7th M.O.R.E. International Symposium
Advances in Orthopaedics

Lugano April 11-12, 2014

Honorary Chairman
Michael Freeman - GB

Keynote Speaker
Daniel J. Berry - USA

Chairmen of the Knee Day
Robert Greenhow - USA
Craig Loucks - USA

Chairmen of the Hip Day
Frédéric Laude - F
Joel M. Matta - USA
Introduction

The 7th Medacta Orthopaedic Research and Education (M.O.R.E.) International Symposium, which took place near the company’s worldwide headquarters in Lugano (Switzerland), underscored Medacta’s commitment to furthering the surgical education and training that has been shown to improve patient safety and reduce the cost of orthopaedic care and recovery.

This event featured separate days dedicated to knee and hip replacement technologies and procedures, including reviews of the current treatment landscapes, clinical research, case studies and previews of forthcoming product innovations. Around 1000 attendees heard from a faculty of more than 40 internationally recognized experts on topics including surgical best practices, emerging clinical data, and planned enhancements for Medacta knee, hip, and spine surgery products. As a special highlights of the Symposium, two live surgeries were transmitted from the Balgrist Uniklinik in Zurich.

The Symposium also coincided with special milestones as Medacta celebrates its 15th anniversary as a Company founded with a vision of creating a better patient experience for people needing joint replacement, the 10th anniversary for AMIS (Anterior Minimally Invasive Approach for hip replacement) and the 5th anniversary for MyKnee (Patient matched technology for knee replacement).

This is, however, a further anniversary, but not exclusively for Medacta... By a first coincidence, 110 years ago a young anatomist and surgeon, whose name was Zuppinger, wrote his Habilitation Thesis in the southern part of the Habsburg empire in Zurich. He proposed, on the basis of what was then the first experimental use of a new method for the anatomical investigation of the knee, X-Rays, that the knee moves in a certain way. It was the first time that X-Rays had been used to investigate knee function and his conclusion that there was a four-bar linkage mechanism in the knee which caused the femur to roll backwards across the tibia as the knee flexed was both new and exciting. The idea was strongly opposed by two major anatomists of the time, Fick and Strasser. In spite of this early opposition, the idea has dominated knee kinematics since then. Personally, I have wondered whether the concept was entirely right: the links in a four-bar mechanism have to be rigid to function as such and, obviously, the cruciate ligaments – especially the PCL near extension, as was pointed out by Strasser, are not rigid. The second coincidence is that just over 10 years ago I happened to be asked to speak in what was once another part of the Habsburg empire, but further north: Prague. There I met two surgeons, Professor Antonin Sosna, my host, and Associate Professor Vera Pinskerova. I also had access to the modern equivalent of Zuppinger’s X-Rays machine, namely an MRI, operated, out of the kindness of his heart by Dr Jan Krasensky, to whom all of us will always be grateful. Of course with an MRI we had an advantage over Zuppinger: the soft tissues are visible and so it was possible to investigate, and in my view, explode the concept put forward 110 years ago and to replace it by another Habsburg concept, coming this time from Pinskerova. So today we perhaps have to mark the 110th anniversary of a possibly mistaken idea of how the knee works which maybe we should replace with a different idea of how it really does work. Whether the new concept will turn out to be correct and, if so, to make a difference to the outcome of knee replacement I have no idea but it seems rational to think that it might.

This book is a compendium of the voluntarily submitted abstracts from all of the invited speakers. The demands on the time of those who care for patients, do research, teach and travel are very great and we want to express our gratitude to all of our colleagues who responded to the request to prepare and to submit an abstract, and to contribute to this publication and to the successful Symposium.

Prof. Michael Freeman
Honorary Chairman
MEDACTA INTERNATIONAL
1999-2014
15 YEARS OF SUCCESS
THANK YOU
for supporting us in our commitment to advance:
- Patient Well-Being
- Ongoing Medical Education
- Healthcare Economic Efficiency

We want to thank all of you all over the world.
Your trust in Medacta has resulted in treatment of more than 110’000* AMIS and 15’000* MyKnee Patients, helping to make Medacta the largest European provider of Hip and Knee arthroplasty solutions with growing success around the world.

*Data at December 2013
## Faculty

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# Hip Day - 12 April 2014

## SESSION 1 - AMIS CLINICAL RESULTS - PART I
- AMIS results in the Australian Register - M. Solomon
- AMIS using Versafitcup and Quadra to overcome adverse tissue response: 5-year results - P. Zingg
- Effect of surgical technique and rehabilitation on radiological results of AMISstem - F. Kalberer
- Short term results using the AMISstem for primary hip arthroplasty through the anterior approach - R. Peter

## SESSION 2 - AMIS CLINICAL RESULTS - PART II
- Prospective randomised controlled clinical trial comparing THA performed either through a posterior approach or AMIS using gait analysis - R. Field
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- Mobility assessment of a dual mobility hip arthroplasty for osteoarthritic hip - P. E. Beaulé

## SESSION 3 - NEW TECHNOLOGIES IN THA
- Economical impact of AMIS and other new technologies in Total Hip Arthroplasty - R. Greenhow
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## SESSION 4 - WORKSHOP: AMIS AND TECHNICAL PEARLS FOR PRIMARY SURGERIES
- Dysplastic cases through anterior approach - K. Oinuma

## SESSION 5 - WORKSHOP: AMIS AND TECHNICAL PEARLS FOR REVISION SURGERIES
- Early experience with a modular Double Mobility acetabular component used for difficult cases - C. Faldini
- Strategies for femoral revision - J. Rodriguez
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- Clinical and Radiological Outcome after 2 Years using the GMK Revision System for Total Knee Arthroplasty - W. Anderl, L. Pauzenberger, B. Kriegleder, B. Laky, E. Schwameis
- C-Arm Guided Triple Taper HA-Coated Direct Anterior THA - G. Bradley
- Superior Patient Satisfaction After TKA by Using “Ideal Arthroplasty Kinematics” - P. Firer
- Double Mobility Cup System in High Risk Patients: Preliminary Results - D. Kaiser, P. Zingg, C. Dora
- Patient Matched Technology vs Conventional Instrumentation and CAS - V. León, A. Lisón
- Treatment of a Severe Knee Destruction Using the GMK Sphere - J.L. Meystre, G. Messerli
- A Prospective Study Comparing Early Results of TKR Performed Utilizing CT-based Custom Made Cutting Blocks with a Standard Technique - A. Nabavi, S. Philibert, R. Morizzi
- M pact System: Clinical and Radiological Outcomes at 2 Years Follow-Up - Jo. O’Donnell, Je. O’Donnell, S. Chandrasekaran
- Early Postoperative Outcomes in Displaced Intracapsular Proximal Femoral Fractures Treated with Hemiarthroplasty. A Retrospective Comparison of Surgical Approaches - D. Rahme
- Versafitcup Double Mobility Cup: Outcomes at a Mean Follow-Up of 5 Years - T. Roumazeille, M. Soenen, H. Migaud, P. Laffargue

The Editorial Board of The Bone & Joint Journal was not involved in the selection or editing of papers.
The M.O.R.E. Institute has been created to provide continuous support to healthcare professionals in the field of Research and Education.

The M.O.R.E. Institute offers Surgeon to Surgeon educational opportunities to share experience and improve patient outcome.
Knee Day - 11 April 2014
Results of Current Knee Replacement

Session 1 - Knee Day

WHY TOTAL KNEE ARTHROPLASTIES FAIL IN 2014: WHAT CAN WE LEARN?

Berry D.J.
Mayo Clinic, Rochester - MN, USA

I. INTRODUCTION

A. Large national registries with “big data” can give an overview of the most common reasons for TKA failures that lead to revision

B. Australian Registry: Top reasons for revision at 10 years:
   1. Loosening/osteolysis
   2. Infection
   3. Patellofemoral pain
   4. Pain
   5. Instability

C. United Kingdom Registry: Top reasons for revision:
   1. Infection
   2. Aseptic loosening
   3. Pain
   4. Instability

II. PERSPECTIVE

A. These large databases only provide data on “failures” severe enough to lead to revision

B. They do not provide data on failures that do not lead to revisions
   1. Reoperation other than revision: for example, periprosthetic fracture
   2. Unsatisfied patients that don’t come to revision: for example, stiffness, pain, unsatisfactory activity level.

III. EARLY VS. LATE FAILURES

A. Early Failures:
   1. Infection and stiffness
   2. The other main sources of early failure are mostly related to technique
      a. Instability
   b. Early loosening
   c. Some cases of stiffness
   d. Malalignment

3. As surgeons, how can we do better?
   a. Better training throughout our careers
      i. Implant-specific training
      ii. Surgical simulation

B. Late Failures: The main sources of late failure that can be modified relate to the effects of implant use, implant durability or patient characteristics.
   1. Loosening
      a. Is there a role for better cemented fixation?
      b. What is the future role of uncemented implant fixation?

2. Osteolysis
   a. Still not a solved problem
   b. Crosslinked polyethylene: pros/cons
   c. Reduced backside wear
      • Better locking mechanisms
      • Polished tibial component surface
      • Mobile bearings

3. Patient factors
   a. Periprosthetic fractures (osteopenia/falls)
   b. Late infection
   c. Obesity, activity, etc.

IV. THE SUBTLE FAILURE: FAILURE TO MEET PATIENT EXPECTATIONS... THE PAINFUL TKA

A. Not a rare problem

B. As TKA is used more in younger active patients, the “performance gap” between patient expectations and what TKA can provide will become more problematic
   1. Patient reported outcome measures: What correlates with failure/dissatisfaction?
   2. Many younger, more active patients will experience limitations after TKA: soreness after high activity, a feeling of less than normal knee stability in challenging circumstances.
      a. Can better kinematic designs lead to greater satisfaction?
      b. Can better kinematic techniques lead to greater satisfaction?
OUTCOMES OF MODERN TOTAL KNEE REPLACEMENT: RESULTS AND LIMITATION

Viè P.1, Anderl W.2
1 Clinique du Cèdre, Bois Guillaume, France
2 Krankenhaus der Barmherzigen Schwestern, Vienna, Austria

Introduction
The Global Medacta Knee (GMK) system provides surgeons with a modern implant design and instruments adaptable to their own surgical preference. GMK is the natural evolution of two established Medacta TKR prostheses: EVOLIS and CINETIQUE. Evolis was designed in 1998 and is a fixed bearing TKR with a bone-referenced technique. More than 37,000 Evolis TKRs have been performed to date worldwide showing very good results in the Australian Register (NJJR Report 2012). GMK inherited from Evolis the same femoral internal profile and the bone preserving PS design. Cinétique was designed in 2001 and is a mobile bearing TKR with a ligament balance-based technique. More than 25,000 Cinétique have been implanted to date. The GMK system inherited from Cinétique the same femoral multiradius sagittal profile, a deep anatomical trochlear groove and an asymmetrical tibial tray. Moreover, GMK Primary shows an anatomical patella and a bone preserving tibial component, with large tibial fins to increase resistance against torsional stress.

The first GMK Total Knee Replacement took place in January 2007 and more than 32,000 GMK Primary have been implanted to date.

Objectives
The main goal of the study is to evaluate GMK implant safety and its clinical performance in the short, medium and long term through the Knee Society Score, Range Of Motion and patient satisfaction, and radiologically, evaluating stability, fixation and presence of radioluencies on x-rays.

Materials and methods
This study included more than 1,000 cases, 12 centers have been involved and the Muller Institute Database has been used to collect clinical data. A consecutive series of 130 patients (with a total of 133 implants) received a GMK mobile cemented Total Knee Replacement in Vienna (Austria) by Dr. Werner Anderl and in Rouen (France) by Dr. Pascal Viè.

Results
130 patients, 91 patients (93 procedures) with a mean 51 months follow up (from 30 months to 86 months) have been evaluated, 14 were lost to follow-up, 7 died, 18 have not been included because they have only short term results at present. 1 patient was revised due to a periprosthetic fracture 6 weeks after surgery and 1 patient was revised due to patella pain (as resurfacing patellar component) at 27 months after surgery. The Knee Society Score increased significantly from 98.9 ± 24.2 points pre-operatively to 176.5 ± 26.4 points at 16-month mean follow-up and to 176.8 ± 27.4 points at 51-month mean follow-up. A statistically significant improvement from pre-operative to post-operative values was also shown in the Range Of Motion evaluation that was 105.4° ± 19.1° pre-operatively, 114.1° ± 10.9° at 16-month follow-up and 115.2° ± 9.8° at 51-month follow-up. There were no cases of patellar instability, implant loosening, wear of the tibial insert or critical radioluencies > 2mm. 97% of the patients gave a satisfaction rating of good to excellent. 6 post-operative complications were shown at the last follow-up due to light anterior knee pain (3), peritrochanteric fracture (1), pain on the medial side (1) and swelling (1). Implant survival rate is respectively 100% and 98.5% when considering mechanical complications or any endpoint reason.

Conclusions
The results at mid-term (51 months mean follow up, from 30 to 86 months) are encouraging and promising. The excellent survival rate respectively of 100% and 98.5%, when considering mechanical complications or any endpoint reason, confirms the good performance of the GMK Primary system. The improvements in patient satisfaction and functional outcomes demonstrate the possibility to provide patients with a better quality of life after surgery.
Material and methods
78 patients were evaluated before and 3 months following TKA.
29 subjects were included as a control group for gait analysis.
- Gait evaluation with a 3D motion analysis system (Vicon, 12 cameras) to capture the body’s kinematics during gait and 2 force plates to detect gait cycle events
- Pain and functional level assessment with WOMAC score, Visual Analog Scale and SF-12 questionnaire
- Satisfaction measured with a one-answer questionnaire on 3 levels: global satisfaction – pain relief – functional improvement

Results
72% to 80% satisfied to very satisfied;
14% to 18% neutral;
6% to 10% unsatisfied.
WOMAC functional score is the most important indicator of patient satisfaction.

EFFECT OF ALIGNMENT AND KINEMATICS ON PATIENT SATISFACTION

Thienpont E.
University Hospital Saint Luc, Brussels, Belgium

Patient satisfaction is an important issue today. It can be evaluated with Patient Reported Outcome Measurement Scores (PROMS) like the New Knee Society Score (KSS), the KOOS Score (KOOS) and the Forgotten Joint Score (FJS-12). The combination of these three scores makes a complete evaluation of the knee after total knee arthroplasty (TKA) possible[1]. Despite all efforts of surgeons, 30% of patients are not satisfied after TKA[2]. This can be attributed to surgical technique, implant aspects and patient factors. Chronic pain (PPSP) after surgery is a genetic phenomenon that is more frequent in patients presenting risk factors like female sex, psychological problems, morphine usage, etc...[3] The features of each implant will influence the clinical outcome of the patient.

Patients need a stable knee in the three planes, enough flexion to perform the ADL or leisure activities they prefer to perform and finally neutral alignment that corrects the preoperative deformity that led to their disease and the osteoarthritis of their knee.

Alignment can be considered as mechanical alignment with the neutral axis running from the center of the hip through the center of the knee to the center of the ankle, also called HKA-axis and expressed as 180° for neutral alignment. Another important alignment axis is the Zone Mechanical Axis (ZMA) that shows where the load-bearing axis of Maquet is running. The central zone or C-zone is the best for TKA because it distributes the load bearing zones equally over the polyethylene of the implant[4].

Correction of the preoperative deformity will happen during surgery because of the osteotomies we are performing at the femoral and tibial level. The aim of these corrections is to position the implant components perpendicular to the mechanical axis at least in the coronal plane. Depending on the quality of the instruments and the experience of the surgeon we can obtain our planned result within a range of +/- 3° of the neutral alignment axis[5].

Technological tools like computer navigation have made it possible to reduce the alignment outliers systematically. However most systems ask for more surgical time than conventional surgery[5]. Patient Specific Instruments were developed to allow pre-navigation with good surgical planning before going to the OR and time reduction because of the simple aspects of fitting custom made guides to the surgical surfaces[6].

Our experiences with PSI have led to the following conclusions:

1. Not all PSI systems are the same and the surgical planning from one company differs from another[7];
2. The quality of a PSI planning depends on the quality of the planning engineer. If he is a better planner than you a surgeon he will ameliorate your results[6];
3. PSI is for sure an added value for the coronal plane of the femur but probably not on the tibial level (planning errors? Difficult three-point fixation? Soft tissue interference?);
4. PSI is part of modern process optimisation creating a smoother work flow for the people around the surgeon in the OR;
5. PSI will allow us to kinematically align knees in the future and probably allow us to produce patient specific implants;
6. PSI will help the average surgeon to perform technically more difficult surgeries if not experienced like unicompartamental replacement, patellofemoral arthroplasty, cruciate retaining implants or extra-articular deformities[8,9].
Coronal alignment of the lower limb is a major factor that determines the clinical outcome for patients as well as the longevity of their implant.

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OVERSIZING COMPONENTS IN TKA: DOES IT MATTER?

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Manufacturers of TKA have introduced narrower femurs to improve bone-implant fit. However, few studies have reported the clinical consequences of mediolateral oversizing. Our hypothesis was that component oversizing negatively influences the results after TKA.

One hundred and twelve prospectively followed patients with 114 consecutive TKA (64 females and 50 males) were retrospectively assessed. The mean age of the patients was 72 years (range, 56 to 85 years). The dimensions of the femur and tibia were measured on a preoperative CT-scan and were compared with those of the implanted TKA. The influence of size variation on the clinical outcomes one year after surgery was assessed.

Results
Mediolateral overhang was observed in at least one area in 66% of the femurs (84% in females and 54% in males) and 61% of the tibia (81% in females and 40% in males). Twenty-two patients presented no overhang in any area and 16 had overhang in all studied zones. The increase in the Pain and KOOS scores were 43±21 and 36±18 in the patients without overhang and 31±19 and 25±13 in patients with overhang (p=0.033 and p=0.032). Knee flexion was 127°±7 and 121°±11, respectively. Regression and latent class analysis showed a significant negative correlation between overall oversizing and overall outcome. Multivariate analysis showed that the causes related with oversizing were (1) gender (females), (2) narrow femurs, (3) trapezoidal femurs and (4) valgus alignment.

Conclusions
This study confirms that oversizing may lead to worse clinical results in TKA. The clinical consequences are that surgeons should pay attention not to oversize implants during implantation and that oversizing should not be ruled out in cases of so called unexplained pain.

PAIN IS A CAUSE OF DISSATISFACTION: SOURCE, INCIDENCE AND TREATMENT

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Addressing perioperative pain is a major factor in producing satisfactory outcomes. Within the context of elective procedures, this process is an “enabling process” to allow progression to the next phase, the recovery phase, and a return to activities of daily living more quickly and comfortably. To achieve this, requires a process of patient education, meticulous surgery and anaesthesia, with minimal disturbance to patient physiology, and a goal orientated post-operative recovery, to allow patients a rapid recovery of mobility. While local infiltration analgesia is the focus, it is only a part of the total treatment.

For the injection, in hip replacements, we use a mixture of Ropivacaine, Ketorolac, Tranexamic acid and adrenaline.

For total knee replacements we use, in addition, dexamethasone in the mixture to minimise the swelling.
THE IMPORTANCE OF FEMORAL COMPONENT SIZING IN TOTAL KNEE ARTHROPLASTY

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Total Knee Arthroplasty (TKA) is undoubtedly associated with an overwhelming success in the treatment of degenerative joint disease. A plethora of published studies have shown that TKA has a very high survivorship which is in the vicinity of 95-99% after 5-10 years. However, the functional benefits to patients and their satisfaction with the operation are frequently overlooked. Fairly recently, peer-reviewed literature suggests that up to 20% of patients are not satisfied with the outcome following TKA.

Patient satisfaction is inherently subjective and undoubtedly multifactorial – painful TKA being the most significant predictor of dissatisfaction. However, the etiology of a painful TKA during the first 2-5 years remains elusive, although consensus has been reached that instability and stiffness constitute the commonest causes of pain.

Knee stability in the sagittal and coronal planes, are primarily dependent on ligament tension, femoral component rotation and sizing.

The purpose of this paper, is to review, assess and report on the importance of femoral component sizing on the A/P stability of TKAs drawing from the experience gained after performing total knee arthroplasties over the past 20 years.

We were always of the belief that the availability of standard and narrow femoral components could assist and empower the knee Arthroplasty surgeon to balance the all-important flexion gap more effectively, precisely and reproducibly by reducing the incidence of medio-lateral overhang. The usage of over 230 “narrow” femoral components over the past year and a half and the evaluation of implant overhanging intra-operatively, confirmed our thesis.
GMK Sphere: Concept and Outcomes

Session 2 - Knee Day

HOW THE KNEE MOVES

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The anatomy and movements of the cadaveric and living knee have been studied using MRI, RSA/CT and 3D digitizer.

Anatomy

In the sagittal section the medial femoral condyle comprises an arc of two circles: the posterior one (Flexion Facet) and the anterior one (Extension Facet). These articulate with two flat tibial facets angled at each other by a mean of 11°. Laterally the surface of the posterior femoral arc is the same as that of the medial side but the anterior arc is 7mm shorter. Thus its radius and the position of its centre are uncertain.

With the anterior recess for the anterior horn of the meniscus in full extension and the posterior recess for the posterior horn in flexion, the central 24mm of the lateral tibial condyle are relatively flat.

Kinematics

The arc of flexion is composed of 3 sub-arcs, each with unique characteristics:

- Full extension – 10°/30° (Hyperextension)
- 10°/30° – 120°/130° (The Arc of Active Function)
- 120°/130° – full flexion. (Hyperflexion)

A) The Arc of Active Function. 10°/30° – 120°/130° covers most of the activities of daily living in a Western lifestyle. In this arc:

1) The contacting femoral surfaces are sagittally circular and the tibial surfaces are flat.
2) The medial femoral condyle does not move antero-posteriorly (by >2mm).
3) The lateral femoral condyle tends to roll posteriorly with flexion but this is not obligatory (up to 90°).
4) Lateral roll-back equates to internal tibial rotation round a medial axis. Rotation is possible because the LCL is slack in flexion and the medial condyle spherical. These features also permit the tibia to rotate into valgus (i.e. to lift-off laterally).


1) The medial femoral condyle rocks forward as it extends so that its extension facet contacts the tibial extension facet. The femur then rotates round its extension facet centre (= the epicondyle/ MCL), finally compressing the anterior horn.
2) Laterally the femoral condyle rolls forward and rotates down onto the anterior horn. From 0° to 130° the condyle rolls back about 20mm.
3) This combination results in an oblique helical axis combining extension with some obligatory tibial external rotation.

C) Hyperflexion. 120°/130° – Full Flexion (150°/160°).

1) The medial femoral condyle rolls back about 8mm, finally compressing the posterior horn between the tibia and the posterior horn recess. The medial meniscus moves back very little.
2) The lateral femoral condyle also rolls back and finally starts to roll round the posterior tibial border. The meniscus moves with the femur and is not compressed between it and the tibia.
3) In full flexion the tibia is in about 3° valgus and 15° internal rotation relative to the femur.

Implication

This kinematic finding suggests a tibial prosthesis with a-p constrained medially (but with freedom to rotate) and no constraint laterally.

THE GMK SPHERE: THE STABLE KNEE REPLACEMENT

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Early attempts at replacing the knee required the use of large hinged implants which were secured to the bones with long stems cemented into the intramedullary canals. Although this method provided a stable bearing there was a high rate of loosening which was attributed to the constraint of these implants resulting in high torsional forces being applied to the cemented fixation of the stems.

We have already learnt from Professor Pinskerova,
the natural knee possesses the capacity to roll back in the lateral compartment on flexing, and also to a very limited extent in the medial compartment. The shapes of the bones in the medial compartment (together with intact ligaments) provide stability to the knee.

When one or both of the cruciate ligaments is excised (according to the surgeon’s philosophy and preference) in condylar knee replacement an alternative system of stabilising the knee has to be incorporated in to the design. A deep conforming tibial trough matched to the femoral condyles could provide stability but without offering the capacity to rollback laterally. The cam and post-mechanism which is widely used by manufacturers can occasionally enable medial and lateral rollback but frequently generates paradoxical movements. In addition the cam and post mechanism rarely engage before 60 to 70 degrees of flexion, so that mid-range instability may occur.

By copying the conforming spherical shapes of the medial compartment of the natural joint and incorporating this in to the prosthetic design, it is possible to create stability for the replaced knee which is present throughout the whole range of flexion. By retaining a non-conforming lateral compartment with a completely flat superior surface for the tibial insert and a curved lateral prosthetic femoral, there is no impediment to the lateral compartment rolling-back if it so wishes.

The developmental features described above are present in the GMK Sphere TKR which marks a process of continuous development in the Freeman-inspired.

**GMK SPHERE - TIPS AND TRICKS**

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Patient satisfaction after total knee replacement continues to be a challenge with reports of a 19% overall dissatisfaction rate. A novel total knee replacement implant is presented that shows excellent stability throughout range of motion, natural kinematics, an expanded size range with anatomical fit, and improved patella tracking. The Sphere knee, a member of the GMK (Global Medacta Knee) family, has unique design features and kinematics that necessitate special considerations during preoperative planning, surgical approach, and implantation. This presentation reviews tips and tricks as well as some video vignettes for new users and also highlights important principles for current users.

**MANAGING VALGUS KNEES WITH GMK SPHERE**

*Van Overschelde P.*  
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The natural knee motion is determined by a stable medial compartment from extension to flexion. The joint line opening is therefore minimal on the medial side. On the lateral side some joint line opening is needed to allow for rotation around the stable medial condyle. This opening is more pronounced in flexion than in extension.

The aim of knee replacement surgery is to copy this natural situation.

The two major determinants of an excellent result after TKA surgery are correct implant sizing and optimal patient specific ligament balancing.

The stepwise technique to balance a valgus knee with a GMK Sphere implant is described.

The preoperative assessment whether a deformity is correctable or not predicts if peroperative ligament releases will be necessary to achieve our goal.

The first step is to create a rectangular extension gap. Spacer blocks are used to verify if the femoral and tibial cuts were sufficient. If at this stage there is an unbalance with a tighter lateral compartment, a selective release of the posterior fibres of the Iliotibial band and/or the posterior capsule is performed.

The second step consists of appropriate sizing and rotational alignment of the femoral component. In some valgus knees the lateral femoral condyle is hypoplastic. This has a big influence on positioning the femoral sizing jig. Undersizing and internal rotation of the femoral component should be avoided at this stage. The technique consists in a standard 8mm resection of the posterior medial femoral condyle and a neutral alignment regarding the epicondylar axis.

If after the cuts have been made there is a remaining tightness on the lateral side some selective releases can be performed at this stage. The popliteus tendon is released at its femoral insertion with the cautery. In extreme cases the lateral collateral and the gastrocnemius fibres are...
released to free completely the lateral femoral condyle. Again spacer blocks are used to test the flexion gap. We aim for a flexion gap that is at least the gap in extension.

In our series 20% are valgus knees. IT band was released to some extent in 19% of valgus knees. Popliteus tendon and lateral collateral release only in 2%, these were extreme cases with still a sufficient medial collateral ligament.

If an insufficient medial collateral ligament exists, this can be determined during the preoperative examination, a hinged knee implant will be used.

The aim at all times treating valgus knees with a GMK Sphere is to correct the alignment to neutral and to end up with a balanced knee where some laxity on the lateral side is tolerated provided the medial compartment is stable.

THE INFLUENCE OF CONTEMPORARY KNEE DESIGN ON HIGH FLEXION MOTION: A KINEMATIC COMPARISON WITH THE NORMAL KNEE

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Introduction
Although Total Knee Arthroplasty (TKA) surgery realizes 90% of outcomes with good to excellent results, where both pain relief and functional restoration are achieved, some patients have difficulty adjusting their gait to accommodate the kinematic pathways prescribed by knee implant designs. Paradoxical motions inclusive of anterior sliding and lateral pivot are examples of aberrant TKA kinematics.

This study compares the inherent motion of contemporary TKA systems through deep flexion with in-vivo kinematic data derived from a population of healthy un-operated knees by employing a computational kinematic simulator.

Methods
Three-dimensional solid models of the femoral, patellar and tibial insert components were created for each total knee design. The modeled components were “implanted” in the virtual joint space of the computational simulator as per the manufacturer’s surgical procedure. A deep flexion activity propelled by muscle forces and constrained by soft tissues was carried out and the flexion-extension results recorded.

Results
Synchronized animations of (a) quantitative data plots and (b) component motions were generated to characterize each design and compared with the normal knee (Figure). Paradoxical motion was displayed in varying degrees by each design with none replicating healthy un-operated knee kinematics. Flexion angles measured during the deep knee bend activity varied between 104 and 144 degrees prior to bony impingement. The post and cam designs drove tibio-femoral contact toward the posterior edge of the insert, allowing higher flexion prior to impingement than the non-post designs.
Discussion And Conclusion
This study indicates that contemporary total knee designs, while improving their kinematic pathways, have not yet achieved normal kinematic restoration.

The implications of this finding strongly suggest that patient satisfaction and long-term in-vivo component durability is not solely a function of device design and material choice. A knee arthroplasty that closely approximates the feel and function of a healthy un-operated knee is increasingly identified by both patients and clinicians as an objective of knee replacement surgery, which must also take into consideration patient selection and surgical proficiency.

References

ACCURATE MEASUREMENT OF THREE-DIMENSIONAL KNEE REPLACEMENT KINEMATICS USING SINGLE-PLANE FLUOROSCOPY

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Introduction
Total knee arthroplasty designs continue to evolve as evidence accumulates on natural and prosthetic knee function. Knee arthroplasty designs based upon a medially conforming tibiofemoral articulation seek to reproduce essential aspects of normal knee stability and have enjoyed good clinical success and high patient satisfaction for over two decades. Fluoroscopic kinematic studies on several medially conforming knee designs show extremely stable knee function and good functional attributes, but very small ranges of tibial internal/external rotation compared to the natural healthy knee. The GMK Sphere design represents a recent evolution in the medially-conforming family of TKA designs that adopts a sagittally unconstrained tibiofemoral articulation in order to allow more natural tibial internal/external rotation. This study was conducted to quantify motions in knees with the GMK Sphere prosthesis during a variety of weightbearing and nonweightbearing activities in order to address two questions:

1. Does the medially conforming GMK Sphere design provide an AP-stable articulation that provides for tibiofemoral translations that are comparable to, but not larger than, translations measured in natural knees?
2. Does the medially conforming GMK Sphere design provide sufficient rotatory laxity to allow tibiofemoral rotations comparable to, but not larger than, rotations measured in natural knees?

Materials and Methods
Fifteen patients (7 males and 9 females) with mean age of 65 years (53 – 75) and a mean BMI of 30 ±3 consented to participate in this study. Sixteen knees received the GMK Sphere total knee arthroplasty design. The mean Oxford Knee Score (OKS) improved significantly from 19 ±7 to 39.5 ± 3.1 at six months post surgery (P< 0.0001). On the day of the study, the mean OKS, Knee Society Score (KSS), EQ5D and Heath status scores were 40, 87, 0.83 and 85 respectively. The mean range of motion from active maximum extension till maximum supine flexion was 108° ± 8°. The motions of all 16 knees were observed using pulsed-fluoroscopy during a range of weightbearing and nonweightbearing activities. Subjects were observed in several static postures, including maximum flexion kneeling and lunging positions. Observed dynamic activities included stepping up and down on a 22cm step. Model-image registration methods were used to quantify three-dimensional knee motions from the digitized fluoroscopic images.

Source of Funding: Medacta International provided funding for the conduct of this study.

Level of Evidence
Level II/III prospective comparative study with historical controls.

Results
During the high flexing kneeling and lunge activities,
tibial internal rotation averaged 8° for both activities. During lunging, the medial and lateral condyles were an average of 5mm and 11mm posterior to the tibial AP center, respectively. During kneeling, where body weight provides a posterior tibial drawer force, the medial and lateral condyles were an average of 2mm and 9mm posterior to the tibial AP center, respectively. During the stair-stepping activity, the medial condyle did not translate significantly, while the lateral condyle moved posteriorly with flexion and tibial internal rotation in a physiologic pattern.

Discussion
The GMK Sphere knee arthroplasty was designed to provide intrinsic stability through a medially conforming articulation, and provide for more natural tibial rotation with an unconstrained lateral articulation. Fluoroscopic observation of these knees during lunge, kneel and stair-stepping activities showed a stable medial articulation with little translation, and a lateral articulation translating in direct relation to tibial rotation. Tibial rotation during kneeling (8° average) was approximately twice that observed in knees with an earlier medially conforming TKA design (Moonot et al., Knee Surg Sports Traumatol Arthosc, 2009) and similar to that observed in natural knees with medial osteoarthritis (Hamai et al., J Orthop Res, 2009). At only six months follow-up, knees with the GMK Sphere arthroplasty show functional kinematics that are AP stable and have more natural tibial rotation, consistent with the implant design intent.

KINEMATICS AND CONTACT PATTERNS BEFORE AND AFTER TKA: AN IN VITRO COMPARISON OF GMK PS VS. GMK SPHERE

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Introduction
Despite consequent advancement in Total Knee Arthroplasty (TKA) up to 20% of patients are not satisfied after surgery. Beside correct implantation, the design of the TKA system is supposed to be a key factor of a successful TKA. Consequently, attempts have been made to restore the natural kinematics through the design of the prosthesis. Therefore, the design of the GMK Sphere is supposed to allow a lateral translation with medial stability. Our study compared posterior stabilized (PS) with medially stabilized (MS) TKA design in terms of kinematics, femorotibial and patellofemoral contact patterns in vitro.

Materials & Methods
Twelve fresh frozen human knee specimens (8 male, 4 female, Ø 63.9 y) were tested in the Munich knee rig under natural conditions and after TKA with the two different types of TKA systems (GMK PS; GMK Sphere; Medacta, Swiss). The knee rig simulated a loaded squat from approximately 20°-120° of flexion with a ground reaction force of 50 N. An ultrasound 3D-motion analysis system (Zebris, CMS 10, Germany) measured complete knee kinematics and pressure sensitive foils (Tekscan Inc. US) analysed the femorotibial and patellofemoral contact patterns. By having the same bone cuts for the PS and MS knee system the direct comparison within every single knee specimen could be performed.

Results
Femorotibial kinematics of PS showed nearly parallel medial and lateral ap-translation. The general ap-translation was significantly reduced in MS. MS showed minimal medial translation with a slightly decreased lateral ap-translation compared to PS.

Contact patterns in MS design showed in the medial femorotibial compartment, that the maximum as well as the mean peak pressure decreased significantly, whilst the contact area increased significantly compared to PS design. In the lateral compartment, no significant differences were found for the maximum peak pressure and the maximum contact area between MS and PS design. Although the mean femorotibial peak pressures increased and mean contact areas decreased with MS compared to PS, respecting different flexion angles.

The retropatellar peak pressure increased significantly after TKA, whilst the contact area decreased significantly compared to natural conditions. The contact area at 120° flexion showed no difference between GMK Sphere and the natural knees. The PS had a lower contact area. The retropatellar mean pressure increased for the PS compared to the Sphere and natural knee. There was no significant difference of the retropatellar peak pressure between MS and PS.

Conclusion
The MS TKA system provided a lateral translation with a medial pivot, which is designed to further restore the physiological kinematics. Although smaller contact
areas with a tendency of higher pressure on the lateral femorotibial compartment might be in vivo a problem in terms of inlay stress with the MS design. In terms of retropatellar contact patterns MS restored natural conditions better than PS.

IN VIVO ANALYSIS OF POLYETHYLENE WEAR PARTICLES AFTER TOTAL KNEE ARTHROPLASTY: THE INFLUENCE OF IMPROVED DESIGNS

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Introduction
Modifications of design have been developed to reduce polyethylene wear after TKA. Number, size, and shape of polyethylene wear particles were reported to be critical for prevalence of osteolysis. We extracted polyethylene particles from joint fluid of the well-functioning TKA patients and compared the characteristics of wear particles between several designs.

Materials and Methods
The well-functioning knees with 11 posterior-stabilized TKA, 11 mobile-bearing TKA, and 11 medial-pivot TKA were analyzed. We aspirated joint fluid in the operation room with the informed consent and isolated polyethylene wear particles using a tissue digestion and image analysis developed by Campbell modified by us.

Results
The mean number of polyethylene wear particles (counts/knee) was 11.6 x 10^7 in posterior-stabilized TKA, 17.5 x 10^7 in mobile-bearing TKA, and 5.7 x 10^7 in medial-pivot TKA. Medial-pivot TKA generated fewer wear particles than posterior-stabilized TKA and mobile-bearing TKA. Mobile-bearing TKA generated larger particles, and medial-pivot TKA generated rounder particles.

Discussion
We found that modification of total knee arthroplasty designs resulted in different polyethylene wear particle characteristics. These differences may be important factors in the long-term development of osteolysis.

PRELIMINARY RESULTS OF GMK SPHERE

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The research department at the South West London Elective Orthopaedic Centre (The EOC) co-ordinates UK and international, multi-surgeon, multicenter surveillance studies of hip and knee implants to provide medium and long-term outcome data on implant performance and survival. Studies are designed to comply with the UK Orthopaedic Data Evaluation Panel (ODEP) recommendations. Data obtained from our ODEP surveillance studies can be compared with benchmark data obtained from more than 3000 hip and knee replacement patients treated at the EOC each year.

One of the analyses that we undertake in our early evaluation of implants is to examine the patient reported pre-operative to post-operative improvements in each of the twelve domains of the Oxford hip or knee score. The GMK sphere knee replacement was first implanted in October 2011. To date, we have acquired pre-operative, six-month and one-year Oxford scores on 144, 75 and 40 patients, under the care of six surgeons, at four hospitals. This early data-set shows that GMK sphere patients enjoy a greater increase in all domains when compared to other designs of knee replacement. Patient matching and evaluation of more cases, at more time points will identify whether this early observation is confirmed by rigorous statistical analysis.

THE GMK SPHERE KNEE: PATIENT SATISFACTION A REASON TO CHANGE?

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Life expectancy is increased, BMI is getting higher and patients have easy access to information. Today patients are well informed and want a Knee replacement which makes and keeps them active. Realistic expectations must be set: it is reasonable to expect pain relief and TKA is a complex and painful surgery. Most of the patients want to be active, play sports and perform daily life activities such as gardening.
Factors affecting the success of a joint replacement procedure are:

1) Patient-related (age, co-morbidities, diagnosis, weight, activities, etc.)

2) Surgeon-related (patient selection, operative technique, surgical approach, technical skill, etc.)

3) Implant-related (design, materials, instruments, etc.). The Swedish Register shows a high variation in failure rates of orthopaedic procedures in the different hospitals, the revision rate can increase by 8 folds between different hospitals. It would be clearly useful to standardize the procedure working on the different factors.

Many patients are not satisfied after TKA. In a study performed by David Beverland in Belfast 440 TKAs and 565 THAs were analysed. Patients were asked if they were “very happy”, “happy”, “OK but not perfect” and “never happy”.

54.69% of THR patients and only 3.86% of TKR patients declared themselves “very happy” while 6.59% of TKA patients and 1.06% of THA patients declared to be “never happy”. Patient’s satisfaction is clearly significantly higher following THA compared to TKA.

The GMK Sphere knee implant has been designed in a logical way. It provides medial AP stability in extension and during the arc of flexion, while laterally it is totally unconstrained allowing for movement as in natural conditions. The fully conforming medial compartment has been shown in the literature to provide high stability and enhance patient satisfaction when compared to conventional knee designs this could provide higher satisfaction levels also among patients operated with GMK Sphere.

During a 6 month follow-up, patients operated with the GMK Sphere knee showed a significant improvement of their Oxford, the EQ-5D and the KSS scores, compared to the preoperative conditions. The GMK Sphere seems to allow excellent flexion, possibly better that what seen before and it allows the knee to be stable. If patients feel stable they do more.
New Technologies in TKA
Session 3 - Knee Day

GMK EFFICIENCY: HOW DOES IT WORK?

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Evolution of the instrumentation
During the last 20 years we have moved from the classic ancillary to the « Patient-Matched » MyKnee ancillary but is it possible to go further? The first TKA cases were performed in the early 1960s with the first condyle metal/UHMWPE created in 1968 and the first Freeman & Swanson in 1970. TKA became more and more complex and the instrumentation followed the same way. It is built to follow the bone axis and to control the ligament balance. Throughout the years, TKA has been established as a successful procedure: the number of indications grows each year reaching 95 % of survival rate after 15 years. The number of knee systems in the market and the size options increase. More trays for the devices are added and the subsequent sterilisation cost increases. There are more surgical steps with canal violation, more blood loss and risk of fat embolism. Computer assisted surgery began in the 2000s and software solutions arrived on the market however, the price level was high: in 2005, a navigation station cost $20,000. Its learning curve is difficult and CAS needs cortical infraction for tracker pins. Surgical time increases by approximately 20 minutes and computers and software need maintenance. However, it allowed increased accuracy and less invasiveness with no canal violation. We obtained real time numerical information about cuts and knee reducibility!! It enables reporting (legal purposes) and is a good training tool. Many surgeons tried these new devices and, for some, this technique became routine.

Advantages of navigation vs conventional:
• Reduced mechanical axis outliers;
• Decreased variability in mechanical axis (Victor et al, CORR 2004);
• Decreased number of outliers (Jenny et al, J Arthr 2005).

Is there a need to change how we perform TKA?
Numbers of cases increase year on year. Patient satisfaction is typically lower and expectations grow. Increased accuracy amounts to a higher survival rate. Outcome of TKA depends on accuracy. It is mandatory to decrease the cost of the procedures. Many TKAs are performed by low volume surgeons. Deviations in coronal alignment > 3° correlate with poor survivorship of implants and higher cost to the medical system.

Why surgeons choose PMT?
After the CAS history we tried PMT with Medacta’s MyKnee in 2010. It is useful for pre-operative planning, accurate implant positioning and there is no intramedullary canal violation. The surgical steps are reduced by up to 60% for bone resections and related time alongside a reduction of up to 66% for the time and costs associated with the washing, assembling and sterilisation procedure. This can potentially lead to at least one extra case per surgery session.

I used it for the first time 3 years ago. I validated the system with navigation, Stryker knee track 4.0. For my comparative study I performed:
• 20 GMK with navigation;
• 20 GMK MyKnee and navigation;
• 20 GMK with MyKnee only.
After 60 I decided to stop navigation but not for revision and very difficult cases.

Actually, after 200 cases I changed the femur size for a lower one on 3 occasions (necrosis in two cases) and in 10 cases, for the tibia, changed to the size just below. In 90% I used poly size 10. With this technique it is mandatory to respect the recommendation and the tips and tricks. In my opinion there is more accuracy with the MyKnee MIS, particularly on the tibial side. MyKnee allows subvastus access which is a very important factor to obtain a good outcome.

Is MyKnee the best patient matched technology today?
Yes, because they are cutting blocks and not just pin positioners and based on the CT and HKA alignment. The online 3D planning is convenient and easy to use and offers multiple options: MyKnee MIS or MyKnee LBS.

Is it possible to go further?
Yes, with GMK Efficiency Single Use Instrumentation.
The French evaluation group was composed of Dr. Bussiere, Dr. Canciani, Dr. Herman, Prof. Leclercq, Dr. Lefevre and Dr. Ray. Three trays are necessary: the general tools pan, the femoral pan for right and left knee and the tibial pan. The preparation of the instruments in the operating room decreased from 20’ to 10’. Likewise, the time to collect the instruments after surgery decreased. The surgical time also decreased from 60’ to 50’ and, quite probably, the sterilisation cost savings made would cover the cost of the GMK Efficiency tray! The first results are good. We potentially have a very good prosthesis, GMK Sphere, with the excellent MyKnee tool and GMK Efficiency.

GMK EFFICIENCY: THE CLEAR CHOICE IN SINGLE-USE INSTRUMENTATION

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GMK Efficiency is a complete, single use instrumentation for total knee replacement. This system was developed by collaborating with dozens of surgeons to ensure accurate and reproducible instrumentation. It was conceived to reduce cost, improve workflow in the operating room and provide sterile, new instruments every time.

The GMK Efficiency system is complete. All steps in preparation of the knee are done with these single use instruments. Blister packaging with modules allows for easy intra-operative flexibility. Single use instrumentation improves turnover, eliminates heavy reusable pans and simplifies back table set-up. It is discarded after each case.

Infections are every joint surgeons worst nightmare. They are embarrassing, costly occurrences that are a tremendous burden on our health care systems. A single periprosthetic joint infection costs our health care systems well over 25,000$. Single-use instrumentation can potentially reduce infection rates by eliminating the variable of our conventional re-usable pans. These heavy pans are often cleaned by many different personnel and are vulnerable to contamination during both sterilization procedures as well as during back table set-up.

GMK Efficiency kits come sterilized in convenient, highly visible and organized blister packs. Hospitals will appreciate savings in sterilization costs, storage costs, and perhaps most importantly turnover and OR time.

Hospitals Central sterilization department will welcome these kits. They are all brand new, sterile and ready to go. Overused, potentially contaminated, and broken instruments will become a thing of the past.

These instruments have been designed, tested and modified to ensure proper function. Special materials incorporated into the design allow for intra-operative resilience and reliability. Improvements in intra-operative work flow are achieved with ergonomic connections resulting in increased OR efficiency.

The GMK Efficiency system is an innovative product that allows complete preparation of the knee. It improves the OR environment, reduces the risk of instrument-related complications, and simplifies OR and materials management.

To the author is knowledge, it is the world first, completely disposable instrumentation system that allows preparation of the knee from start to finish.

In summary, the GMK Efficiency system has benefits for caregivers, the hospital and our patients.
**MyKnee Results**

Session 4 - Knee Day

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**IMPROVED MECHANICAL ALIGNMENT WITH PSI COMPARED TO CVI IN TKA**

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**Purpose**

The aim of this single-center study was to compare early clinical outcome, radiological limb alignment and component positioning between conventional instrumentation (CVI) and CT-based patient-specific instrumentation (PSI) in primary mobile-bearing total knee arthroplasty (TKA).

**Methods**

A total of 290 patients (300 knees) with severe, debilitating osteoarthritis scheduled for TKA using either CVI (n=150) or PSI (n=150) were included in the prospective study. Patients were clinically assessed before and at least 2-years after surgery according to the Knee-Society-Score (KSS), visual-analog-scale for pain (VAS), the Western-Ontario McMaster Universities Osteoarthritis Index (WOMAC), and the Oxford-Knee-Score (OKS). To evaluate accuracy of CVI and PSI, HKA and 3-D component positioning were assessed on postoperative radiographs and CTs.

**Results**

At the 2-year follow-up clinical outcome (KSS, VAS, WOMAC, OKS) was comparable between the CVI and PSI. Mean HKA-deviations from neutral alignment (CVI: 2.2°±1.7°; PSI: 1.5°±1.4°; p<0.001), rates of HKA-outliers (deviation >3°; CVI: 22%; PSI: 10%; p=0.016), and 3-D component positioning outliers (deviation >2°) were significantly superior in the PSI-group. Non-outliers (HKA: 180°±3°) showed better clinical results 2-years after TKA.

**Conclusions**

CT-based PSI is an accurate and reliable way to improve mechanical alignment and 3-D component positioning in primary TKA, while significantly reducing the rate of outliers in all planes compared to CVI. Clinical outcome was comparable between the two groups at the early follow-up.

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**CT-BASED POST-OPERATIVE ANALYSIS OF TKR USING PMT AND CAS**

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We have performed a prospective open observational non-randomised study, to evaluate the accuracy of the MyKnee MIS system in 35 patients by comparing the pre-operative planning and measurements obtained by CT images, intra-operatively by iMNS and post-operatively by CT images. The purpose of this topic is to assess the efficiency and the accuracy of the cut made using the MyKnee MIS guide after correct positioning checked by the navigation system, compare the pre-operative sizes planned for the femoral and tibial components and those actually implanted, record any adverse events.

The method consists of performing MyKnee MIS pre-operative planning, landmark acquisition according to navigation protocol, blind positioning (without looking at the navigator) of the MyKnee guides, acquisition of the position of the MyKnee MIS guides using the adapter for navigation, performing the cuts, cut checks using the navigation system, post-operative CT scan 3 months after surgery.

We have evaluated pre-op data: femoral angles (varus/valgus, flexion, external rotation), tibial and femoral size, HKA planned using the MyKnee system; intra-op data: HKA acquisition and femoral angles (varus/valgus, flexion, external rotation) using iMNS, tibial angles (varus/valgus, slope) using MyKnee MIS cutting blocks guided by iMNS before and after bone cuts, HKA measured by iMNS after definitive implant; post-op data: femoral angles (varus/valgus, flexion, external rotation), tibial angles (varus/valgus, slope), HKA performing a CT scan 3 months after surgery.

From the analysis of those cases the correlation between planned alignment and final alignment measured through CT post-op analysis shows a 100% matching of femoral and tibial sizes.

- Regarding HKA 86% within +/- 3°, 71% within +/-2°;
- tibial varus/valgus 100% within +/-3°, 100% within +/-2°;
• tibial slope 86% within +/- 3°, 71% within +/- 2°;
• femoral varus/valgus 100% within +/-3°, 78% within +/-2°;
• femoral external rotation 92% within +/- 3°, 78% within +/- 2°.

We have had 3 adverse events where the patients quit the protocol and did not undergo post-op CT; in those cases we left PSI and continued using the navigation technique.

From our experience the results suggest that the MyKnee MIS procedure is reliable and highly accurate as well as navigation; the procedure does not allow to assess ligament balance during the planning step and to correct stiffness; it does not have precise control tools for the correct positioning of the cutting blocks, nor for checking the cuts performed; is satisfactory in terms of accuracy, blood loss, post-op pain, low rate of complications, short recovery and reduced surgical time.

For all these reasons, we believe that the MyKnee MIS procedure is useful, with proper precautions, for surgeons using conventional instrumentation; less useful, due to the lack of precise control and measurements, for surgeons who habitually use navigation systems.

CT-BASED PATIENT-SPECIFIC INSTRUMENTATION IS ACCURATE FOR TKA: A SINGLE-SURGEON, PROSPECTIVE TRIAL

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The present IRB approved study evaluates the early results of 100 TKAs using CT-based Patient-Specific Instrumentation (PSI) (MyKnee, Medacta International, SA, Castel San Pietro, Switzerland). For this technique, a CT scan of the lower extremity is obtained, and from these images, the knee is reconstructed 3-dimensionally. Surgical and implant-size planning are performed according to surgeon preference, with the goal to create a neutral mechanical axis. Once planned and approved, the blocks are made.

Outcomes measured for the present study include surgical factors such as Tourniquet Time (TT) as a measure of surgical efficiency, the actual intraoperative bony resection thicknesses to be compared to the planned resections from the CT scan, and complication data. Furthermore, pre- and post-operative long standing alignment and Knee Society Scores (KSS) were obtained.

There were 50 Left and 50 Right TKA’s performed in 61 females and 39 males. All patients had diagnosis of osteoarthritis. The average BMI was 31.1 and average age was 64.5 (range 41-90). 79 patients had pre-operative varus deformities with Hip Knee Angle (HKA) average of 174.7° (range 167°-179.5°). 19 patients had pre-operative valgus deformities averaging 184.4° (range 180.5°-190°). Three patients were neutral.

Average TT was 31.2 minutes (range 21-51 minutes). With regard to the bony resections, the actual vs. planned resections for the distal medial femoral resection was 8.7 mm vs. 8.9 mm respectively. Further actual vs. planned femoral resections include distal lateral 7.2 vs. 6.7mm; posterior medial 8.3 vs. 8.9 mm; and posterior lateral 6.2 vs. 6.8 mm. The Actual vs. planned tibial resections recorded include medial 6.4 vs. 6.3 mm and lateral 8.3 vs. 8.2. The planned vs. actual bony cuts are strongly correlated, and highly predictive for all 6 measured cuts (p=<.001). No intraoperative complications occurred.

Average Knee Society Score (KSS) improved from 45.9 to 81.4, and KSS Function Score improved from 57.7 to 73.5 at 6 weeks postoperative visit. There were no thromboembolic complications. Two patients had a post-operative infection requiring surgical intervention.

Post-operative alignment was 179.36° (range 175°-186°) for all patients. Alignment was neutral, within 3° in 95.9% of patients. There were only 4 outliers with maximal post-operative angulation of 6°.

In conclusion, these early results demonstrate efficacy of CT-based PSI for TKA. The surgery can be performed efficiently, accurately and safely. Furthermore, excellent short term clinical and radiographic results can be achieved.

IS CT-BASED TRANSEPICONDYLAR AXIS A RELIABLE REFERENCE FOR FEMORAL ROTATION?

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It is very important to perfectly balance the knee in extension and flexion during TKA to avoid the lift-off, which is an important cause of polyethylene wear. Many surgeons use an independent cutting technique and have need of some anatomical landmarks to place the femoral implant in the rotation they consider to be the correct one. These landmarks include the posterior condylar axis,
the Whiteside antero-posterior line and the transepicondylar axis. However, the determining of these landmarks is highly inaccurate and not reproducible.

Concerning the transepicondylar axis, numerous studies have shown intra- and inter-observer variability of its registration. Obviously the palpation of the epicondyles during the surgery can cause some errors from 11° of external rotation to 17° of internal rotation. The use of a CT-scan decreases this risk of error but is still not perfect, especially on the lateral epicondyle with some error of 1.5 mm intra-observer and 3.5 mm inter-observer.

In our mind, the gap balancing technique is the only way to free the surgeons from these landmarks and their imprecisions.

In this technique, the femoral rotation is automatically generated by applying symmetrical tension on both collateral ligaments. The MyKnee LBS system is thus perfectly adapted to this technique as it provides precise cuttings, accurate balance and personalised surgery for every patient.

RESULTS OF MYKNEE MIS COUPLED WITH MINI SUBVASTUS APPROACH

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Introduction

Since 2003, for knee replacement surgeries, I have used a subvastus minimally invasive technique that preserves the quadriceps and the extensor apparatus, allowing for a faster and earlier functional recovery. This technique can be difficult and has a long/steep learning curve but this can be helped by the use of a motorised knee positioning device which is essential for the surgical technique.

This technique is often criticised that it exposes the surgeon to a less precise implantation of the prosthesis. The use of pre-operative planning, as with the MyKnee patient matched cutting blocks (Medacta, Castel San Pietro Switzerland) solves this problem and ensures functional gain and implant precision of the prosthetic components.

Surgical Technique

The surgical approach is derived from the subvastus approach described by A. Hoffman and re-introduced in 1990. The skin incision ranges from 10 to 12 cm, the patella is everted, the whole surgery is based on the “mobile window” concept. The assistance of a motorised knee positioning device is essential. The key feature of this technique is to expose the knee joint in sequential steps.

Minimally invasive instrumentation has been specifically designed to adapt this technique to the GMK prosthesis (Medacta, Castel San Pietro Switzerland).

Since 2011, I have used MyKnee patient matched cutting blocks (Medacta, Castel San Pietro Switzerland) which include pre-operative planning based on Computer Tomography images.

Over time we have improved the MyKnee blocks to fit the minimally invasive approach. The final version of the MyKnee MIS blocks shows reduced size and better stability to ensure the resections are accurately performed.

Method

The study aims to assess the accuracy and quality of the MyKnee protocol by comparing two series of 100 consecutive patients, the first series being operated on using conventional instrumentation and the second series using MyKnee MIS (Medacta, Castel San Pietro Switzerland). We focused the study on the analysis of the radiological parameters relating to the accuracy of the implant placement and, amongst others:

- The post-operative alignment (HKA)
- The accuracy of the resections and (mainly) the comparative study of tibial slope, femoral component size and patella centering.

For the MyKnee MIS technique we studied the postoperative matching of the planned parameters (size of the implant components, flexion and extension gaps).

In both series the planning is coherent with the values expected by the surgeon (HKA 180°, tibial slope of 3°, good positioning on anterior femoral cortex, external rotation of 3°). The prosthetic implant is the β (Medacta, Castel San Pietro Switzerland) implanted through an independent cut technique, with an ultra-congruent polyethylene insert and without patella resurfacing.

Results

The patients with good post-operative alignment (HKA) rise from 97% in the first conventional instrumentation series to 99% in the second MyKnee series.

When compared, the analysis of the tibial slope and patellar centering shows comparable results in both sets. The femoral medio-lateral dimension is improved using the MyKnee technique with 95% satisfactory results due to the availability of narrow femoral implants. The MyKnee MIS planning has always been respected without additional cuts. In 3% of cases, the femoral and tibial sizes have been changed.
Conclusion
The main contraindication to the subvastus minimally invasive technique, i.e. the intrinsic technical difficulty and the consequent potential risk of inaccuracy, can be solved by using the MyKnee MIS. These findings should help in the future to further promote this technique with the goal of significantly improving the post-operative course of patients undergoing knee replacement.

IMPROVED POSITIONING OF THE TIBIAL COMPONENT IN UNICOMPARTMENTAL KNEE ARTHROPLASTY WITH PATIENT-SPECIFIC CUTTING BLOCKS

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Introduction
Unicompartmental knee arthroplasty (UKA) has undergone a recent resurgence in popularity. Numerous authors have cited alignment as an important prognostic factor in the survival of UKA. Limb alignment affects not only the longevity of UKA by increasing wear of the polyethylene, but also affects the unreplaced contralateral compartment. Malpositioning of the components produce unequal wear patterns, thus further leading to early failure and additionally influencing clinical outcome as well. Data shows in up to 100% a malpositioning of the tibial implant. With the introduction of patient specific instrumentation (PSI) this rate could decrease dramatically.

Objectives
This study is the first to investigate component alignment of medial UKAs implanted through a patient-specific cutting block technique.

Methods
We investigated pre- and postoperative CT-scans of medial UKAs implanted with patient-specific cutting blocks and compared the accuracy of postoperative outcome with the preoperative planning. We included 25 knees from 24 patients (10 male, 14 women, mean age 70 y, range 59-86 y). CT-scans were made from the operated knee pre- and postoperatively with additional images from the ipsilateral hip and ankle to measure the mechanical axis (HKA). Postoperative tibial varus/valgus, posterior slope and rotational alignment was measured through 3-dimensional reconstruction and compared to the preoperative planning. Additionally, we compared the HKA measured by CT-scans with conventional long-leg standing x-rays.

Results
Postoperative HKA showed mean values of 177°±2.8° (preoperative planning 175.4°±2.5°). The measurements of HKA with conventional x-rays showed comparable results with 177.3°±2.8°. The difference between postoperative final implant position compared to the preoperative planning showed for the tibial varus/valgus a mean of 0.5°±1.2° (2.9°±0.7 varus planned), for the tibial posterior slope 0.7°±2.0° (4.6°±1.3° planned), and for the tibial implant rotation a mean difference of 1.6°±3.5° external rotation (0° planned).

Conclusion
This study shows excellent results in rotational and varus/valgus alignment of the tibial implant in patients undergoing medial unicompartmental knee arthroplasty. Considering the crucial role of correct alignment of implant positioning for the survival of UKAs, the patient-specific cutting block technique seems to be a promising technique to optimize implant positioning.
MANAGING VARUS/VALGUS INSTABILITY IN TKA: HOW MUCH CONSTRAINT?

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I. Introduction
A. Varus-valgus constrained implants and rotating hinge implants are both used when prosthetic constraint is needed for relative medial-lateral ligamentous insufficiency.

II. Level Of Constraints
A. Varus-valgus constrained implants provide moderate augmentation of varus-valgus stability.

B. Varus-valgus constrained implants gain this stability by a tall central post which articulates tightly with a femoral housing.

C. The tall post provides constraint in the coronal plane, provides greater jump distance to prevent knee dislocation, and also creates some rotational constraint. Varus-valgus constrained implants with a mobile bearing which allows rotation (and thus may dissipate some force while maintaining stability) now are also available.

D. Rotating hinge implants provide much greater varus-valgus constraint and also much more resistance to dislocation in flexion.

III. Force Transmission
A. Rotating hinge implants are more constrained than varus-valgus constrained condylar implants and hence transmit more force to interfaces.

IV. Results
A. Varus-valgus constrained implants: Several series with favorable mid-term results.[1-11]

B. Rotating hinge implants
1. Older series: high loosening rates and problems with patellofemoral stability.
2. More recent series: improved results—lower loosening rates.[12-24]

V. Indications
A. Varus-valgus constrained
1. Moderate collateral deficiency
2. To help protect condylar TKA against dislocation with moderately increased flexion gap

B. Rotating hinge implants
1. Severe collateral insufficiency
2. Failed varus-valgus constrained implants due to collateral insufficiency
3. Complete loss of flexion gap control
4. Tumor prosthesis replacement of distal femur
5. Consider more favorably in older, lower demand patient than younger, more active patient

VI. Technical Tips
A. With either varus-valgus constrained or rotating hinge, use stems to dissipate interface forces.

B. With varus-valgus constrained implants provide as much soft tissue balancing as is feasible—the post won’t last forever.

C. Optimize limb alignment—this reduces stresses on implants that are compensating for deficient soft tissues.

References Constrained Condylar
8. Springer BD, Sim FH, Hanssen AD, Lewallen DG: The modular
Total knee arthroplasty (TKA) successfully alleviates pain and improves knee function. Between 1990 and 2007, in the US, the number of total hip arthroplasties (THA) increased twofold to about 200,000 and the one of TKA almost 5-fold to about 550,000. In Finland, the number of THA increased from 5,000 to 9,200, and the one of TKA from 3,000 to 9,100 between 1995 and 2009. The comparison of these figures indicates a less strict indication of TKA in the US, as opposed to Finland. Prosthetic joints are highly susceptible to infection. Kurtz et al. projected that 65,000 THA- and TKA-associated PIJs will be observed in the year 2020 in the US.

Traditionally, PIJs are classified as early (<3 months after surgery), delayed (3-24 months after surgery), and late infections (>2 years after surgery). For clinical purposes, a classification considering the surgical treatment concepts would be more useful. Acute hematogenous PJI of less than 3 weeks duration and early postinterventional PJI (<1 month after surgery) can generally be treated with implant retention. In contrast, in patients with chronic PJI, the biofilm on implant material can generally not be eliminated by antimicrobial agents. Therefore, all foreign material has to be removed.

In patients undergoing debridement with implant retention for PKJI, the reported success rates differ from 43% up to 95%. Therefore, one could argue that implant retention is not a valuable treatment option in patients with PKJI. The analysis of risk factors for failure could allow identifying patients which can be treated with retention with good success. Unfortunately, there is no large study available with statistically sound data on risk factors for failure in patients with PKJI. However, different observational studies point toward the following predictors for failure: (i) presence of a sinus tract, (ii) arthroscopic versus open debridement, and (iii) lack of rifampin treatment of staphylococcal PJI. Taken together, debridement with implant retention is an established procedure for either (i) early postoperative infection within 4 weeks after implantation, or (ii) acute hematogenous infections within 3 weeks after onset of symptoms, provided that the implant is stable, the pathogen susceptible to a biofilm-active antimicrobial agent (rifampin against staphylococci, fluoroquinolones against Gram-negative bacilli), and skin and soft tissue are intact. In addition, open debridement should be performed.

CHALLENGES IN PERIPROSTHETIC KNEE JOINT INFECTION (PKJI)

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Total knee arthroplasty (TKA) successfully alleviates
Leader in Anterior Approach Education

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Hip Day - 12 April 2014
AMIS Clinical Results - Part I
Session 1 - Hip Day

AMIS RESULTS IN THE AUSTRALIAN REGISTER

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Direct anterior approach (AMIS) was introduced into Australia in 2007. The approach was generally unfamiliar to the vast majority of Australian surgeons. Medacta provided a comprehensive education and training program to familiarise surgeons with the AMIS technique. The Australian National Joint Replacement Registry tracks and records all hip and knee replacements implanted in Australia and reports each year providing analyses on usage and revision rates.

In 2007 seven surgeons (7) performed 73 hips and in 2013 sixty (60) have performed 2340 hip replacements. The vast majority (95%) are performed using the AMIS technique. In 6 years the Quadra stem has become the 3rd most common stem implanted in Australia and the 2nd most common uncemented stem used.

The registry first reported the results of the Quadra/Versafit combination in the 2009 report. There were 6.7 revisions per 100 observed component years and the cumulative percent revision at one year was 4.9%. The registry highlighted the implants as having a higher than expected revision rate compared to the average.

“This prosthesis is significantly different from other primary conventional total hips because of a high risk of revision in the first two weeks after the procedure”.

The 2010 report again highlighted a higher revision rate. The Quadra-H femoral stem had been used in 837 procedures and had a one year cumulative percent revision of 3.1%.

In the 2011 report the Registry made the following comment “There is a higher rate of revision in the first 2 weeks and after this period there is no difference.”

One third (33%) of revisions were due to femoral fractures.

In the 2012 report there is no mention of a higher revision rate and the Quadra revision rate is now reported to be comparable to the general average revision rate.

“Previously the Registry has highlighted that the Quadra-H femoral stem was associated with a higher rate of revision in the first two weeks and after this period there was no difference. The Registry has undertaken an analysis of the procedures performed in the last two years and this difference is no longer evident.”

The learning curve effect
The Registry has analysed the revision rate of surgeons who have performed more than 50 procedures and there is a clear reduction in the complication rate the more experienced a surgeon becomes. There is a four times higher rate of revision in the first 15 procedures compared to after 100 procedures. Between 50-100 procedures the revision rate reduces to twice the rate compared to the over 100 procedure group.

The results of the Quadra stem and the AMIS technique have improved significantly due to surgeons becoming familiar with the surgical approach as a result of the outstanding effort that Medacta has made in training and education.

AMIS USING VERSAFITCUP AND QUADRA TO OVERCOME ADVERSE TISSUE RESPONSE: 5-YEAR RESULTS

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The direct anterior approach in total hip replacement (THR) anatomically offers the chance to minimize soft-tissue trauma since an intermuscular and internervous plane is explored. Using MRI, a retrospective comparative study of the direct anterior approach with the transgluteal approach was performed. There were 25 patients in each group. The groups were similar in terms of demographics, complexity of reconstruction and absence of symptoms. Detachment of the abductor insertion, partial tears and tendinitis, the presence of peri-trochanteric bursal fluid and fatty atrophy were significantly less pronounced and less frequent when the
direct anterior approach was used. We conclude that use of the direct anterior approach results in less adverse soft-tissue response.

Opponents associate minimally invasive THR with additional risks, potentially resulting in increased implant failure rates. The purpose of the second study was to document complications, outcome, polyethylene wear, five-year survivorship of THR using the AMIS approach and to test the hypothesis that eventual high complication and revision rates would be limited to an early series. A consecutive series of the first 150 primary THR (Versafitcup/Quadra) using the AMIS technique was retrospectively analyzed. Due to implant revision for any reason the overall five-year survival rate was 94.6%, 78.9% for the first 20 and 96.8% for the following 130 procedures (p = 0.001). The hazard ratio for implant failure was 0.979 indicating a risk reduction of 2% every further case. The five-year implant survivorship of those procedures performed by two junior surgeons was 97.7%. 62% of the cups were implanted within the safe zone. Four hip dislocations and two septic implant failures were encountered. The median HHS and Womac were 99 pts (61-100) and 0 pts (0-7.5), respectively. The mean annual polyethylene wear was 0.0059 mm/y. We conclude that adoption of AMIS temporarily exposed patients to a higher risk of implant revisions, which normalized after the first 20 cases. The experience of a single surgeon’s learning curve could effectively be taught to junior surgeons. AMIS using Versafitcup and Quadra results in a good to excellent clinical and radiological mid-term outcome.

EFFECT OF SURGICAL TECHNIQUE AND REHABILITATION ON RADIOLOGICAL RESULTS OF AMISTEM

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Introduction
Cementless straight rectangular stems are routinely used in the THA worldwide with good and reliable results. However, literature reports for this type of prosthesis a high occurrence of radioluencies which are usually non-progressive over time and occur in the proximal part of the stem. These are not related to clinical symptoms as demonstrated by excellent survival rates. A retrospective radiographic and clinical analysis has been planned for AMIS-H (Medacta International SA, Switzerland) to compare its performance to the results found in literature.

Methods
Consecutive case series of 266 patients (284 hips) who underwent primary total hip arthroplasty for any type of etiology using the AMIS anterior minimally invasive approach (Medacta International SA, Switzerland) between November 2009 and January 2012. Patients were only included in the study if they took part in a 1 year evaluation. A statistical analysis has been performed on these 284 cases in order to investigate if: radiolucency signs on the femur according to gruen classification are combined with discomfort or pain, surgical technique and rehabilitation protocol, anatomical shape of the femur (Dorr classification), patient characteristics or implant details.

Results
Radiolucencies, if present, were concentrated in the proximal zone: 8.8% of the radioluencies bigger than 2mm were in zone 1, 3.2% in zone 7, 10.6% in zone 8 and 0.4% in zone 14. No critical radiolucent lines were reported in the distal zone. Most patients (83.8%) were pain free, the others experienced slight (11.6%), mild (2.1%), moderate pain (0.4%), marked (0.4%) and it is unknown in 1.8% of cases. There is no correlation between radioluency and anatomical shape of the femur (Dorr classification), patient characteristics nor implant details.

An interesting point was highlighted when looking at the date of surgery. In 2010 22.9% of patients (40 out of 175) had at least one radiolucency bigger than 2mm, whereas in 2011 the occurrence of radioluencies decreased to 5.5% (6 out of 109). This difference is statistically significant (p<0.001).

Conclusions
The decrease in occurrence of radioluencies in 2011 is probably due to the changes introduced to practice: removing a minimal amount of bone from the greater trochanter and the adoption of a less aggressive rehabilitation protocol by extending the need for using crutches during the first six post-operative weeks (allowed full weight bearing).

In conclusion, although the anterior minimally invasive approach gives patients an almost pain-free and faster recovery after surgery, a less aggressive rehabilitation protocol is needed to facilitate the bone-implant osteointegration process.
SHORT TERM RESULTS USING THE AMISTEM FOR PRIMARY HIP ARTHROPLASTY THROUGH THE ANTERIOR APPROACH

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Introduction
The minimally invasive anterior approach has progressively become the most frequently used approach for primary hip arthroplasty in our department. Used since 2006, it has actually become the preferred exposure in more than 85% of our cases. Although technically challenging, the anterior Hueter exposure considerably reduces the delay to functional recovery in our patients. The AMISTem was used as the standard femoral implant for anterior hip arthroplasty since 2009. The goal of this study was to evaluate the rate of short and mid-term complications and clinical outcome using the AMISTem stem.

Methods
Since 1996, every hip arthroplasty implanted in our department is prospectively entered into a database. Patients are clinically and radiologically followed at 1, 2, 5, 10 and 15 years. Among our 6554 patients, all those fitted with AMISTem, implanted via an anterior approach between 4/2009 and 6/2013 were identified. We evaluated complications (including infection, dislocation, intra- and peri-prosthetic fractures), all cause revision over the whole study period (end of study 12/2013), and clinical outcomes at 2 years postoperative. Surgeon experience was divided between experienced surgeons with more than 50 anterior exposures, versus surgeons “in training” with less than 50 anterior exposures. Procedures were performed on a Medacta traction table, under fluoroscopic control.

Results
728 AMISTem were included (55% women, mean age 67 yrs., mean BMI 26.4, ASA 1-2 85.3%, primary OA 76.9%, uncemented stem 85%). 38% of the procedures were performed by surgeons “in training”. With respect to complications, there were 9 (1.2%) intra-operative fractures (greater or lesser trochanter), 7 (1%) dislocations occurring within 6 months postoperative, 5 (0.7%) infections, of those 4 within first and 1 within second postoperative year, and 5 periprosthetic fractures. Over the study period (range 6-57 months, mean 23 months) 13 (1.8%) THAs required revision at a mean FU time of 5.6 months. Causes of revision were: recurrent dislocation (n=2), mechanical reason (n=3), infection (n=4), and periprosthetic fracture (n=4). The overall short-term complication rate (infection, dislocation, all fractures) was 2.4% for an experienced surgeon and 5.4% for a surgeon in training (risk difference 3%, 95% CI 0-6, p=0.0358). The risk of revision was 0.4% vs. 4% (risk difference 3.6%, 95% CI 1.2-5.9, p=0.0005) comparing the experienced surgeon to the one in training.

Conclusion
THA with the AMISTem implanted via an anterior approach showed good short-term results. Surgeon experience substantially influenced the incidence of complications and revision.
AMIS Clinical Results - Part II

Session 2 - Hip Day

PROSPECTIVE RANDOMISED CONTROLLED CLINICAL TRIAL COMPARING THA PERFORMED EITHER THROUGH A POSTERIOR APPROACH OR AMIS USING GAIT ANALYSIS

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The direct anterior approach for total hip replacement has shown excellent results for early recovery and functional outcome scores. We examined if this approach had an effect on post operative gait function when compared to the posterior approach, and if there was a radiological difference in soft tissue recovery in the post operative period.

62 patients (mean age 65.6 years (38-75) were randomly allocated to undergo total hip replacement via anterior or posterior approach. All patients underwent a standardised postoperative rehabilitation protocol. Pre and post operative questionnaires were completed for Oxford and Harris Hip Scores, EuroQol Wellbeing and Health Status Scores. Gait was analysed using motion analysis sensors, IDEEA recorder and ActView Software. MRI analysis was carried out using 3T scanner with MARS protocol.

Anterior approach did not compromise length of hospital stay or patient satisfaction. Gait analysis showed better early recovery with the anterior approach. MRI analysis showed minimal change in the anterior structures at up to three year post procedure. The posterior group frequently showed degenerative changes and atrophy of the posterior structures after the same interval. The anterior approach provides very encouraging post operative results, and the surgical learning curve did not compromise patient recovery.

COMPARISON BETWEEN ANTERIOR AND POSTERIOR APPROACHES FOR THA

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The higher incidence of dislocation in relation to the posterior approach, and the recent adverse results associated with large head metal on metal implants, have led to a reassessment of the anterior approach as a way of addressing the incidence of dislocation, and allowing the use of smaller, non-metal-on-metal bearings for total hip replacement. The aim of this study is to compare function in patients with a posterior approach total hip replacement with those having an anterior approach.

This is a sequential case series of the first 100 anterior and the last 100 posterior approach hip replacements. It comprised 98 (46 males and 52 females) and 94 (40 males and 54 females) patients respectively. The anterior group had an average operation age of 70.01 (±9.38) years and included 2 bilateral procedures. The posterior group had an average operation age of 70.3 (±8.40) years and had 6 bilateral procedures. Clinical outcome scores of SF36v2, WOMAC, Harris Hip and Tegner activity score were analysed at pre-operative, 6, 12, 24, 36, 48 and 60 month intervals.

Average 6, 12, 24, 36, 48 and 60 month SF36v2 Total scores in posterior and anterior approaches were: 110.17, 119.59, 120.27, 125.46, 121.44, 124.53 and 130.34, 133.10, 129.25, 126.56, 122.95, 130.10 respectively. WOMAC Total scores for aforementioned intervals for the posterior approach were: 71.27, 77.78, 80.33, 80.92, 80.40 and 79.34; and for the anterior approach were: 85.30, 87.33, 85.41, 87.08, 87.47 and 81.42. Tegner scores for 6, 12, 24, 36, 48 and 60 month intervals were: 1.38, 1.83, 2.35, 2.31, 2.56 and 2.44 for the posterior approach; and 2.76, 2.79, 2.57, 2.11, 2.62 and 2.20 for the anterior approach. Harris Hip scores for 6, 12, 24, 36, 48 and 60 month intervals were: 73.31, 76.93, 78.65, 76.58, 79.16 and 78.40 for the posterior approach; and 83.73, 85.07, 82.88, 85.00, 71.71 and 84.71 for the anterior approach.

Significant differences (p<0.05) were shown between the posterior and anterior groups for SF36v2 Total scores and Physical scores at 6, and 12 months. There is also significant difference (p<0.05) between posterior and anterior group in SF36v2 Physical at 24 months. Significant differences (p<0.05) were present for WOMAC Total scores at 6 and 12 months. Tegner outcomes at 6 and 12 months had a significant difference (p<0.05). Harris Hip significant differences (p<0.05) were shown at 6, 12, 24, 36 and 60 months.
Postoperative clinical outcome scores were marginally higher within the anterior approach group especially in the 6 to 12 month intervals. This may suggest better recovery outcomes for the anterior approach patients.

MOBILITY ASSESSMENT OF A DUAL MOBILITY HIP ARTHROPLASTY FOR OSTEOARTHRITIC HIP

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Introduction
Hip instability is a common complication in total hip arthroplasty (THA). Dual mobility acetabular cups have been shown to reduce the incidence of dislocation, especially in cases of recurrent instability and revision total hip arthroplasty.1-3 Both Guyen et al.4 and Hamadouche et al.5 reported on clinical series of 54 and 51 hips treated for recurrent instability with use of a dual mobility cup with a minimum 2 year follow up. In both series the overall success rate was 94-96% with only one hip displaying evidence of cup loosening. This implant design offers significant advantages over constrained liners in respect of minimising interfacial stresses. In addition, proponents of the dual mobility design have suggested that it provides an increased range of motion. However, it has not yet been shown if patients implanted with such a prosthesis benefit from this increased range of motion in their activities of daily living. Motion analysis can measure how patients perform movements, and is a valuable tool in the measurement of the effectiveness of a type of surgery.

Purpose
The purpose of the current study is to analyse and compare the lower-limb joint kinematics and joint kinetic of patients undergoing total hip arthroplasty with either a dual mobility system (Medacta Versafitcup DM by Medacta), or a standard fixed total hip arthroplasty (Versafitcup CC by Medacta) during level, incline and decline plane gait, stair ascending/descending, and sitting/standing using a state-of-the-art 3D motion analysis.

Methods
30 patients were selected at random to receive either a Dual Mobility (DM) or standard (fixed) total hip all performed through the direct anterior approach using the AMIStem. All patients underwent analysis pre and post op at a minimum of 6 months post op.

In order to quantify the improvements of the joint kinematics between pre-operative and post-operative, the root mean square error (RMSE) was calculated using group means to determine the difference between each surgical group (DM or fixed) and the control group. The residual value (RV) was measured by subtracting the post-op RMSE from the pre-op RMSE value.

Statistical analysis on squat depth and RV using t-tests was used for p ≤ 0.05.

Results
The preliminary findings suggest that neither the conventional fixed bearing nor dual- mobility prosthesis restores joint kinematics similar to the control group at six months post-surgery. The DM group seemed to have better hip function pre-operatively than the fixed group where the fixed group showed an improvement for the hip kinematics. However, from pre- and post-operative motion testing, there were some significant improvements in kinematics of squatting for the DM group (Squat depth as percentage of leg length for DM group: pre-op 71±1%, post-op 69±2%; fixed group: pre-op 67±1%, post-op 74±1%; control group: 49±1%).

The conventional group experienced a moderate increase in peak hip and knee flexion angles, and a small increase in peak dorsiflexion angle. The dual-mobility group experienced a large increase in peak knee flexion angle, a small increase in peak dorsiflexion angle, with no change in peak hip flexion angle. This could indicate that the prosthesis may have provided more stability, allowing for increased lower-limb ROM.

Conclusions
The dual-mobility group experienced a large increase in peak knee flexion angle, a small increase in peak dorsiflexion angle, with no change in peak hip flexion angle. In addition, from pre- and post-operative motion testing, there were some significant improvements in kinematics of squatting for the DM group. This could indicate that the prosthesis may have provided more stability, allowing for increased lower-limb ROM. These preliminary results suggest that neither the conventional nor dual- mobility prosthesis restores joint kinematics similar to the control group at six months post-surgery. However the DM group showed some significant improvements compared to the fixed group. A longer-term analysis could show further improvement after the six-month follow-up.
References
ECONOMICAL IMPACT OF AMIS AND OTHER NEW TECHNOLOGIES IN TOTAL HIP ARTHROPLASTY

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Total hip arthroplasty is one of the most cost-effective procedures in all of medicine. Some might argue, therefore, that change is unnecessary. This presentation starts by reviewing a historical perspective of change in hip replacement surgery. Examples are given that highlight the need to continue to evolve and improve how we perform hip replacement surgery. In a world of health care reform it is critical that any new techniques and technologies resolve a problem, are clinically effective, and are cost effective.

Anterior Minimally Invasive Surgery (AMIS) meets these criteria by improving clinical outcomes and providing economic advantages. Clinical studies support this approach and show reduced muscle and tendon damage, improved gait, less pain, better function, improved Harris Hip Score, lower dislocation rate, shorter hospital stay, reduced hospital costs, ability to discard walking aids sooner, and improved patient satisfaction. In addition, there is a recent trend towards outpatient joint replacement and this approach is conducive to the outpatient setting. A short review of ancillary technologies is also provided.

DEBATE: ANTERIOR APPROACH WITHOUT TABLE

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Minimally invasive approaches for hip arthroplasty have been introduced during recent years, and each has its reported pros and cons. They have been devised with the goal of decreasing peri-operative pain, speeding up post-operative function, and improving patient satisfaction when compared with standard THA. These patient-centered goals are combined with the surgeon’s desire of a safe, reproducible minimally invasive procedure that has durable, properly positioned components. The direct anterior approach to the hip for THA was developed to try to address some of the complications of THA, including dislocation, leg-length discrepancy, and abductor dysfunction, and it is regarded as allowing faster patient recovery to ambulation, normal abductor strength and decreased dislocation rate. It also takes advantage of supine positioning, which allows improved intraoperative monitoring and anesthesia care. Some authors have favored the use of a special table to ease femoral preparation, while others perform it on a regular OR table. This presentation focuses on the direct anterior approach without table.

DEBATE: UNDERSTANDING THE BENEFITS OF THE ORTHOPEDIC TABLE

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To explain the purpose of the orthopedic table I would first say that the ideal way to operate would be with no operating table. I do not mean with a standard operating table as the “no table” advocates do, but with no table. The patient would be suspended in the operating room by a “body magnetic field”. Operating tables are by their nature an impediment to orthopedic surgery because where they touch the patient the surgeon has no access to the skin and the surface of the table necessarily blocks the motion of limbs in one or more directions. With the patient suspended in this “body magnetic field” the surgeon would have access to all skin areas, the force field could rotate the body into any orientation and could also move and hold a limb in a specific position or apply an axial distraction or compression force on that limb. Of course that technology does not exist at the present time. The purpose and function of the orthopedic table is to approach the no table ideal. Orthopedic tables contact the skin in limited areas to leave the maximum body surface open for access and the orthopedic table, by a ball joint system moves an extremity in all directions, rotates it and applies axial forces and then stably holds desired positions.

Robotic surgery is a discussed issue for THA. I believe
that the current emphasis on the robot doing the precision work is the wrong direction. A robot or mechanical device however is beneficial for positioning and securely holding the bone while the surgeon does the precision work. I view the table as such a device that provides its mechanical “hands” to hold and position the extremity. The table I use also has a simple robotic function as it raises and lowers the femur for access with the motor driven hook.

Maximal soft tissue preservation is a goal of anterior approach. I find that the table’s capability to hold, position and elevate the femur limits the tendency for struggle for femoral access. Retractors can be used in a more gentle way and not to lever the femur into a position of access. The table enhances the capability to preserve all external rotator attachments and limit damage to the tensor fascia lata muscle.

I also include x-ray views with the image intensifier during surgery. We need to know the result before wound closure. A carbon fiber table allows x-ray and the movements of the table and leg spars, levels the pelvis (essential for judging cup position) and can accurately and stably hold both hips in the same position of abduction and rotation which is essential for accurate interpretations of leg length and offset.

The table gives the surgeon the maximum capability to deal with difficult patients and problems. Though it is true that Anterior Approach can be performed without the orthopedic table I would say that the surgery is easier for the standard case with the special table and made possible for all patients regardless of body weight and muscularity.

Finally, surgical assistants to hold and position an extremity are not readily available in all settings and a special table quickly pays for itself by taking the place of an assistant.

**THE MYHIP SYSTEM: FROM PLANNING TO SURGERY**

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Pre-operative planning is an important step of a total hip arthroplasty procedure, which may help to avoid early complications such as leg length discrepancies, dislocations, fractures and abductor insufficiencies. However, conventional pre-operative planning relies only on the patient's anatomy and does not take into consideration dynamic aspects such as the joint kinematics, which impedes it to fully consider the evolving behaviour of the prosthetic joint that may lead to implant failures. In addition, a recent study showed that daily tasks involving high hip flexion (≥ 95°), could expose the prosthetic hip to impingements and to posterior subluxations\(^1\), it would therefore be important to understand the joint kinematics with a simulated implant position.

This led to the development of the MyHip technology, a patient matched technology for the hip joint. This technology uses patient CT scans to enable the use of a tool to perform 3D pre-operative planning and 3D cinematic simulation of the ROM of the patient’s hip, considering the patient’s posture (including the pelvic incidence). The pre-operative planning process, validated by the surgeon, is then used as the basis for the production of patient-specific femoral and acetabular guides, which are unaffected by intra-operative patient movement. This new technique will potentially improve the accuracy of implant positioning.\(^1\)\(^2\)\(^3\)\(^4\)\(^5\)\(^6\)\(^7\)\(^8\)

The goal here is to describe this new technique and the initial associated experience.

**References**

AMIS and Technical Pearls for Primary Surgeries

Session 4 - Hip Day

DYSPLASTIC CASES THROUGH ANTERIOR APPROACH

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In recent years, many direct anterior approach advantages have been reported, including rapid recovery and return to everyday activities. However, there is no data regarding the efficacy and safety of this approach for severe dysplastic hip. We studied the early clinical and radiographic results of 322 THAs for consecutive patients with Crowe grade 2 to 4 developmental dysplasia. 186 hips were in grade 2, 85 hips in grade 3 and 83 hips in grade 4. All operations were done by a single surgeon using the direct anterior approach on a standard surgical table. Fourteen hips required femoral shortening osteotomy. The mean operative time was 66 minutes and the mean operative blood loss was 464 ml. Four cups were revised for early migration due to initial fixation failure. Three of the 4 failed cups occurred in the first 20 cases. The cup fixation failure didn’t occur after the first 62 cases. There were 4 dislocations. Three patients dislocated in the first 2 weeks postoperatively and limited to one episode. One patient underwent a revision for recurrent dislocations. The clinical portion of JOA hip score (maximum, 100 points) improved from a mean of 42.5 preoperatively to 90.3 at the last follow-up. No patient had a positive Trendelenburg or Duchenne limp at the last follow-up. We conclude that the direct anterior approach is a safe and reproducible technique for severe dysplastic hip, but cup fixation failure may occur during the learning curve.
AMIS and Technical Pearls for Revision Surgeries

Session 5 - Hip Day

EARLY EXPERIENCE WITH A MODULAR DOUBLE MOBILITY ACETABULAR COMPONENT USED FOR DIFFICULT CASES

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Dislocation is a major complication after THA, often requiring revision surgery. Dislocation is usually due to impingement, muscle weakness or soft tissue laxity. All these conditions are often present in revision cases or in difficult primary procedures such as DDH, post traumatic arthritis and secondary arthritis in patients with neurological impairment. We reviewed our early experience with a modular double mobility cup system in a series of patients who had a high risk of dislocation and we focused on the tips and tricks of the surgical technique.

In all cases an Mmact acetabular component (Medacta, Switzerland) with a Double Mobility Converter (Medacta, Switzerland) and a double mobility liner was used.

In cases of isolated acetabular revision with a retained femoral stem the surgical technique was not changed from our standard procedure. An anterior approach was used in order to have a better acetabular exposure and to reduce risk of dislocation due to the approach. Once the failed acetabular component was removed bone defects were addressed according to Paprosky classification. A multi hole hemispheric metal back was used. Usually, at least two screws were used to achieve better primary stability. Once the satisfactory implant position and stability was achieved the Double Mobility Converter was used to take advantage of the double mobility system which was particularly useful when the retained femoral component had a suboptimal version.

In cases of primary surgical procedures in which the risk of dislocation was high for the intrinsic characteristic of the patient, the surgery was carried on as for standard cases. We usually prefer a minimally invasive anterior approach, when contraindicated a mini invasive posterior-lateral approach. The surgical technique changes from the standard because we chose the type of liner (double mobility or standard) after a thorough intra-operative test of implant range of motion and stability with trial components. In all cases in which the implant stability was not completely satisfying the double mobility was chosen.

At a six month follow up we had no dislocation. The modular system allowed a flexible intra-operative decision making with satisfactory results.

STRATEGIES FOR FEMORAL REVISION

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The use of tapered, fluted, modular, distally fixing stems has increased in femoral revision surgery. The goal of this first study was to assess mid-term to long-term outcomes of this implant in femoral revision with bone-loss. Seventy-one hips in 70 patients with a mean age of 68.5 years were followed for an average of 10 years. Preoperative HHS averaged 50 and improved to an average of 87 postoperatively. 79% of hips had Paprosky type 3A, 3B or 4 bone-loss and 44% had an associated proximal femoral osteotomy. All stems osseointegrated distally (100%). Two hips subsided >5 mm (mean 8mm) but achieved secondary stability. 68% of hips had evidence of bony reconstitution and 21% demonstrated diaphyseal stress-shielding. One stem fractured at its modular junction and was revised with a mechanical failure rate of 1.4%. Distal fixation and clinical improvement were reproducibly achieved with this stem design.

In the second study we noted that modular, tapered, fluted stems with distal fixation are being increasingly used for the management of periprosthetic femoral fractures. The purpose of this study was to retrospectively evaluate outcomes of treatment of B2/B3 periprosthetic femoral fractures using two different stem designs. Different modular stem design features include surface roughness, and flute geometry. We found that these design factors may influence clinical success in the setting of periprosthetic fractures.
ACETABULAR AND FEMORAL REVISION THROUGH THE ANTERIOR APPROACH

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Techniques have evolved that allow almost all revisions to be performed through the anterior approach (AA). It is ideal however for hip surgeons to have skill at approaching the hip, femur and pelvis by more than one approach so that the most safe and effective approach can be chosen for a given case.

I believe however that when there is a choice of approach, I normally choose anterior because I feel there are usually advantages even for revisions. The first advantage is to avoid post revision problems that relate to impaired musculature including dislocation, limp and generally impaired function. The other main reason for anterior is to maximize accuracy of cup position, leg length and offset which is facilitated by the patient being supine and checks with the image intensifier.

Comparing anterior to posterior approach I would say that acetabular access is typically easier from anterior and femoral access easier from posterior. Despite challenges with the femur I choose AA for the majority of femoral and acetabular revisions.

For surgery I place the patient supine on the HANA table. The table’s radiolucency as well as multiple functions of tilt, traction and extremity positioning will help with acetabular and femoral exposure. The femoral hook will also help with gaining femoral exposure and stabilizing the femur during instrumentation and implantation.

For acetabular revision the incision may be longer than normal but the same deep interval is followed. Particularly if you need to work around a well fixed stem the femur must be mobilized and displaced posterior and slightly proximal while working on the acetabulum medial to the neck. I open and preserve the capsule as with a primary hip. Changing the liner is the easiest revision however an ingrown cup can also be removed and/or bone defects addressed. Usually for acetabular exposure the table flexes the hip about 10 to 15 degrees, holds the extremity in about 60 degrees external rotation and pushes the femur proximal to place the stem prosthetic neck along the postero-superior rim.

If the femoral stem is removed acetabular exposure is simplified.

For femoral revision the incision is often extended proximal and distal. If the stem is loose, exposure and revision may not be much different than with a primary. If however a “straight shot” down the canal is necessary for cutting around a well fixed stem, removing cement, or placing a long revision stem extra femoral exposure will be necessary.

For getting this “straight shot” along the axis of the femoral canal there are several strategies. For thin females and particularly with dysplastic hips, extension of the hip with the table leg spar and anterior elevation with the hook may be sufficient along with release of capsule from the femur. For most patients however proximal structures including the anterior superior iliac spine and tensor fascia muscle will block access. In some cases it is possible to gain adequate access by detaching most or all of the tensor origin from the iliac crest and inter spinous notch. My own preference is to detach the abdominals and sartorius muscle from the ASIS and expose the distal and anterior internal iliac fossa and perform an osteotomy of the ilium from just anterior to the AIIS and ending at the gluteus medius tubercle. It is my experience from acetabular fracture and periacetabular osteotomy that muscle detachment from the inner ilium rather than the outer is better tolerated by the patient and this osteotomy can be repaired easily and reliably with 2 screws.

The femur metaphysis and shaft can be exposed by distal extension of the incision or making a separate more posterior incision. Osteotomies of the proximal or metaphyseal femur are also possible though the surgeon must stay within the neurologic plane and maintain soft tissue pedicles to osteotomized sections of the femur.

While working along the “straight shot” down the canal the table holds the extremity extended and externally rotated while the hook holds the femur anterior and stabilizes it.

The image intensifier is used as for a primary to guide proper cup positioning and maximize accuracy of leg length and offset by comparison with the opposite hip.
CONTINUING EDUCATION PROGRAM

1st Step
Surgeon to Surgeon Visits

2nd Step
Learning Center
(cadaver workshop/live surgeries)

3rd Step
Proctor support for first cases

4th Step
Continuing education through advanced learning opportunities
Poster Session
Introduction

With increasing numbers of primary total knee replacement (TKR) procedures during the last two decades, the occurrence of complications and revision surgeries is also rising\[1\]. Despite well documented survival rates for primary implants\[2-3\] information regarding long-term durability of revision implants is still rare. Mid- to long-term studies have reported survival rates between 71% and 98%\[4-10\] with the risk of further surgery at 16%, 5 years after revision surgery\[5\].

The objective of this clinical investigation was to evaluate clinical, functional and radiological outcomes and short-term survival of the TKR GMK Revision either used for primary or revision surgery.

Patients and Methods

Twenty-four consecutive patients (f=19, m=5; mean age 67 years, mean BMI of 31 kg/m²) underwent TKR using the GMK Revision System (Medacta International, SA Switzerland) for severe deformity (n=2) or fracture (n=5) in primary surgery and for revision surgery in 17 patients. Whilst 15 patients required a complete revision prosthesis, only femoral (n=2) or tibial (n=7) revision components were used combined with GMK primary components, if feasible. Additional patella resurfacing was performed in two patients. Offsets (n=11), tibial augments (n=16), posterior femoral augments (n=8), and distal femoral augments (n=11) were used to restore the joint line and achieve stability. The following inlay types were used: ultra-congruent mobile (n=10), Hybrid (i.e. CINETIQUE-GMK) ultra-congruent (n=4), and semi-constrained (n=10). A clinical examination using the Knee Society Score (KSS) was performed. Radiographs were analysed to evaluate radiolucency.

Results

After a mean follow-up of 34.7±9.1 months, 18 patients were available for clinical examination, whilst three patients required revision surgery due to loosening of femoral component (n=1) and instability (n=2). In those two patients revised for instability, the initial ultra-congruent mobile inlay was changed to a semi-constrained type. Significant improvements from pre- to post-operative were detected with KSS for knee from 40.3 to 76.1, KSS for function from 49.3 to 79.6 and ROM from 92.9° to 105.0°. Radiolucencies were detected in three patients.

Conclusions

GMK Revision System in TKR for primary as well as for revision surgery showed significant improvements from pre- to post-operative regarding KSS and ROM. The study reports a 3-year survival rate of 95.8% considering loosening and 87.5%, if considering any reasons as endpoint.

In conclusion, the GMK Revision System is not only a reliable system for revision surgery after failed primary TKA, but also a good option for primary TKA in cases of severe joint destruction, instability, or fractures.

Bibliography


C-ARM GUIDED TRIPLE TAPER HA-COATED DIRECT ANTERIOR THA

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Introduction
Total Hip Arthroplasty through the direct anterior approach was first developed 60 years ago but it was all but unknown until the past decade. In the last years it has been widely debated.
This study exams one community surgeon’s experience and thus sheds light on whether the ATHA is a viable operation for all orthopaedic surgeons.

Materials and Methods
The study prospectively evaluates 332 hips having a THA through the direct anterior approach. Primary OA was by far the most common diagnosis. 2 hips were converted from a previous operation and 2 were revisions. Side and sex distribution were approximately equal.
No hips were excluded; all hips were replaced through the direct anterior approach. A special orthopaedic table and intraoperative c-arm were used universally. All hips had the same HA coated, cementless, triple-taper stem (Quadra-H, Medacta International SA, Switzerland); a variety of cups were used. 92% of the bearings were ceramic on poly; all but 11 heads were 32mm or smaller.
Anti-embolic prophylaxis was used with intraoperative bilateral thigh high sequential pumps, early mobilization and aspirin for most. Those patients deemed at risk received lovenox, and those already on Coumadin continued with bridging lovenox. Charnley Merle D’Aubigne, Harris, and WOMAC scores were obtained before surgery and regularly thereafter.

Results
Mean surgery time was 70 minutes (60 to 175), fluoroscopy time was 7 seconds (4 to 21) and patients went directly home 2 days after surgery (SD 0,6). The percentage of implants within the safe zone was 99,7% (-10° to 30°) for AC component anteversion, 100% (30° to 51°) for AC inclination and 80,4% (±5 mm) for limb length. Hip scores improved significantly for all hips at a mean follow-up of 25 months (± 11): PMA increased from 8±2 to 17±1 (p <0.001), HHS increased from 41±14 to 90±8 (p <0.001) and WOMAC decreased from 75±17 to 30±10(p <0.001).
Complications that occurred were recorded: 5 intra-operative complications (1.5%) without any clinical consequence (2 perforations, 2 intraoperative fractures, 1 lesser trochanter fracture), 3 dislocations (0.9%), 1 fracture because of a fall (healed, no additional surgery needed) (0,3%), 4 medical complications (1.2%) (1 PE, 1 UGI bleed, 1 ileus, 1 CVA), 3 reoperations (0,9%) (1 early fall and fractured femur and 2 late falls with acetabular fracture and 1 recurrent dislocation) and 2 patients died for reasons unrelated to the arthroplasty (0,6%).

Discussion and Conclusion
According to these data, the direct anterior approach utilizing a special orthopaedic table and intraoperative fluoroscopy can produce satisfactory or better results with few complications.
C-arm time was comparatively minimal and seems to contribute to good implant positioning. Using an HA coated triple-taper stem there was no atraumatic loosening in this short term follow-up.
The dislocation rate was low even though large head sizes were never employed. There were no periprosthetic infections suggesting that claims for relative soft tissue sparing may be factual.

SUPERIOR PATIENT SATISFACTION AFTER TKA BY USING “IDEAL ARTHROPLASTY KINEMATICS”

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Abstract
Introduction: Patient Satisfaction after TKA is starting to be considered as a priority outcome and an important addition to traditional outcome measures. The reported satisfaction rate in the literature is disappointing (75%-89%). Traditional techniques for TKA have made neutral (0° ±3°) coronal alignment a primary technical goal. We present the results of “Ideal Arthroplasty Kinematics” ie perfectly balanced knee irrespective of mechanical alignment.

Materials and Methods
864 (92.9%) of 914 patients operated between January 2007 and December 2012 were prospectively
followed up. Average follow up time 40.4 months. They were asked if they were satisfied, unsatisfied or unsure by an independent research-nursing sister. Unsure patients were categorized as unsatisfied. 817 (94.5%) of this group had satisfactory postoperative long leg x-rays as per Paley’s technique. The patient satisfaction was correlated to post operative mechanical axis (M.A.)

Results
803 (92.9%) of the followed patients were satisfied with their knees. 719 (88%) had a M.A. within ±3° of neutral; so called aligned knees. 98 (12%) had a M.A.>3° (Outliers). Patients with aligned knees had a 92.4% satisfaction rate and those that were outliers were satisfied 92.9% of the time. N.S.

Conclusion
By attempting to achieve “Ideal Arthroplasty Kinematics” ensuring the medial and lateral soft tissues are balanced within a couple of degrees using a tensiometer better patient satisfaction has been achieved than previously reported. Patient alignment did not affect satisfaction rate. It seems it is better to leave constitutionally varus patients in varus and similarly valgus patients in valgus.

A COMPARATIVE EVALUATION OF IMPLANT COMPONENT ALIGNMENT PARAMETERS IN T.K.A: PRE-OPERATIVE PLANNING VS. POST-OPERATIVE CT OBTAINED VALUES, USING PATIENT MATCHED INSTRUMENTATION

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Introduction and Rationale
Total Knee Arthroplasty (TKA) remains the treatment of choice for advanced knee arthritis. A common cause of failure that could lead to revision surgery is malalignment of the components due to surgical technique. Implant components aligned outside a range of 3° of varus to 3° of valgus have been associated with a higher rate of failures. Patient matched instrumentation has been developed in order to reach the best knee alignment according to patient’s anatomy. The objective of this prospective clinical investigation was to compare the pre-operative planning alignment parameters of the femoral and tibial components in T.K.A to the accuracy and effectiveness achieved following the usage of patient-matched cutting blocks manufactured using CT scans.

Materials and Methods
Thirty (30) consecutive primary TKAs were performed using the medial parapatellar incision approach. The implant used was the GMK PS with Fixed Bearing (Medacta International SA, Switzerland) and the associated “MyKnee” patient matched instrumentation. In order to create a 3D Solid bone model of the patient’s specific anatomy of the knee joint, the patients underwent CT Scanning. Subsequently, a preliminary surgical plan is proposed by the manufacturer and, after the surgeon’s validation, the cutting blocks can be prepared. Post-operatively, each patient underwent CT scanning. Two patients had to be excluded from the cohort due to the scan format used not being followed correctly, rendering the images non-readable. Parameters concerning implant sizing, HKA, tibial varus/valgus, tibial slope, femoral varus/valgus and external rotation were measured and compared to the ones obtained pre-operatively recording the deviations from the plan. A statistical analysis was performed to determine the mean and standard deviation values.

Results
Mean H.K.A Angulation was 177° [range 168°-190,5°] before surgery and 180°±1,8° [174,5° – 183°] postoperatively: only one outlier was detected. Preoperative mean tibial slope was 7.1° [-2.5°-16,5°] and reached a mean of -0.6°±1,4°[-3,5° – 2°] postoperatively: 3 outliers were reported. After surgery tibial varus was between -2° and 3° (mean 0.3°±1,1°), femoral varus between -3° and 2.5° (mean 0.5°±1,1°), femoral external rotation between -1.5° and 1.5° (-0.1°±0.9°). It is clear that our results suggest that even when the “acceptance” criteria with regards to post-operative alignment as this refers to the various angulations are very strict, the outcomes are extremely satisfactory.

Conclusion
Although we do admit that the cohort of patients that were included in this study is relatively small, the accuracy of the results obtained mean we are very optimistic about routinely using this patient-matched instrumentation technology in Total Knee Arthroplasty. There is no doubt in our minds that we can confidently say that surgery outcomes can be as accurate as preoperative planning.
**DOUBLE MOBILITY CUP SYSTEM IN HIGH RISK PATIENTS: PRELIMINARY RESULTS**

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**Introduction**

The double mobility concept was introduced to reduce dislocation in total hip arthroplasty. This is an original acetabular component with a double articulation: the head articulates in a mobile inlay that articulates in a metallic cup. Thus the range of motion and the jumping distance significantly increase, theoretically decreasing the risk of dislocation.

The aim of the current retrospective analysis is to evaluate the outcomes of a consecutive series of patients implanted from May 2008 to August 2011 in terms of dislocations and cup revisions for any reason.

**Patients and Methods**

Patients were divided into two groups depending on whether a primary or revision prosthesis was implanted.

From May 2008 to August 2011 a total of 1046 primary hip replacements were performed. A DMCS was implanted in 40 cases (3.8%). Indications for a DMCS in primaries were: neuromuscular disease (14), severe irreversible hip abductor weakness (10), cognitive dysfunction (8), ≥ 3 prior hip surgeries (4), physical impairment (3) and morbid obesity (1).

In the same period a total of 345 revision procedures were performed. A DMCS was implanted in 49 cases (14.2%) during this period. Seventeen were septic revisions. The indications for a DMCS in revisions were: recurrent instability (27), ≥ 3 prior hip surgeries (13), severe irreversible hip abductor weakness (4), cognitive dysfunction (3), physical impairment (1) and neuromuscular disease (1).

Analysis of their medical history has been performed with emphasis on implant position and signs of loosening. In addition, a phone interview was conducted and a questionnaire, including WOMAC scores, was sent in August 2013 (minimum follow up 24 months) as a final follow-up.

**Results**

Dislocations and aseptic or septic revisions were recorded. In the primary group, after an average follow-up of 47 months, 2 periprosthetic fractures were observed. 9 patients (10 DMCS, 1 bilateral) died unrelated to the surgery a mean of 9 months after the index surgery. None of them underwent revision or dislocation. 7 patients (8 DMCS, 1 bilateral) were lost to follow up. At their last follow-up a mean of 12 months after index surgery, none of them underwent revision or dislocation. In the revision group, after an average follow-up of 41 months, 2 hip dislocations, 3 septic cup revisions (2 persistent infections, 1 new infection) and 2 non-septic cup revisions were observed. Six patients had died unrelated to the surgery a mean of 7.5 months after index surgery. None of them underwent revision or dislocation. 5 patients were lost to follow-up. At their last follow-up a mean of 8.4 months after index surgery none of them sustained revision or dislocation. No radiological signs of loosening were recognised.

The dislocation rate was 2/89=2.2% after an average follow-up of 31.7 months.

At last follow-up the WOMAC score had significantly improved when compared to the pre-operative scores.

**Discussion & Conclusion**

The dislocation rate is comparable with literature even in this high risk patient collective (of the 49 revisions included in the study, 27 had recurrent instability).

These preliminary results justify the continuous use of the Versafitcup DM and Versacem implants in high risk patients for dislocation. In 2012 high cross-linked polyethylene inlays were introduced reducing issues of wear when using DMCS.

**PATIENT MATCHED TECHNOLOGY VS CONVENTIONAL INSTRUMENTATION AND CAS**

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**Introduction**

There is surprisingly little evidence to support the widely held assumption that restoring the coronal alignment to 180º ± 3º in total knee arthroplasty leads to improved function and longevity. Some publications consider a deviation from the neutral mechanical axis greater than ± 3° is demonstrated to decrease the implant longevity.

On the other hand, some authors affirm that there is no statistical difference between outliers in mechanical alignment and well aligned knees. We ignore a strict correlation between the preoperative deformity and the optimum postoperative axis and more work must be done to clearly define the appropriate target for limb alignment in various patient groups after total knee arthroplasty.
Objectives
The aim of this study is to assess the accuracy of patient matched technology with MyKnee system and to compare this to conventional mechanical instrumentation and to computer assisted surgery.

Methods
The mechanical axes of the long leg before and after operation were evaluated. Lateral radiographs were taken too.
We have analyzed the Hip-Knee-Ankle angle (HKA), the Condylar-Hip angle (CH), the Plateau-Ankle or medial proximal tibial angle (PA), the lateral angle of the femoral component and the posterior tibial slope. We have analyzed 263 total knee prosthesis performed by the same team with four instrumentation systems: conventional mechanical instrumentation (A, 44 cases), computer assisted surgery for the tibial time combined with the ligament balance system (B, 14 cases), Medacta’s navigation system (C, 51 cases) and MyKnee patient matched technology (D, 154 cases).

Results
HKA preoperative: 172,46° ± 6,37°, with remarkable predominance of varus knees. Preoperative evaluation ordered by the different systems: HKA angle: A 171,91° ± 5,23°, B 174° ± 4,37°, C 173,84° ± 6,98° and D 172,02° ± 6,6°. CH angle: A 90,2° ± 3,49°, B 90,64° ± 2,62°, C 91,55° ± 3,15° and D 90,23° ± 3,16°. PA angle: A 86,23° ± 4,94°, B 87° ± 2,51°, C 86,55° ± 2,05° and D 86,04° ± 3,13°. Postoperative HKA angle: A 178,8° ± 3,97°, B 179,14° ± 3,74°, C 180,37° ± 2,05° and D 179,44 ± 2,42°. Postoperative CH angle: A 89,52° ± 3,43°, B 90,21° ± 3,04°, C 90,94° ± 1,67° and D 90,3° ± 2°. Postoperative PA angle: A 89,3° ± 2,88°, B 89,21° ± 1,67°, C 89,31° ± 1,1° and D 89,17° ± 1,3°. No significant difference among different alignment systems was obtained, but there is a difference if we consider the frequency distribution between outliers in mechanical alignment and well aligned knees. HKA angle 180° ± 3°: A 68,18% (31,82% outliers), B 57,14% (42,86% outliers), C 88,24% (11,76% outliers) and D 89,6% (10,4% outliers). CH angle 90° ± 2°: A 59,10% (40,90% outliers), B 35,71% (64,29% outliers), C 74,50% (25,50% outliers and D 83,8% (16,2% outliers). PA angle 90° ± 2°: A 81,82% (18,18% outliers), B 78,57% (21,43% outliers), C 94,12% (5,88% outliers) and D 87% (13% outliers).

Conclusion
With MyKnee technique the percentage of patients with neutral alignment, with a tolerance of ± 3°, increased from 5% pre-operatively to 89,6% post-operatively. Attending to the obtained results, our current preference to perform TKA surgery is MyKnee system. This system offers additional advantages, but further studies are needed to address this.

TREATMENT OF SEVERE KNEE DESTRUCTIONS USING THE GMK SPHERE

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Introduction
The GMK Sphere is an innovative total knee replacement system based on studies of knee anatomy and kinematics, and designed to deliver maximum functional stability with minimal bone resection. This case report illustrates how the GMK Sphere implant can restore mobility and stability even in a patient with severe bone and soft tissue damage.

Case Presentation
A 62 years old patient came from Cameroon to Switzerland 36 years ago, suffering from an important flexion contracture (about 100°) of both knees due to very extensive leg burns. After many skin grafts and orthopedic treatments and surgical interventions, the contracture was reduced to 20°. The patient could walk without help and recovered full working capacity in the trade business until 2010. Since many years, he was using a walking stick, and then 2 crutches more recently.

Pain and stiffness were increasing, threatening professional and daily living. For these reasons, a surgical treatment had to be considered.

From a clinical point of view, the patient showed a flexion of 40° and an active lack of extension of 20°. The patellar tendon was completely atrophic and shortened, reduced to a “patello-tibial synostosis.” The scarred soft tissues were tightly fixed to both condyles and the whole articular space was reduced to a rudimentary femoro-tibial articulation.

An arthrodesis was proposed in two academic and regional orthopedic centers.
We considered that it was worth trying to improve stability and mobility with a TKA.

**Treatment**
The patient underwent a total knee replacement with GMK Sphere using the MyKnee technology. According to a pre-operative CT scan, a 3D model of the patient knee was built and patient-specific cutting blocks were prepared. Considering the severe soft tissue modifications, a GMK Hinge prosthesis was at disposal, in case of insufficient stability. An anteromedial approach was used: the patella was mobilized after resection of its posterior part. Through a classical longitudinal transtendinous quadriceps opening, soft tissues on the whole anterior and lateral surfaces of the condyles were released, with difficulty, until we got a flexion of 100°. Both cruciate ligaments were excised. Sufficient access to both tibial and femoral articular surfaces was obtained to allow for typical bone resections and implantation of the components using the MyKnee technique. At the end of the procedure, as the patella had been mobilized and had no more tendon, it was therefore fixed to the tibia using two tension wires. This fixation does not lead to biomechanical problem due to the spherical, congruent, medial compartment. The medial condyle has no significant horizontal mobility and the patella is integrated into the spherical shape of the tibial component. Flexion reached 120°, with full extension and the knee was stable.

**Outcome**
Five months after surgery, static correction and excellent stability were confirmed. Knee mobility reached 75° of flexion, 15° of active extension, and 0° of passive extension. Patient reported no knee pain.

**Discussion and Conclusion**
The GMK Sphere allowed demonstrating the possibility of restoring a mobile, stable, and painless articulation, even in these very difficult conditions. Five months after the surgical procedure, perfect static correction was achieved with excellent stability. Ranges of motion increased (flexion: 75°; active extension: 15°; passive extension: 0°) and the patient felt no pain. He is now very satisfied and can return to his daily and professional activities.

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**A PROSPECTIVE STUDY COMPARING EARLY RESULTS OF TKR PERFORMED UTILIZING CT-BASED CUSTOM MADE CUTTING BLOCKS WITH A STANDARD TECHNIQUE**

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**Introduction**
The aim of this study is to compare the short term clinical results of TKR performed with the use of custom made cutting blocks with the results of a cohort of patients who underwent the surgery using the standard technique.

**Method**
93 patients (103 knees) underwent TKR with the use of CT-based custom made cutting blocks (CM). All patients were assessed prospectively with Oxford knee score and EQ5D 3L questionnaires. These were repeated at three months and twelve months. Blood loss as measured by the differential of pre-op and day one haemoglobin levels was recorded as well as length of stay in hospital and units of transfused blood. These results were compared to 84 consecutive preceding patients (90 knees) who had undergone TKR with the use of the same implants (Evolis cemented Medacta, Switzerland) but through a standard technique (S) as well as with the data available from the New Zealand joint registry.

**Results**
With a follow up of 12 months, the CM group had a mean pre-operative score of 20, 35 at 3 months, and 41 at 12 months. The S group had a pre-op mean score of 19, 35 at 3 months, and 37 at 12 months. There was no statistical difference in the scores between the 2 groups pre-op and at 3 months. The scores for the CM group were significantly better at 12 months with a p-value of 0.02. In the New Zealand registry 72% of patients had either good or excellent outcomes (scores above 34). In our study, 87% of patients in the CM group had good or excellent outcome at 12 months, whereas 71% of patients in the S had good or excellent results. There was no difference in blood loss between the groups. The transfusion rate was lower in the CM group (3.2%) compared to the S group (16.4%). Mean tourniquet time was 45 minutes in both groups. There were no revisions in either group.
Conclusion
CT based custom made cutting blocks produce statistically improved clinical outcomes when compared to the standard approach in the short term following Total Knee Replacement surgery. The transfusion rate is also lower in this group.

MPACT SYSTEM: CLINICAL AND RADIOLOGICAL OUTCOMES AT 2 YEARS FOLLOW-UP

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Introduction
The goal of cementless prostheses is to reach a solid bone fixation through an alternative method rather than bone cement. These implants therefore have a surface topography that is conducive to attracting new bone growth. Mpact cup is a modular hemispherical press-fit acetabular shell with an external Titanium porous coating called Mectagrip. This consists of a layer of pure titanium with pores size between 300 and 800 μm, continually interconnected with an overall porosity up to 70%.

The aim of this study is to evaluate clinical and radiological outcomes for the Mpact system coupled with Quadra-H femoral stem at 2 years follow-up.

Material and Methods
From March 2011 to Sept 2011, 50 cups were implanted. Excluding a case of revision for infection that required complete implant removal and later re-implantation, the other 49 THAs, corresponding to 48 patients, were clinically and radiologically assessed at 3 months (mean 74 ± 37 days) and 1 year (mean 401 ± 55 days) after surgery. At 2-year follow-up (mean 751 ± 48 days), 24 patients have already been assessed, 9 of whom were not able to be present at the clinical visit and were evaluated only radiologically.

Results
At 3 months follow-up HHS showed a significant increase (from 48.3±11.3 preoperative to 91.7±8.9) and slightly improved also at 1 and 2 years follow-up (97.9±3.4; 99.0 ± 1.8).

Range of motion significantly increased at first follow-up (from 88.4°±16.3° to 122.2°±13.4 °) and reached 130° ± 14.1°at 2 years. At 2 year follow-up all patients reached a mobility higher than 120° except for one case, due to a psoas tendinopathy. All patients reported excellent and good satisfaction. It was reported there was only one case of medial wall acetabular bone fracture at 3 months, healed uneventfully taking no action. One case of bursitis and one case of psoas tendinitis, not related to the cup, were reported at 1 year. From a radiographic point of view, all implants were stable; it was reported 2 cases of slight ectopic periarticular ossification. The 2 years survival rate is 100% with aseptic loosening as endpoint.

Conclusion
The Mpact System with Mectagrip coating shows excellent results and proves to be reliable. No direct cup complications such as locking mechanism failure, late loosening, or failure to osseointegrate have been reported.

EARLY POSTOPERATIVE OUTCOMES IN DISPLACED INTRACAPSULAR PROXIMAL FEMORAL FRACTURES TREATED WITH HEMIARTHROPLASTY. A RETROSPECTIVE COMPARISON OF SURGICAL APPROACHES

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Introduction
Hip fractures are a common source of injury in the elderly and geriatric patient. Minimally invasive surgical approaches have been advocated in hemiarthroplasty to afford faster rehabilitation, decreased postoperative pain, perioperative blood loss, muscle damage and improved patient outcomes. We aim to demonstrate the benefits of Anterior Minimally Invasive Surgery (AMIS) for patients with hip fractures, particular the geriatric patient with likely medical comorbidities, requiring a hemiarthroplasty compared to the more commonly performed anterolateral and posterior approaches.

Material and Methods
From June 2009 to December 2011, 98 hemiarthroplasties were performed for treatment of displaced intracapsular femoral neck fractures: 40 cases were done via an anterior approach, 48 via an anterolateral and 10 via a posterior. Information concerning demographic, surgical approach, experience of primary operative surgeon, pre and postoperative haemoglobin levels, perioperative complications, postoperative time to walk 20 meters, thromboembolic events, transfusion and mortality were collected.

Descriptive statistics such as means, medians, standard deviations, and relative frequencies were used to describe data, and 95% confidence intervals for the means were computed. Two sided Student’s t test, Mann-Whitney U
tests, Fisher’s exact test and Pearson’s $\chi^2$ tests were also used to compare results. A $p$ value less than 0.05 indicated a significantly statistical difference.

**Results**

There was no significant difference in baseline characteristics of the three groups.

A hemiarthroplasty via an anterior minimal invasive approach produced 12.5 g/L less blood loss per case ($p<0.0001$) which also resulted in a significant decrease in transfusion rate ($p<0.0001$).

The incidence of pulmonary embolism (PE) by hemiarthroplasty through an anterior approach was significantly lower ($p < 0.03$).

The anterior approach significantly decreased the incidence of acquiring a deep venous thrombosis (DVT) ($p <0.001$).

Patients undergoing a hemiarthroplasty via an anterior approach took less time to walk 20 meters after their operation ($p <0.0001$) and had a shorter time in hospital ($p<0.0001$). There was no statistical difference in outcome parameters when comparing cases performed by registrars to that of visiting medical officers. There was no difference in mortality between the anterior (7.5%) approach group and that of the other approaches (5.2%).

**Conclusion**

Our review data strongly suggests that hip hemiarthroplasty performed by an anterior approach can reduce blood loss, reduce length of stay in hospital, decrease thromboembolic events, and expedite short term regain of mobility. These benefits may result in significant cost savings to the health system.

VERSACUP DOUBLE MOBILITY CUP:
OUTCOMES AT A MEAN FOLLOW-UP OF 5 YEARS

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2. Polyclinique du Parc de Cholet
3. Centre Hospitalier Régional Universitaire de Lille

**Introduction**

The concept of a dual mobility cup had been developed to minimize risk of dislocation after total hip replacement. Early results, with the first generation of dual mobility, had low dislocation rate (0 to 0.29%) but showed 2 causes of failure in the mid-term: early loosening and wear of the polyethylene liner. The goal of the current investigation is to confirm the efficacy of a new generation dual mobility cup (the Versacup DM, Medacta International SA, Switzerland) to prevent the occurrence of luxation and to verify the absence of loosening or early wear.

**Methods**

A consecutive series of 121 subjects who underwent primary total hip replacements with a double mobility cup between March 2003 and December 2005 was clinically and radiographically reviewed at a mean follow-up of 5 years after surgery.

Out of 121 cases, 107 have been reviewed, 11 died and 3 were lost to follow-up. Mean age at surgery was 75 years (54 to 85). Osteoarthritis was the primary diagnosis (88.8%); rheumatoid arthritis (3.7%), rapid destructive osteoarthritis (3.7%), osteonecrosis (2.8%) and femoral neck fracture (0.9%). All surgeries were performed through a posterolateral approach.

**Results**

The mean pre-operative Harris Hip Score was 49.2 ± 21.2 and the post-operative, at a mean follow-up of 5 years after surgery, was 91.9 ± 9.2.

The radiographic assessment highlighted no critical radiolucent lines around the cup and no osteolysis. No dislocation of the prosthesis or intra-prosthetic dislocation occurred. One case of acetabular and femoral component revision was necessary due to a deep infection. The survival rate for the acetabular component at 5 years is 99.2% using revision for any reason as the endpoint and 100% excluding septic failures.

**Discussion and Conclusion**

This study confirms that double mobility cup can prevent the risk of dislocation with a 0% of dislocation rate in this series. The elliptical shape of the Versacup DM, together with the presence of equatorial macrostructures and a hydroxyapatite coating, provides an excellent press-fit, a very good primary stability and optimal osteointegration. The risk of wear is reduced by the concave surface of the cup which is mirror polished without holes or pins and by the quality and thickness of the polyethylene liner.

THE MINIMAX ANATOMICAL STEM:
AN INNOVATIVE AND VERSATILE SOLUTION FOR HIP ARTHROPLASTY (CLINICAL AND RADIOLOGICAL EVALUATION AND CASES REPORT)

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**Introduction**

The MiniMAX (Medacta International SA, Switzerland) is an anatomical cementless, HA coated stem. The sagittal
double curved design and frontal curved shape with metaphyseal press fit and the thin tip, facilitates the insertion through a small incision. The metaphyseal area is designed with the best fit and fill to restore physiological loads and guarantees a good rotational stability thanks to the presence of macrostructures. The aim of the current clinical study is to evaluate the performance and the security of MiniMAX stem, coupled with Versafitcup acetabular component (Medacta International, SA Switzerland), clinically through HHS and R.O.M. and radiologically evaluating x-ray. The Kaplan Meier survival rate of the stem has been computed considering any reason and aseptic loosening as endpoint.

Material and Methods
135 patients (144 procedures) underwent a primary THA, whereas 2 patients (2 procedures) underwent revision surgery. Indications for surgery include mainly primary coxarthrosis (86.8 %), as well as particular cases, dysplastic patients or patients with undersized stem with tip effect femur requiring revision surgery 93% of surgeries were performed using an Anterior Minimally Invasive Surgery (AMIS) with the aid of the AMIS Mobile Leg Positioner (Medacta International, SA Switzerland), 1% realised using posterolateral minimal invasive technique and 6% performed through a conventional approach.

Results
At a mean follow-up of 37 months, 135 patients (144 procedures) were evaluated, 2 patients died, 1 from senectus and 1 from a tumor. Overall a great improvement in mobility was reported for all patients, and most specifically, no one reported thigh pain. An excellent improvement was shown both in R.O.M. from 84.2° to 123.8° (in primary group) and from 85° to 130° (revision group) and in HHS from 41.9 to 96.9 (primary group) and from 36 to 86.5 (revision group). From radiological analysis, all prosthesis were shown to be fixed and stable, with no signs of critical radiolucencies.

4 patients underwent revision for reasons unrelated to the implant: suspected infection 1 month after surgery (1); definitive infection occurred 1 year post-surgery (1) trauma which caused a femoral periprosthetic fracture after 1-year post-surgery (1) and ceramic insert breakage occurred 32 months post-surgery (1). The clinical result of lack of thigh pain in all examined cases confirms the choice of a specific and unique tip design optimised to guide the prosthesis insertion into the femoral canal and to avoid distal interference. An excellent 3 year-survival rate of respectively 99.3 % and 98% when considering aseptic loosening and any reason as endpoint was shown.

Conclusions
In general, the design of this prosthesis has been decisive in the results obtained, confirming the versatility of the MiniMAX stem in primary and revision surgeries when the quality of the cancellous bone is good, as well as in particular cases, such as dysplastic patients or patients with undersized subsiding painful femoral stems for stress shielding requiring revision surgery.
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*Data at December 2013