FM86  In Situ Fixation and Arthroscopic Osteochondroplasty for mild Slipped Capital Femoral Epiphysis: Can the α-angle be normalized?

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Introduction: In situ fixation of mild (epiphyseal–shaft angle <30°) slipped capital femoral epiphysis (SCFE) is a well accepted treatment method. However, the remaining retrotilt morphology represents a CAM type deformity suspected to favour early osteoarthritis by femoroacetabular impingement. Arthroscopic osteochondroplasty during in situ fixation could overcome this disadvantage with limited additional invasiveness. The aim of the present study was to test the hypothesis that α-angles could be improved to normal by arthroscopic osteochondroplasty in addition to in situ fixation. An α-angle[1] less than 55° was considered normal.

Methods: Between April 2010 and November 2011, nine patients (6 female, 3 male; range 10 – 15y; BMI 17–32 kg/m2) presented with mild SCFE (mean epiphyseal–shaft angle 26±5°) and received arthroscopic osteochondroplasty in addition to in situ fixation. Two plane x-rays and native hip MRI including radially reformatted images were available pre- and postoperatively in all patients. α-angles were measured on radially reformatted images in the anterosuperior section pre and postoperatively by two independent raters.

Results: α-angles improved from 57.6° (range 45-74°, SD 8.6) to 38.2° (range 30-51°, SD 7.1). No complications were encountered.

Conclusion: Hip arthroscopy in addition to in situ fixation can restore physiological α-angle in mild SCFE.
Introduction: Severe pincer impingement (acetabular protrusio) is an established cause of hip pain and osteoarthritis. The pain is considered to be due to an early dynamic pathological contact of the excessive acetabular rim with the femoral head-neck junction. However, according to the literature, the radiographic joint degeneration in severe pincer impingement typically occurs in the superomedial aspect of the hip sourcil, which is not explained by the femoroacetabular impingement concept. We therefore asked the following questions: (1) is there a static overload in the medial aspect of the protrusio joint? (2) Does acetabular rim trimming lead to an increased static overload in protrusio hips?

Methods: Four hip morphologies derived from patient data were analyzed using three-dimensional finite element models: normal, dysplasia, acetabular protrusio and acetabular protrusio with rim trimming. In vivo force and motion data for walking and standing to sitting were applied to calculate contact pressures, von Mises stresses and femoral head migration.

Results: In protrusio hips, we found a static overload at the medial margin of the lunate surface, which was amplified by an additional medialization of the femoral head leading to eccentric loading. The calculated von Mises stress was up to 54% higher in comparison to normal hips. Acetabular rim trimming in a protrusio hip even increased the static overload at the medial aspect of the lunate surface up to 28%. During walking, the dysplastic configuration, compared with protrusio, resulted in opposite patterns of stress and contact pressure having its peak values located at the anterolateral acetabular rim.

Conclusion: The findings substantiate the hypothesis that severe pincer impingement (protrusio) represents a unique pathology which involves a dynamic impingement problem at the lateral edge of the acetabulum, and - similar to a 'medial dysplasia' - a static overload at the medial edge of the acetabular lunate surface. Based on these findings, the curative joint-preserving treatment of this pathomorphology would consist of a reorientation of the acetabulum rather than isolated rim trimming alone.
Sports and activity levels after open treatment of femoroacetabular impingement

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Introduction: Studies involving professional and semi-professional athletes indicate that surgical treatment of symptomatic femoroacetabular impingement (FAI) is highly successful in terms of return-to-sports and satisfaction, irrespective of the surgical approach used.1-5 In contrast to these results achieved in highly selected patients, only little is known about the sports behaviour and activity levels after surgical FAI treatment of the more typical young recreational athlete.

Methods: This retrospective study included 153 patients (mean age 30 years, 40.5% females) with 192 hips treated. Sports behavior and satisfaction were determined at a mean follow-up of 59.4 months after surgical hip dislocation using a questionnaire. Activity levels were assessed by the Hip Sports Activity Scale (HSAS) and the UCLA activity scale.

Results: Of 126 patients being regularly sports-active before surgery, 107 (85%) were so at follow-up. Nineteen patients (12%) stopped participating in regular sports and eight (5%) commenced with sports after the operation. The most popular activities before surgery were skiing (22%), cycling (22%), jogging (20%) and soccer (13%). At follow-up, most patients were engaged in cycling (23%), fitness-/weight-training (20%), skiing (18%), and jogging (11%). Of all patients, 75% were satisfied with their sports ability and 60% stated that their sports ability had improved after surgery. Mean pain levels during sports were 2.1 according to the VAS. Mean HSAS (range from 0-8) and UCLA (range from 1-10) levels were 3.5 and 7.7 whereby males reported significantly higher levels than females (4.1 versus 2.7 and 8.2 versus 7.0, respectively).

Conclusion: The present data show that the vast majority of FAI patients treated by surgical hip dislocation can return to sport activities and that most patients are subjectively satisfied with their sports ability at a mid-term follow-up. Activity levels as assessed by the HSAS and the UCLA are significantly higher in male patients but this does not yield in higher satisfaction rates. Differing and overly optimistic expectations might explain this observation, indicating that sport expectations need to be comprehensively discussed and possibly adjusted to a reasonable level before surgery.

References:
FM89 Effect of CCD-angle on impingement free hip range of motion

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Introduction: Several aberrations of hip morphology can reduce hip range of motion (ROM) by femoroacetabular impingement (FAI). Among them asphericity of the head-neck junction and regional or global acetabular overcoverage are extensively discussed in the literature. Other aberrations such as valgus and varus deformities of the proximal femur are not.

The aim of the study was to explore the effect of varying centrum-collum-diaphyseal angles (CCD) on impingement free ROM.

Methods: A CAD-based 3D simulation model of the hip was installed to gradually deform the femur to create CCD-angles from 90-160°. To improve estimates of normal ROM two additional hip models based on MRI pictures of a volunteer were used. FAI was defined as bone to bone contact within physiological hip ROM defined from literature.

Results: With decreasing CCD angles of less than 110°, range of abduction and internal rotation at 90° of flexion were reduced and led to FAI. No impingement was seen with flexion and extension. With increasing CCD angles, the range of adduction and extension got reduced and resulted in FAI for adduction and extension at 135° and 145°, respectively. No impingement was seen with external rotation at 90° of flexion. Zones of impingement on the acetabular side were located at the superior rim with coxa vara and at the posteroinferior rim with coxa valga. Acetabular rim trimming could not compensate for CCD angles outside the range of 110-135° since combined movements remained impinged. Zones of impingement on the femoral side were found to be distal to the head neck junction at the mid-cervical region showing the smallest cross sectional area.

Conclusion: In the investigate model, variations of the CCD angle shows a marked influence on impingement free hip ROM. Outside CCD angles of 110-135° FAI occurs. Typical rim trimming and/or neck osteochondroplasty does not allow for adequate bony correction to solve FAI.
**Introduction:** The iliocapsularis muscle is a little known, but uniformly present muscle of the hip. It originates from the anteromedial hip capsule and anterior-inferior iliac spine. Its insertion is located just distal to the lesser trochanter. The iliocapsularis muscle has a postulated function as a hip stabilizer. In a previously MR-based study a hypertrophied iliocapsularis was found in developmental dysplasia of the hip (DDH). Therefore, we asked whether the proportions of the iliocapsularis muscle in relation to the rectus femoris muscle predict a deficient acetabular coverage (DDH)?

**Patients and Methods:** The anatomical dimensions of the iliocapsularis and rectus femoris muscle were compared between 45 hips with DDH (Group I) and 40 hips with excessive acetabular coverage (Group II). DDH (Group I) was defined as an LCE angle of less than 25° with a minimal acetabular index of 14° on anteroposterior AP pelvic radiographs. Group II with excessive acetabular coverage was defined as an LCE angle exceeding 39°. The anatomical dimensions of both muscles were evaluated in axial arthro-MRI slices at the height of the femoral head using the following parameters: thickness, width, circumference, and cross-sectional area (CSA). For all four parameters ratios were calculated comparing the iliocapsularis values with the rectus femoris values. We calculated positive and negative predictive values using receiver operating characteristic (ROC) curves for each parameter used to diagnose DDH.

**Results:** The iliocapsularis to rectus femoris ratio was increased for thickness, width, circumference, and CSA. At a one-to-one ratio all parameters had a high positive predictive value ranging from 77% to 89%. From all four parameters the highest positive predictive value had the CSA with 89% (95% confidence interval, 74 – 97%).

**Conclusion:** The anatomic dimensions of the iliocapsularis muscle in comparison to the rectus femoris muscle are associated with acetabular morphology. All parameters are indicators for DDH with the CSA having the highest positive predictive value. These results suggest that the iliocapsularis muscle is a stabilizer of the hip. Additionally, preoperative evaluation of this muscle can be used as an adjunct for decision making when treating patients with borderline DDH.
Hip Range of Motion in Everyday Life

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Introduction: To date, there is no clear consensus as to the amplitude of movement of the "normal hip". Knowing the necessary joint mobility for everyday life is also important to understand different pathologies and to better plan their treatments (correct implant positioning in total hip arthroplasty, define amount of bone resection in the treatment of femoroacetabular impingement, planning of reorientation osteotomies, etc.). To address these questions, we performed a preliminary study that aims at defining in a precise way the necessary hip joint mobility for everyday tasks based on the coupling of MR imaging and optical motion capture.

Methods: Motion capture and MRI was carried out on 4 healthy volunteers (mean age, 28 years). A morphological analysis (alpha angle, acetabular depth and version, etc.) was performed to assess any bony abnormalities. Motion from the subjects were acquired during routine activities (stand-to-sit, lie down, lace the shoes while seated, pick an object on the floor while seated or standing) known to be painful or prone to implant failure (dislocation, impingements). The hip joint kinematics was computed from the recorded markers trajectories using a validated optimized fitting algorithm which accounted for skin motion artifacts (accuracy: translational error ≈ 0.5mm, rotational error < 3°). The resulting computed motions were applied to patient-specific hip joint 3D models reconstructed from their MRI data.

The hip range of motion was quantified for each subject and for all motions, thanks to two bone coordinate systems (1 for the femur and 1 for the pelvis). Given the computed bone poses from motion capture data, hip angles were determined at each point of the motion, independently of the major anatomical planes.

Results: According to the morphological analysis, all subject’s hips were normal. For all movements, a minimum of 95° hip flexion was required (mean range 95° - 107°), lacing the shoes and lying down being the more demanding. Abduction/adduction and IR/ER remained low (± 20°) and variable across subjects.

Conclusion: As shown in this study, daily activities of a "normal hip" involve intensive hip flexion, which could explain why such motion can yield hip pain or possible implant failure. This information should be considered by orthopedists and implant manufacturers in the surgical planning and prosthesis design when restoring patient mobility and stability.
Introduction: Determining the hip range of motion (ROM) is one of the key points of its clinical examination. Unfortunately this process may lack precision since during hip movement there might be motion of other joints around the pelvis. It is also unknown if the examiner’s clinical experience plays a role. We present the results of a preliminary study that aims to assess the accuracy of the hip ROM clinical exam executed by different examiners.

Methods: 2 healthy volunteers (26 and 31 years) participated to the study. A hip clinical exam was performed successively by 2 orthopedists (2 and 12 years' experience), while the motion of the subjects was simultaneously recorded using optical motion capture. The following sequences were captured: 1) supine: maximal flexion, maximal IR/ER with hip flexed 90°, maximal abduction; 2) seated: maximal IR/ER with hip and knee flexed 90°. For all measurements, a hand held goniometer was used by clinicians to measure hip angles in those different positions.

Their results were compared to the internal hip joint kinematics computed from the recorded markers trajectories using a validated optimized fitting algorithm which accounted for skin motion artifacts (accuracy: translational error ≈ 0.5mm, rotational error < 3°). The resulting computed motions were applied to patient-specific hip joint 3D models reconstructed from their MRI data. Given the computed bone poses from motion capture data, hip angles were determined at each point of the motion independently of the major anatomical planes, thanks to two bone coordinate systems (1 for the femur and 1 for the pelvis).

Results: The error made by the clinicians varied in the range of ± 10°, except for the flexion and abduction where the error was higher (flexion: mean 9.5°, range -7° - 22°; abduction: mean 19.5°, range: 8 - 32°). No significant differences between the errors made by the two examiners were noted (mean error for each examiner: 7.4° vs. 8.4°). 3D simulations of the process revealed interesting motion trends of other joints around the hip that could explain overestimation of flexion and abduction during the exams.

Conclusion: To our knowledge this is the first study of this kind assessing the accuracy of the hip clinical exam. The results seem to indicate that the clinical exam is a precise method for determining hip passive motion, if extra care is taken to stabilize the pelvis during flexion and abduction to prevent overestimation of the ROM. The examiner’s experience was not found to be a determining factor. Further studies including more subjects are required before validating the values of hip clinical exam as a gold standard.
FM93  Validity, reproducibility and responsiveness of the Oxford Hip Score in patients with femoroacetabular impingement

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Introduction: With the gradual acceptance of femoroacetabular impingement (FAI) as a disease mechanism of the hip, the scientific interest in the syndrome has increased and it has been described more frequently in the literature. The use of patient-reported outcome measures (PROMs) in the assessment of treatment success is now commonplace. However, with the exception of the Hip Outcome Score (HOS), the hip-specific PROMs used in previous studies on FAI patients or in patients with other hip disorders have not been externally validated for use in FAI patients. One such instrument is the Oxford Hip Score (OHS). The OHS is quick and easy to complete. It was developed to assess patients with total hip arthroplasty (THA), in terms of their pain, mobility and function due to their hip problem. The aim of this study was to examine whether the psychometric properties (validity, reproducibility and responsiveness) of the OHS were acceptable enough to extend its use to patients with FAI.

Methods: 165 consecutive patients with FAI undergoing either arthroscopic surgery with labral preservation or limited anterolateral open surgery with labral resection completed the OHS and HOS before the operation. Six and 12 months postoperatively they were asked to complete the questionnaires again. 126 (76%) patients returned completed questionnaires at all three time-points. Over the same period, 613 consecutive patients undergoing THA completed the OHS at baseline, and 550 (89%), at all three time-points. At 6 and 12 months’ follow-up, the patients also rated the global treatment outcome (“how much did the operation help your hip problem?”) on a 5-point Likert-scale with responses ranging from “helped a lot” to “made things worse”.

Results: The reproducibility of OHS was good and was similar for both the THA and FAI groups (SEM of 5.6% for THA and 6.2% for FAI, and ICC 0.97 for both FAI and THA). The responsiveness (Cohen’s d) of the HOS in FAI patients was high and similar to the HOS (d from 1.32 to 1.61 for the OHS and from 0.99 to 1.64 for the HOS). The correlation coefficients between HOS subscales (activity of daily living and sport) and OHS were large (r= 0.67 to 0.85). Similarly, high correlations were found between the changes scores of the two instruments (r=0.60 to 0.76) and between changes scores and the transition question (r=0.52 to 0.59). In the FAI patients, floor and ceiling effects ranged from 0 to 7.6% for OHS and from 0 to 16.8% for HOS.

Conclusions: The OHS showed sufficiently good psychometric attributes to support its use in FAI patients. When compared with the HOS (an instrument specifically developed for FAI patients), the measurement properties were similar. In conclusion, the study showed that the OHS, although originally developed for patients undergoing THA, can also be used for assessing pain and function in FAI patients.
Oblique 'Bikini' Incision for Anterior Approach Total Hip Arthroplasty: Technique and Preliminary Results

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Background: The direct anterior approach for total hip arthroplasty uses an internervous plane without muscle detachment from bone. However, the classic longitudinal skin incision does not follow the anatomic skin creases and can result in scar widening and subjective discomfort. We therefore modified our incision technique to a short oblique skin incision following the anatomic skin crease of the groin.

Purposes: We sought to determine whether (1) the oblique incision leads to improved subjective and objective scar results compared with the longitudinal incision, (2) functional and pain scores are similar between the two approaches, and (3) the new incision is safe with respect to complications, blood loss, implant position, and lateral femoral cutaneous nerve (LFCN) symptoms.

Methods: Fifty-nine patients underwent total hip arthroplasty using either the classic (n = 33) or the new oblique incision (n = 26). At six months after surgery, we compared objective and subjective scar results, WOMAC, Oxford Hip and UCLA scores, blood loss during operation, cup inclination, and the presence of LFCN symptoms between both groups.

Results: Objectively, the modified incision resulted in significantly shorter and narrower scars. Subjectively, patients in the modified incision group were substantially more satisfied with the aesthetic appearance. Functional and pain scores did not differ between the groups. No complications occurred in either group. Blood loss and cup inclination were similar. There were no differences in the presence of LFCN symptoms.

Conclusions: In this preliminary series, the ‘bikini’ incision for an anterior approach THA led to improved scar cosmesis and was found to be safe in terms of blood loss, appropriate component placement, and risk for LFCN injury.
Limitations of the Vastus Lateralis Muscle as a Substitute for Lost Abductor Muscle Function: A cadaver study

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Introduction: The vastus lateralis muscle (VL) is widely used as a muscle flap in plastic surgery. The VL was first described as a functional flap for the treatment of hip abductor discontinuity in 2004. The transfer of the VL is difficult because it is innervated in a two-fold manner with shorter proximal and longer distal nerve branches. When seeking to determine whether, and to what extent, the VL can be transferred, the short nerve branches are the limiting factor. The aim of the present study was to investigate the innervation of the VL and adjacent muscles with special emphasis on the proximal shift of the VL.

Methods: Twelve cadaveric hemipelvises with legs from eight specimens were investigated. All nerve branches to the VL and vastus intermedius (VI) were carefully dissected. The length of all nerve branches and the angles of the proximal nerve branches to the VL, in relation to the longitudinal axis of the femur, were measured. The nerves were then traced intramuscularly in their distal course, and their dividing pattern was studied.

Results: The shortest proximal branches, which were two to four in number, had a mean length of 3.6 cm (range, 1.9 to 5.0cm). The short muscle branches to the VL coursed at a mean angle of 50.1 degrees (range, 30 to 70 degrees) in an anteroposterior (AP) direction and at a mean angle of 47.9 degrees (range, 35 to 65 degrees) in a mediolateral (ML) direction. Based on this data, the potential proximal shift of the VL was calculated: 4.6 cm (range, 2.1 to 6.9cm) in the AP- and 4.7cm (range 1.3 to 7.5cm) in the ML-direction. The length of the distal nerve branches were, on average, 11.3 cm (range, 7.8 to 16.1 cm). The short muscle branches to the VL ramified before they entered the muscle and side twigs supplied various portions of the VL and VI. Nerve branches that primarily supplied the VL ran as terminal branches to lateral portions of the VI and vice versa.

Conclusion: When harvesting and shifting the VL as a functional flap, one must protect its innervation. This is not possible. Firstly, the VL shift inevitably damages side branches to the VL and the VI. The same is true for nerve branches in the deeper aspect, running crosswise between the VL and the VI. Secondly, direct muscle branches to proximal portions of the VL are too short to allow a significant shift.
FM96  Intraoperative monitoring of periacetabular osteotomy using 3-D custom made cutting and repositioning guides: a cadaver study.

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Introduction: The goal of periacetabular osteotomy (PAO) is to reorient the acetabulum in a more physiological position. Its realization is challenging because 1) osteotomy planes should keep the pelvic ring intact while staying extra-articular and 2) the final position of the acetabular fragment lies within a narrow three-dimensional range. Assistance with custom cutting- and reorientation-guides would thus be very helpful and save intraoperative x-ray time. Our purpose is to present a pilot study on such guides.

Methods: 8 cadaveric (6 female and 2 male) hemipelvis, (mean age 85,25 years, range 56-100) were scanned using Siemens CT with voxel size 0.65*0.65*1.25 mm. After segmentation of the images using Mimics® software, 3D models of each specimen were created. A PAO was virtually performed on the 3D models and reorientation of the acetabulum was defined. Using 3-matic® software, an anatomy-specific guide was designed aimed to assist in iliac, posterior column and superior pubic ramus cuts as well as in acetabulum reorientation. Also position and length of fixation screws were planned. Regarding guidance and fixation of reposition 2 concepts of custom made guides were developed. Concept 1 was tested on 6 cadavers and concept 2 on two cadavers Laser-sintered guides were used to perform PAO on respective specimens. PAO was performed using original instruments by two surgeons (one experienced, one novice). CT images were acquired postoperatively. Preoperative, postoperative and virtually planned acetabulum reorientation were compared.

Results: Application of the guides through the standard modified Smith Peterson approach and performance of the osteotomies, reorientation and fixation went uneventfully. Two cadavers showed very low bone quality with insufficient stability of fixation and were excluded from further analysis. The postoperative analyses showed that the cutting planes were completely extra-articular and the posterior column intact in all 8 specimens. Correlation between planning and postoperative result in terms of the acetabular index (AC), centre edge angle (CE), acetabular anteverision angle (AcetAV) and the position of centre of rotation (COR) revealed following differences:

COR preoperatively compared to postoperatively showed a deviation of 7,20 mm (stdev 1,86mm) on all performed PAOs (n=6). Deviation of COR of concept 1 (n=4) showed 7,82mm (stdev=2,04). Deviation of COR concept 2 (n=2) showed 5,96mm (stdev=0,49).

Both concepts (n=6) showed differences from of the CE angle of 5,78° (stdev 4,04°), AC angle of 5.11° (stdev 3,27°), AcetAV angle of 14.98° (stdev 11,09°).

Concept 1 (n=4) showed differences from of the CE angle of 4,61° (stdev 4,49°), AC angle of 3,98° (stdev 3,56°), AcetAV angle of 13,61° (stdev 9,66°).
Concept 2 (n=2) showed differences from of the CE angle of 8.13° (stdev 2.16°), AC angle of 7.38° (stdev 0.36°), AcetAV angle of 17.72° (stdev 17.66°).

**Conclusion:** The use of 3D guides was possible through a standard approach without extension and revealed reliable fit of the guides to bone, reliable positioning of the osteotomies and planned corrections.
FM97 Positioning of sacroiliac screws using an intraoperative 3D CT (O-Arm©) guided navigation in posterior pelvic ring fractures

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Objective: Sacro-iliac (SI) screw fixation for sacroiliac joint disruption and fractures of the sacrum is an accepted method of treatment. Aberrant screw or wire placement can lead to significant complications, including injury to the fifth lumbar nerve root, sacral venous plexus, iliac vessels, or cauda equina. Incorrect positioning of the SI-screws has been reported in up to 16% and in 7% this lead to neurovascular complications. In order to avoid such complications some authors suggest an intraoperative 3D CT guided navigation for screw positioning. We report our experience in the use of an intraoperative 3D CT guided navigation for the positioning of SI screws using the mobile O-Arm scanner.

Methods: From August 2008 to December 2012, we performed 23 O-Arm® navigated SI-transfixations in 20 patients. Indications were unstable posterior ring fractures and painful SI-joint disruption. The operations were performed either in a prone position, when solely a dorsal fixation was performed, or supine, when associated with anterior pelvic ring stabilization. The reference pin was positioned for navigation purpose. A first O-Arm scan of the pelvis was performed for planning. Using this scan, 1 or 2 percutaneous 6 to 8 mm diameter screws were inserted using the Medtronic® navigation system. A final scan was then performed for screw position control.

Results: 16 patients were male, 4 were female. Median age was 45.5 (18;84). 3 patients were operated bilaterally, 7 underwent an exclusive SI-transfixation. 13 also had an anterior pelvic ring or acetabulum osteosynthesis. 6 were SI joint disruptions, 16 were sacrum fractures and 1 was combined. The second intraoperative control scan showed that all screws were correctly positioned. The patients showed no intraoperative or postoperative complications.

Discussion: In our experience, navigation guided SI screw positioning using the O-Arm scanner is a safe method, that enables correct screw placement and a low radiation dose for the operator. The advantages of the O-Arm compared to other devices are its mobility that allows intraoperative use and the image quality, which is comparable to standard CT-scan. Advantages of a mobile CT imaging combined with navigation inside the OR are lack of radiation for the surgeon and the staff, the lack of patient transport and the precision and reproducibility of the screw positioning. The downside is the high acquisition cost.
**FM98  Mid-term outcome following fixation of anterior pelvic ring injuries using the modified Stoppa approach.**

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**Introduction:** The modified Stoppa approach was introduced for less invasive open reduction and internal fixation of anterior pelvic ring injuries. The aim was to describe the outcome with focus on the elderly after treatment of pelvic ring injuries using this approach.

**Methods:** A consecutive series of 46 patients (50 yrs, 19-79; 27/46 C-type fractures) treated operatively using the modified Stoppa approach between 07/2004 and 08/2011 was assessed in accordance to age (group A: “<60yrs” (n=33), group B: “≥60yrs” (n=13)). Surgical data, accuracy of reduction according to the Rommens criteria and at a mean follow up of 33 months (12-95) the need for revision, union rates, the functional outcome using the Majeed Scoring and Oswestry Disability Questionnaire and the occurrence of chronic pelvic pain by the Mainz Pain Staging System were assessed.

**Results:** In most cases (43 of 46, 94%) anatomic or nearly anatomic reduction was achieved. All fractures consolidated. In 3 of 46 (7%) patients intraoperative complications were noted, in 4 of 46 (9%) patients revision surgery was necessary due to failure at the anterior pelvic ring. The majority of patients presented with an “excellent” or “good” functional result (35 of 46, 76%) according to the Majeed Score and suffered from no or minor chronic pelvic pain (35 of 46, 76%). The mean rated level of impairment was 18% (0-54%) using the Oswestry Disability Questionnaire. No statistical significant differences were noted between frequencies or mean values in both age groups in any tested item.

**Conclusion:** The modified Stoppa approach provided adequate exposure for reduction and fixation of pelvic ring injuries. No differences in morbidity or the outcome related to age were observed so that surgical treatment with open reduction and internal fixation of the anterior pelvic ring in type B- and C- pelvic ring injuries is an adequate technique even in the elderly.
FM99 Short-term outcome after management of acetabular fractures using the Pararectus approach.

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Introduction: The Pararectus approach was introduced previously as a new anterior intrapelvic approach for treatment of displaced acetabular fractures. The aim was to present the short-term outcome data after its clinical implementation.

Patients: A consecutive series of 20 patients (mean age 59 years, range: 17-90; 17 male) with displaced acetabular fractures involving predominantly the anterior column and the quadrilateral plate was treated between 12/2009 and 12/2010 using the Pararectus approach. Initially, the accuracy of reduction using CT scans and the occurrence of intraoperative complications were assessed. Enrolled in a prospective evaluation protocol, patients were evaluated 12 and 24 months postoperatively. Clinically, the Harris Hip Score, the Western Ontario McMasters (WOMAC) Score and the Merle d’Aubigné and Postel grading adapted by Matta were used. Radiographically, conventional radiographs were analyzed for occurrence of osteoarthritis (OA), heterotopic ossifications (HO) or avascular femoral head necrosis (AVN) according to Tönnis-, Brooker- and Ficat classifications respectively. Failures were defined as total hip arthroplasty, a Merle d’Aubigné score of less than 14 points, a Harris Hip Score of less than 70 points, and/or a radiographic progression of osteoarthritis (Tönnis grade 2 or 3). The clinical and radiographic outcome was rated according to Matta.

Results: Initially, the reduction was noted to be “anatomical” in 19 and “imperfect” in one patient. Minor lesions to the peritoneum were noted in two patients, minor vascular damage in a further two. All surgeries were finished uneventfully and fractures healed in all patients. During follow up, three patients were lost to follow up (two patients died eleven and 19 months after surgery, one patient was discharged overseas and lost), further three patients refused consultation 24 months postoperatively as they were doing well (two patients suffering from dementia and one elderly patient). Two patients had to be excluded from further evaluation as they required a total joint replacement four and 18 months, respectively, after the index procedure. In the further 12 patients, no failures were observed, the clinical outcome was rated according to Matta as “excellent” or “good” in seven and five patients, respectively whereas the radiographic outcome showed “excellent” results in ten cases, “good” or “fair” results in one patient in each case two years after surgery.

Conclusion: In the treatment of complex acetabular fractures in patients the Pararectus approach allowed for anatomic restoration with minimal access morbidity and provided promising outcome at the short-term. At our department in Pararectus approach has become the standard approach in the presented fracture patterns.
One stage revision of infected hip arthroplasty with and without cement

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Introduction: According to a treatment algorithm (N Engl J Med 2004;351:1645-54) well selected patients with infected hip replacement qualify for one-stage revision. Eradication of infection is achieved by implant exchange and antibiotica administration without additional local antibiotics, thus permitting fixation without antibiotic loaded cement. The outcome of our one-stage revisions is presented.

Methods: After joint aspiration and identification of the microorganisms all patients qualifying for one-stage-exchange were included. Thorough debridement and cemented or uncemented reimplantations were performed according to the preference of the surgeon. In case of cementation Palacos® R+G was used. At least 3 additional intraoperative biopsies for bacteriological and histological analyses were sampled. Antibiotic treatment was administered intravenously for two weeks, followed by oral therapy for a total duration of 3 months. Patients had a standardized clinical and radiological follow-up.

Results: Between 1996 and 2011, 40 patients (41hips) were treated with a one-stage procedure. In 26 cases an uncemented revision stem (Wagner or Revitan, both Zimmer®) was implanted and 38 cases received an acetabular ring (Müller or Burch Schneider). Coagulase-negative staphylococci were the most frequent pathogens (44%), followed by S. aureus (22%), streptococci (19%), and gram-negatives (10%). Polymicrobial infection was present in 4 cases. Mean follow-up was 4.7 (2.3 to 15.2) years. Three patients had died before 2 years follow-up, not related to treatment. No patient had persistence of infection or reinfection. However, there were 4 revisions for aseptic loosening of cemented stems. The mean HHS was 81 (26 to 99) at final follow-up.

Discussion: One-stage revision of established hip infection has an excellent clinical and microbiological success rate even in fixation without antibiotica-loaded cement. A careful selection of suitable patients according to well-defined criteria and a three-month treatment with appropriate antibiotics that are active against biofilm are a prerequisite for this strategy. For correct treatment stratification an interdisciplinary approach including orthopedic surgeons and infectious diseases specialists is necessary.
FM101  Radiological short term results after total hip arthroplasty using the Fitmore ® hip stem

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Introduction: The purpose of this retrospective multicenter case series was to evaluate the radiological outcome after implantation of the uncemented Fitmore® Hip Stem (Zimmer GmbH, Switzerland)

Methods: From April 2007 to December 2008, the first 145 consecutive patients (m:f =1:1.23; median age 57.4 yrs, range 21–87 yrs) treated with the Fitmore ® hip stem as part of a total hip arthroplasty (THA) were included in this study. The indication for the THA was mostly primary degenerative arthritis (n=99), dysplasia (n=17), but included other indications (n=20). The typical approach used was the antero-lateral (n=125).

Clinical and radiological controls took place postoperatively, after 6 weeks, 12 months and 24 months.

Changes to the primary position of the stem including varus/valgus as well as subsidence were measured. Furthermore, changes in the femoral bone including cortical resorption and hypertrophy, cancellous condensation or radiolucencies and signs of oscillation in the interface between stem and surrounding bone adapted to the Gruen zones were evaluated.

Results: In the first 6 weeks an increase of 0.5° to a varus position of 3.1° was detectable. An average stem subsidence of 2.4mm after 1 year with no changes in the following year is not significant.

After 1 year, 35% of all patients show some calcar resorption proximal medial on the averted side of the prosthesis (no significant changes at the direct stem-bone-interface) and 59% show cortical hypertrophy at the level of the stem tip, mostly at the lateral side. A radiolucent line was present in 16% at the greater trochanter and in 14% at the tip.

After 2 years, bony adaptation in the calcar region can be seen in 44%. Cortical hypertrophy in the distal part of the stem is visible in 64%, but also a significant decrease of stem oscillation signs (6% at the greater trochanter; 10% at the tip) is notable.

Conclusion: The Fitmore ® hip stem shows in the first 2 years a stable position in the proximal femur with a non significant subsidence of 2.4 mm and a non significant increase of varus of 0.5°. Between 1 and 2 years no further changes in position are measurable.

The changes in bony appearance will be discussed.
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FM102 No regeneration potential of the human acetabular labrum after resection

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Introduction: In a previous animal model for hip joint arthritis, regeneration of the acetabular labrum was observed after resection of the antero-superior segment, without development of secondary degenerative joint disease (DJD)¹. The biological response of the human hip joint following labrum resection is unknown. Using MRI investigations this study determined whether labral regeneration following extensive resection in humans takes place.

Methods: In a consecutive series of 800 patients operated for FAI by surgical dislocation by the senior author, 13 had undergone acetabular labral resection over an arc of at least 60° (antero-superior) due to the presence of an irreparable lesion. Nine patients (three women) were available for evaluation at an average of 3.9 ± 1.2 years following surgery. The mean age at surgery was 37.8 ± 8.8 years, the mean BMI was 25.2 ± 2.4kg/m². One patient had a previous hip arthroscopy with partial labral resection. After informed consent all patients had a structured interview, an examination of the involved hip and a contrast-MRI including radial reconstructions. Extension and location of the labral lesions were recorded on a clock face from surgical records. The MRA appearance of the site of resection was then evaluated by three independent reviewers and a consensus reading was obtained. The modified Harris Hip Score (HHS), the UCLA score, the Hip Outcome Score (HOS-ADL: Activities of daily living; HOS-Sport) and the SF-12 were recorded.

Results: All but one patient were asymptomatic and none had any revision surgery or had sought further treatment prior to this evaluation. Two patients were very satisfied, 3 satisfied, 2 neither nor, 1 was dissatisfied, and 1 very dissatisfied. Surgery met the expectation in 7 patients and 6 of them would redo surgery. While looking at the site of resection, MRA did not show the presence of a structured, triangular shaped regenerate with the same signal intensity as a normal labrum. Overall, the mean HHS was 82.6 ± 14.2. The mean UCLA score was 6.0 ± 2.1. The mean HOS-ADL was 83.6 ± 15.1 and HOS-Sport was 61.2 ± 31.4. The mean SF-12 PCS was 40.1 ± 11.4 and the SF12 MCS 50.5 ± 9.0.

Conclusion: According to this series, the defect created by resection during surgery was not filled by any structured, triangular shaped tissue and hence the presence of acetabular labrum regeneration in humans seems not to be likely.

Wide acetabular labrum resection oes not seem to be a viable alternative to labral reconstruction when the lesion is too important to be repaired.