superficial electromyography to calculate pre and post operative off-set. The data that we have achieved are still too few to be able to produce results; if there is possible, presenting them in future editions.

SHORT TERM OUTCOME OF CEMENTLESS STEM WITH LATERAL FLARE FOR ELDERLY FEMORAL NECK FRACTURES

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Elderly femoral neck fractures are often treated with cemented stems according to the reason that bone quality of the patients is not good enough to obtain the initial stability for supporting press fit cementless stem. Some elderly patients also have medullary expanding so called stovepipe canals which make initial stability of press fit stems difficult. Stems with lateral flare have some mechanical advantages to obtain proximal fixation compare to the straight stems without lateral flare. Concerning to initial stability, their vertical loads can be supported not only by proximal medial cortex but also by proximal lateral cortex. The stems also have rotational stability because of the proximal high fit and fill. As lateral flare is a transverse extension in axial section, the stem occupies the proximal canal widely. So it provides strong rotational stability. The purpose of this study was to evaluate the outcome of press fit cementless stem with lateral flare for elderly femoral neck fractures with poor bone quality and with medullary expanding.

We performed a retrospective review of the clinical

records and radiographs of consecutive 42 patients (42 hips) of femoral neck fracture operated with cementless stems with lateral flare in 2005 and 2006. In this period, all displaced femoral neck fractures were operated using cementless stems with lateral flare (Revelation Hip System, DJO, USA) in our hospital. We could follow 24 patients for over one year. 12 of 24 patients had so called stovepipe canals according to Canal Flare Index < 3.0 (Noble et al). Minimum follow up duration was one year. The mean age of the patients at the time of operation was 78.2 years. The mean duration of follow-up was one year and three month. At the time of final follow-up, stem subsidence, stem fixation, spot welds and demarcation line at distal part of stem are assessed on radiograph. And operation time, blood loss at operation and complaint of thigh pain through all the follow up period are also investigated on clinical record.

There was no stem subsidence over 2mm and demarcation line in two cases. All stems were assessed bone-grown fixation. We could find at least one spot welds in all patients around porous coated part of the stem. The mean operation time was 60.1 min. and mean blood loss was 240.5 ml. There was no patient who complaints of thigh pain after operation.

Cementless stems with lateral flare were seemed to obtain good initial stem fixation for elderly femoral neck fracture patients even they have poor bone quality and medullary expanding.

APPROPRIATE COMBINED ANTEVERSION FOR PATIENTS WITH EXCESSIVE ANTEVERTED OR RETROVERTED FEMURS IN TOTAL HIP ARTHROPLASTY AND THE UTILITY OF THE CHANGEABLE NECK

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Combined anteversion (CA) is defined as the sum of the anteversions of acetabular and femoral components. In this study, we determined the appropriate CA in a variety of femoral versions using a total hip arthroplasty model. In addition, we also examined the usefulness of a changeable neck to improve range of hip motion in these cases.

Using a THA model, the range of motion (ROM) was tested in various CA values obtained by changing the anteversion of a cup in six increments after setting the femoral anteversion to 20° or 60° anteversion and 20° retroversion. The angle of the changeable neck was changed in 11 increments of 5°. To evaluate stability, the range of internal rotation at 90° flexion, the external rotation at 0° extension, and the range flexion was measured when any impingement occurred prior to dislocation. We defined the required ROM that met 40° internal rotation, 30° external rotation, and 110° flexion.

In normal 20° anteversion group, the required ROM was achieved with CA between 30° and 50° without using any changeable necks. In excessive anteversion 60° group, the range of external rotation was less than 10° even when the acetabular component was set 10° retroverted, because of the bone impingement between the greater trochanter and the posterior acetabulum. When 25° retroverted changeable neck was used, ROM improved to 30° external rotation and satisfied the required ROM. In 20° retroversion group, the internal rotation angle was 31° even when the acetabular component was opened 35° anteverted, because of anterior neck-liner impingement. When 25° anteverted changeable neck was used, ROM improved to 39° internal rotation and 130° flexion.

In cases with normal anteversions, the required ROM can be achieved by adjusting CA. In cases with excessive anteversion or retroversion, there was a limitation of the CA adjustment. The use of changeable necks allows for further improvement of ROM by compensating femoral anteversions.

FINITE ELEMENT ANALYSIS OF BUFFERED IMPLANT FIXATION IN COMPARISON WITH CURRENT IMPLANT FIXATIONS

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The cemented and cementless implant fixations are popular in orthopaedic arthroplasty. However, these implant fixations have some problems such as cement failure, wear debris, stress shielding, revision and so on. To overcome these problems, we are developing a new concept of buffered implant fixation which uses a bone-friendly buffer between the implant and the bone. In this study, we performed a finite element analysis to evaluate the buffered implant fixation in comparison with cemented and cementless implant fixations in mechanical aspects. In addition, we investigated the effect of buffer taper angle to the stress distribution in the buffered implant fixation.

Three-dimensional FEA of the cemented, cementless and buffered fixation were performed using the ABAQUS program. In these FEA, the 'standardized femur', which is the composite femur model supplied by Pacific Research Lab., was used as the bone model and the CPT stem and the Versys Fibermetal Midcoat stem were modeled for the cemented fixation and the cementless fixation, respectively. These three-dimensional models were meshed using the tetrahedral elements with 4 nodes (C3D4) and the additional contact definitions. The buffered implant fixation is similar with the polished cemented fixation except the material between the implant and the bone. The polyetheretherketone (PEEK) was selected as the buffer material. Also, several taper angles of buffer were simulated to change the stress distributions in the buffered fixation. The external load three times of mean body weight (74.3 kg) was cyclically loaded at the femoral head with the angle of 20° in adduction and 6° in flexion while the distal end of femur was fixed.

In the buffered implant fixation, the taper-locked effects were observed. The buffered fixation had greater cyclic compression for the bone compared to the cemented fixation. Also, the failure probability of the buffer in the buffered fixation was less than that of the cement in the cemented fixation. The risk factors in the buffer were 0.148 for the tension and 0.176 for the compression while, the risk factors of cement in the polished cemented implant fixation were over than 1. Moreover, the buffered fixation had widely distributed compression compared to the cementless fixation and the stress distribution could be modified easily to change the taper angle of buffer. The FEA results showed that the buffered implant fixation would provide an appropriate mechanical environment.

ARTIFICIAL FEMORAL HEAD REPLACEMENT COMPARED WITH DYNAMIC HIP SCREW(DHS) INTERNAL FIXATION OF AGED PATIENTS WITH INTERTROCHANTERIC FRACTURES--A METAPHASE, PROSPECTIVE, RANDOMIZED STUDY

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The purpose of this investigation was to prospective compare the results of artificial femoral head replacement with those of treatment with a DHS internal fixation for unstable intertrochanteric fractures in elderly patients.

Sixty-one cases of aged patients with intertrochanteric fractures were randomized into two treatment groups. All patients were followed for a minimum of four years from 9.1999 to 4.2003, 29 patients were treated with artificial femoral head replacement, the other were treated with DHS internal fixation. The clinical results of two ways for the treatment of aged patients with intertrochanteric fractures were observed.

There were no significant differences between the groups in terms of functional outcomes, blood loss, or units of blood transfused. Patients treated with artificial

femoral head replacement had a shorter hospital stay and operative time, less time to weight-bearing, fewer general complications, and lower mortality rate compared with those treated with the DHS internal fixation.

We conclude that in elderly patients with an unstable intertrochanteric femoral fracture, a artificial femoral head replacement provides superior clinical outcomes but no advantage with regard to functional outcome when compared with a DHS internal fixation.

OPERATIVE STRATEGY AND REHABILITATION IN THE MANAGEMENT OF PATIENT WITH ANKYLOSED HIP JOINTS CAUSED BY LATE ANKYLOSING SPONDYLITIS

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To investigate the effect of bilateral total hip replacement for patients with ankylosed hip joints caused by late ankylosing spondylitis (AS) and to discuss its related pre- and post-operation rehabilitation problems.

Data of 20 patients with ankylosed hip joints caused by late AS undergone total hip replacement (40 hips) were reviewed. Among the total 14 patients (28 hips) undergone bilateral total hip replacement, other 6 patients (12 hips) undergone twice operations. We used Harris score, assessment of the joint pain, range of motion to make sure the curative effect of the operative strategy.

The mean duration of follow-up was 3.8 years, all hip joints function was improved, and the flexion deformity of the involved hips were disappeared. The range of hip flexion were 75°-105° (average 86.2°), and the range of hip extension were 5°-15° (average 8.7°), the average Harris score was from 32.8 pre-operation improved to 88.2 post-operation, the patients experienced no pain on their hips, the pain of the knee and the lower back complained before the treatment were obviously relieved.

Bilateral total hip replacement is an effective treatment for ankylosed hip joint caused by late ankylosing spondylitis, early rehabilitation intervention is useful for the functional recovery of the joints

Bipolar Hemiarthroplasty Using Non-cemented Femoral Stem in Non-traumatic Osteonecrosis of the Femoral Head Nine to Nineteen years Follow-up

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The purpose of this study is to evaluate the clinical and radiographic results of 20 patients (27 hips) who underwent primary bipolar hemiarthroplasty with non-cemented femoral stem and biarticular cup from January 1989 to April 1999 who were followed for more than nine years. Average follow up was 13.4 years (range : 9-19 years). The type of non-cemented femoral stem was Harris-Galante type in ten hips, Multilock porous coated stem in seven hips, and Multilock porous and tricalcium phosphate coated stem in ten hips. The etiology of osteonecrosis of the femoral head was idiopathic in eleven hips, alcohol abuse in twelve hips and steroid administration in four hips. According to Ficat's grading system, all twenty-seven hips were in stage. Clinically, we evaluated the Harris Hip scores. We also evaluated the radiographic measurements around the femoral stems and the bipolar cups.

The average Harris Hip score improved from 57.2 points to 89 points; and 2(7.4%) hips were associated with thigh pain and 5(18.5%) hips with groin pain. Around the femoral stem there was progressive radiolucent line more than 1mm in width in 1(3.7%) hip, and osteolysis was present in 9(33.3%) hips. On evaluation of radiographs for stability of fixation, we found that 21 hips(77.8%) showed osseous ingrowth, 5 hips(18.5%)

WEAR MAPPING ANALYSIS WITH RETRIEVAL 28MM COCR-COCR HIP BEARINGS – 11-YEARS EXPERIENCE

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While there are many variation laboratory and clinical studies using metal-on-metal (MOM) bearings after introduction of the 28mm MOM THR in 1988, the mapping of wear phenomena in such retrieval cases has been minimal. In laboratory study, 28mm MOM bearing's wear-rate was low with "run-in" and "steady-state" than large diameter MOM without theory of fluid-film lubrication. In clinical results were not superior to the same way of laboratory study. We present a detailed analysis of 33 retrieved MOM hip bearings with 1-11 years follow-up.

We compiled 33 retrieval cases (MetasulTM : Zimmer/CenterPulse Inc., Austin, TX) including clinical information, ion concentrations from ball diameters, cup designs and stripe wear damage. The bearing surfaces were mapped using reflected light microscope (RLM), white light interferometer (Zygo Newview 600, Zygo.) and SEM(XL-30 FEG). Wear maps were constructed according to types of surface wear identified.

Patients ranged from 36 to 76 years of age (Means: 56.9 years); 54% were males. Main causes for revision were progressive radiographic lines around the cups, osteolysis and pain. The 28mm ball diameter was used in 86% of cases (largest = 52mm ball). The CoCr liner incorporated a polyethylene adaptor in 75% of cases. Cup diameter >50mm was present in 75% of cases. Eight femoral stems were recovered and all showed major impingement marks around the neck and five also had a metallosis (Mode-4A). Stripe wear was evident on 71% of CoCr balls with medial stripes twice as common as lateral. Stripe wear was identified in 25% of CoCr liners and extended 25-160o circumference around the liners. Clear liner rim damage was present in 10 (30%) and 3 demonstrated severe damage of polyethylene adaptors.

There are many limitations to such retrieval studies. These data are biased to cases that failed due to hip pain, radiographic signs of progressive osteolysis and some with high levels of metal ions. There was also the bias of having predominantly a CoCr sandwich design (polyethylene adaptor in 75% of cases). In early 1980s, the thin walled UHMWPE cup was introduced and used larger diameter balls for decreased risk of dislocation. However, unfortunately these big-ball cups produced significant PE wear debris, and diameter trends were returned to the Chanley's small-ball paradigm again. In the same time (late of 1980's), these second-generation MOM (28,32mm) was introduced for low wear characteristics alternate THR bearings, with sacrificing of joint stability and motion range. However, use of the small ball added well-known risks of impingement, subluxation and dislocation with rigid cups. In this study, using the 'damage modes' from McKellop, normal mode-1 wear occurred in only 14% of cases whereas modes 2-4 had an incidence approaching 30% each and signs of cup impingement were evident in 64% of cases. Thus summarizing MOM wear phenomena in "small" 28mm sandwich cup designs, there was retrieval evidence showing that damage modes 2-4 likely placed these patients at risk for adverse wear effects.

COMPARISON OF MINIMAL INCISION TOTAL HIP REPLACEMENT VERSUS STANDARD INCISION TOTAL HIP REPLACEMENT USING THE LATERAL FLARE HIP SYSTEM

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To compare the early result of minimum incision surgery (MIS) to standard incision procedures with use of lateral flare hip replacement (Revelation Hip System, DJO, USA). 38 primary total hip arthroplasty of 36 patients were performed using lateral flare hip system. Lateral flare hip has symmetric contact to medial and lateral cortical bone at high proximal part and it provides definite endpoint of stem insertion. From this point of view, we can say that this system is suitable for MIS. Among the 38 hips, 21 hips were performed by MIS (less than 10cm) and 17 hips were performed by Standard incision. MIS were performed from November 2004 to December 2005. And Standard incisions were performed from June 2004 to December 2005. Two surgeons performed all operations (NW and YT). The main surgeon decided whether MIS was applicable or not for each patient. Antero-lateral intra gluteal approach (modified Dall) was applied for all surgeries. The same rehabilitation program was applied on both groups postoperatively. The average follow-up period of MIS patients was 28.6 months and 34.7 months in standard incision. We investigated the early result of these patients.

There was a relationship between patients' height and the length of skin incision (p<0.05). No significant difference between two groups was proved in CRP, CPK and D-Dimer (CRP: 13.9/11.9mg/dl, CPK: 405.5/380.5mg/dl, D-Dimer: 6.1/5.3mg/dl). Both intraoperative blood loss and operation time were less in MIS group (blood loss 530.9ml vs. 772.8ml, operation time 99min vs. 115.4min) (p<0.05). The days until the patient was able to do active straight leg raising were 17.3 in MIS group and 22.4 in standard incision group and hospital stay days were 26.7 vs. 29.2. But no significant differences were proved in hospitalization. On roentgenographic findings, the inclination of acetabular cup was 42.0 degree in the MIS group versus 41.2 in the standard incision group and no significant difference was found. In Radiographic findings, one stable fibrous fixation was observed in each group. The other cases were bone ingrowth fixation. Japanese orthopedics association (JOA) hip score was not significant different in each group at the final follow up (88.1 in MIS group and 85.9 in Standard group). Also as the result at the term of 6, 12, 18 and 24 months after operation, JOA hip scores was not significant difference in each group. There were no revision cases in this study until the final follow up.

In the present study, intra-operative hemorrhage and operation time were significantly less in MIS group. It was supposed that at the patient selection, each surgeon decided the candidate of MIS due to patient's hip condition. But in another situation, no significant difference was found for example in serum CRP, CPK and D-Dimer levels. Clinical and radiological outcomes were not significantly different between MIS and Standard group in this study.

TREATMENT OF FEMORAL NECK FRACTURES BY BIPOLAR HEMIARTHROPLASTY THROUGH SHORT EXTERNAL ROTATOR PRESERVING MIS APPROACH IN PATIENTS WITH NEUROLOGIC DISORDERS

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We developed a modified posterior approach that preserved the short external rotator muscles to prevent dislocation after THA or BHA. The present study aimed to evaluate the effectiveness of short external rotator preserv-

ing posterior(ERP) approach for bipolar hemiarthroplasty in treatment of femoral neck fractures in patients with neurologic disorders. Between March 2004 and February 2006, we performed 187 cementless bipolar hemiarthroplasties for displaced femoral neck fractures on 36 patients with neurologic disorders, who were operated on by ERP approach (Group 1) and 151 patients without neurologic deficits, who were operated on by conventional posterolateral approach (Group 2). We compared operation time, the amount of postoperative blood loss, the early postoperative complication rates, the dislocation rate within 1 year, and duration of hospital stay between two groups.

The amount of postoperative blood loss was significantly decreased in group 1 (p < 0.01). There were no significant differences in mean operation time and early postoperative complication rate including wound problem, deep vein thrombosis or infection and duration of hospital stay. There was no dislocation after operation in group 1, but seven patient (4.6%) had dislocation in group 2. Nine patients (25.0%) died within postoperative 1 year in group 1 and twenty six patients (17.2%) died in group 2.

Cementless bipolar hemiarthroplasty through ERP approach provides a favorable outcome for treatment of displaced femoral neck fracture in patients with neurologic disorders who is considered as high risk of dislocation. Also, it decreases the postoperative blood loss and the needs of postoperative abduction brace.

DIRECT ANTERIOR APPROACH IN LATERAL POSITION: EASY AND TOLERABLE MINIMALLY INVASIVE TOTAL HIP ARTHROPLASTY

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Direct anterior approach (DAA) in supine position is one of the successful minimally invasive surgery (MIS) approaches, but it may need special traction table and stem selection is limited. DAA in lateral position is easier, and full porous cylindrical stem is easily inserted in this approach. The purpose of this presentation is to report this technique and result. 55 patients with osteoarthritis (Crowe group1 to 3) were undergone THA with DAA in lateral position and followed for a minimum of 7months. Approach and cup settlement is the same as usual DAA in supine position. After liner placement, proximal femur is pushed up antero-laterally with the hip hyperextension, external rotation and adduction, which make excellent view of femoral neck cut surface. Because the leg is shortened, neurovascular relaxation is achieved. PCL retractor of TKA instrument is used to keep tensor fascia femoris muscle laterally over greater trochanter. No other special instrument is needed in stem insertion. Hip scores improved from 37.8 preoperatively to 87.8 postoperatively. Mean incision length was 9cm and mean operation time was 85minutes including routine intra-operative X-ray check. Neither auto blood donation nor cell saver was used. Blood transfusion was not needed. Stem position with over 2 degree varus were in 5 cases (9%) and over 2 degree valgus were in 3 cases (5%). There were no dislocation, loosening, infection, or femoral nerve injury.

In supine position, hip motion in sagittal plane has limitation. DAA in lateral position afford more extension with easily controlled external rotation and adduction which is the key to insert stem easily. DAA in lateral position is easy and tolerable MIS.

BILATERAL SIMULTANEOUS TWO-INCISION MINIMALLY INVASIVE TOTAL HIP ARTHROPLASTY

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The two-incision technique uses strategically located incisions to insert the prosthesis components in to specific intermuscular or internervous planes in an effort to minimize damage to these tissues. Even though there