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FM 1

The Ligamentum Capitis Femoris – An Arthroscopic Evaluation of Function in Situ

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Introduction: Reviewing the literature there's evidence that lesons of the ligamentum capitis femoris (LCF) can have quite a pathologic value. By now the arthroscopically performed reduction, resection or trimming of ruptured or injured ligaments that cause impingement are state of the art. Latest examinations of the ligament found similarities to the ACL, whereas one can separate three different bundles in the LCF compared to two in the ACL. These findings lead to the question whether reconstructions of the LCF are worth to be considered. As there's nothing known about the definite function of the LCF in adults we performed this study to gain more information about this topic.
Material and Methods: Cadaver hips were prepared down to joint capsule and bone. Parts of the lamina quadrangularis were removed by means either of hammer and chisel or high speed cutters to open the fossa from the plevic side. 30° and 70° angled optics were used to examine the performance of the LCF during different movements of the joint.
Results: Every different form of appearance of the LCF described in the literature (ovaloid, flat, round, ...) could be found during different movements of the hip joint.We couldn't separate three different bundles, we could proof a "continuous recruitment of fibres" when taking different positions; in nearly every movement of the joint parts of the LCF get tightened. As already known the LCF gets the highest tension in flexion-adduction-external rotation and in extension-abduction-external rotation of the hip. The most unstressening position for the LCF is in 0° rotation (extension or flexion), whereas every kind of rotation (internal or external) tightens different sections of the LCF. The more the rotation gets, the more fibres get recruited.
Summary: The described technique of examining the LCF offers the opportunity to see and evaluate the actions of the LCF during the full range of motion of the hip joint respectively the tensioning of fibres in different positions. Reviewing the literature it's one of the first examinations of the LCF performed in situ.The LCF gets tensioned in every form of rotation, independent of the flexion-extension-position. In flexion-adduction-internal rotation (impingement-position) the posterior fibres are strongly tensioned. The other positions show tensioning of different fibres depending on the motion. This supports the theory of the mechanic stabilising effect of the LCF in hip joints.

FM 2

Hip arthroscopy for treatment of femoroacetabular impingement. Is outcome comparable to open surgery?

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Introduction: Femoroacetabular impingement (FAI) is a risk factor for the development of osteoarthrosis of the hip. Surgical hip dislocation remains the gold standard in treatment of FAI, but because of surgical progress in hip arthroscopy this treatment becomes more popular. Difficulty of this technique is restricted intraarticular view with possible over- or undercorrection of the femoral head neck junction. To compare the two techniques we retrospectively reviewed the results of a consecutive cohort of patients treated with surgical hip dislocation or hip arthroscopy for symptomatic FAI.
Methods: Between 2006–2009 all patients treated for symptomatic FAI were reviewed and divided into group 1 (hip arthroscopy, n = 66), and group 2 (surgical hip dislocation, n = 132). These two groups were analyzed for clinical outcome (Harris Hip Score) and radiological results.
Results: Both groups showed a significant improvement of the angle alpha from preoperative 59° to postoperative 48° in group 1, and preoperative 75° to postoperative 45° in group 2 (p <0.0001). No statistical significance was seen in clinical outcome concerning Harris Hip Score between both groups. Both groups reached excellent results in 73%. In group 2 hard metal removal was necessary in 34 out of 132 cases (25%) after a mean of 12 months (3–55 months) and postoperative adhesiolysis in 16 out of 132 patients (12%) after a mean of 16 months (5–55 months). Group 1 had postoperative adhesions in 4 patients out of 66 (6%), after a mean of 8.3 months (4–25 months).
Conclusion: Sufficient osseous correction and good functional outcome of cam type FAI can be achieved by hip arthroscopy with comparable results to surgical hip dislocation.

FM 3

HIP ARTHROSCOPY VERSUS SURGICAL HIP DISLOCATION FOR FEMOROACETABULAR IMPINGEMENT (FAI): RESULTS OF A PROSPECTIVE COMPARATIVE STUDY

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Background: Surgical treatment of femoroacetabular impingement (FAI) is either performed by surgical hip dislocation (SHD) or by arthroscopy (HAS). There are no comparative studies assessing the quality of morphological correction, rehabilitation time, morbidity or short-term outcome. The aim of the present study was to compare radiological and clinical outcome after SHD and HAS.
Methods: Between 2007 and 2009, 38 patients (23 HAS, 15 SHD) were included in a prospective, partially randomized study with standardized follow-up examination at 6 weeks, 3 and 12 months. The amount of acetabular and femoral bony resection was measured on X-rays and on radial reformations of MRT (7 sectors within the anterosuperior quadrant) by assessment of the angle a, the crossover sign and the acetabular coverage angle. To compare the clinical outcome, the Harris Hip (HHS) and WOMAC score as well as pain (VAS), the subjective hip value (SHV), and the period of incapacity to work were assessed. In addition, the amount of internal rotation and abduction strength was measured.
Results: The mean age was 28 years (range 18–46). Neither the extent of preoperative bony deformity nor the demographic data (age, gender, BMI, profession) differed between the groups. The postoperative measurements on MRT and on cross-table views were equivalent. The length of hospital stay was shorter after HAS (3 vs 5 days, p <.001). The HHS was higher after HAS at 6 weeks (81 vs 55, p <.001), 3 months (92 vs 80, p = .038) and 12 months (93 vs 84, p = .030). Likewise, the WOMAC score after 3 months (0.9 vs 2.3, p = .024) and the subscale for pain after 12 months (0.8 vs 2.2, p = .010) was higher. Following HAS, patients had less pain during activities of daily living after 3 months (13 vs 25, p = .038). SHV was higher after HAS at 6 weeks (71% vs 47%, p <.001) and 3 months (83% vs 69%, p = .018) while abduction was stronger after 3 (p <.001) and 12 months (p = .042). There were no differences in terms of internal rotation after 3 (p = .347) and 12 months (p=.120). Compared to SHD, the amount of cumulated days of incapacity to work was insignificantly lower after HAS (77 vs 101, p=.120). After SHD, hardware removal was performed in 7 and arthroscopic adhesiolysis in 2 cases. There was 1 lesion of the lateral femoral cutaneous nerve following HAS.
Conclusions: When compared to surgical hip dislocation, hip arthroscopy for FAI results in equivalent bony correction, faster recovery, less morbidity and superior short-term outcome.

FM 4

Hip arthroscopy for femoroacetabular impingement: subjective short-term outcome and complications in collective of 281 patients

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Introduction: Arthroscopic treatment of femoroacetabular impingement (FAI) becomes increasingly popular. Whereas the claimed effect on reduced progression of osteoarthritis methodically remains difficult to detect, we wondered about the subjective benefit for the patient in terms of pain relieve and functional improvement and complications.
Methods: Between 01/2006 and 07/2009 326 hip arthroscopies in 326 patients were performed. Excluded were 45 patients because of indications other than FAI (septic coxitis: 3, residual pain after other hip surgeries: 22, diagnostic: 20). According to preoperative MRT with arthrocontrast and x-ray examination, the remaining 281 patients were allocated to either a palliative group (Tönnis ≥1 and extended cartilage damage), or a curative group (FAI with limited cartilage damage). WOMAC, subjective hip value and self estimated benefit in percents were used as outcome measure after a minimum follow-up of 1 year (mean: 22, range: 12–54 month).
Results: Overall, 25 patients (9%) claimed relevant residual pain resulting in re-arthroscopy (8), periacetabulär osteotomy (1), surgical hip dislocation (1) and total hip replacement (17) after a mean postoperative time of 9 months. When compared to the palliative group, hip arthroscopy in curative intention was performed in significant younger patients (29y versus 42y, p <0.001) and resulted in significant better WOMAC scores (1.28 versus 2.27, p <0.001), a significantly higher subjective hip values (77% versus 71%) and estimated benefit (77% versus 72%). Eighty-six per cent (versus 80%) would undergo hip arthroscopy again in the same situation. Beside cartilage damage, age was identified as an additional factor that significantly correlated with a lower Womac score (Spearman's rho 0.352, p <0.01). In 3% of the cases transient hypoaesthesia of the lateral cutaneuous femoral (3), genitofemoral (3) and saphenous (2) nerve was seen. Two deep vein thrombosis (0.1%) and five insufficiency neck fractures (2%) were encountered. The later healed uneventfully without surgery.

Conclusion: A relevant (>70%) improvement of clinical symptoms can be expected in at least 80% of cases. Extended cartilage damage especially in the older patient should lower expectations.

FM 5

Hip joint capsule – Normal values and implications for hip arthroscopy

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Purpose: Goal of this study was to determine the normal values for thickness of the hip joint capsule, the location of distal capsular insertion and the presence and extent of the recess between labrum and capsule. This is important to assess the possible clinical impact of postoperative changes like thickening of the capsule or the formation of adhesions between labrum and capsule and as guidance for optimal portal placement in hip arthroscopy.
Methods: 30 patients with clinical symptoms of femoro-acetabular impingement (FAI) who underwent MR arthrography prior to open or arthroscopic hip surgery were included in this study. Measurements of the hip joint capsule were taken on radial MRI slices along the femoral neck.
Results: According to our measurements, the thickest part of the joint capsule is antero-superior between 12 and 3 o'clock (4.2–6.2 mm). The longest distance from the femoral head/neck junction to the femoral insertion of the capsule is on the superior part between 9 and 3 o'clock (17.9–25.4 mm). If a capsular recess is present, its biggest depth is found on the inferior part between 3 and 9 o'clock where it ranges from 63 to 93% relative to the labrum.
Conclusions: The results presented in this study can be helpful for planning the portal placement in hip arthroscopy.
Level of evidence: Level II, diagnostic study.

FM 6

Topographical Cartilage Thickness Variation in Patients with Femoroacetabular Impingement

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Femoroacetabular impingement (FAI) is a pathologic condition of the hip that leads to osteoarthrosis (OA). The surgical hip dislocation for the treatment of FAI offers full access to the hip joint and the opportunity to measure cartilage thickness in-vivo. We investigated the topographical cartilage thickness variation in patients with FAI and early stage OA using an ultrasonic probe during surgical hip dislocation. We performed a prospective case-series of 42 patients (45 hips) that underwent surgical hip dislocation. The mean age at operation was 30.6 (18–48) years. Indication for surgery was symptomatic FAI with 4 hips (9%) with pincer type, 8 hips (18%) with cam type, and 33 hips (73%) with mixed-type of FAI. Cartilage thickness was measured intraoperatively using an A-mode 22 MHz ultrasonic probe at 8 locations on the acetabular cartilage. The maximum in cartilage thickness was found in the weight bearing zone (range 2.8–3.5 mm), whereas the minimum was found in the posterior acetabular horn (1.0–2.2 mm). In all hips, cartilage thickness was increased on the outer rim of the lunate surface compared to the inner rim. In the anterior and posterior acetabular horn, the anterior area, and the superior area (inner rim of the lunate surface) a significantly decreased cartilage thickness in pincer-type compared to cam type of FAI was found ($p < 0.05$). Hips with FAI show specific damage patterns with pincer type of FAI having generally thinner cartilage than cam type FAI. This is the first study measuring in vivo cartilage thickness in the human hip.

FM 7

Vastus lateralis advancement for irreparable hip abductor tears – Clinical and radiological outcome

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Introduction: Degenerative and postoperative hip abductor tears can be associated with intractable pain and dysfunction and may therefore be reconstructed. The presence of large defects may compromise direct repair in some cases and ask for alternative techniques such as tendon allograft reconstructions or vastus lateralis advancement. Having occasionally used vastus lateralis advancement in the past we wanted to document patient's benefit and possible donor site morbidities after this procedure.
Methods: Eleven consecutive patients underwent proximal advancement of the vastus lateralis muscle during the past 5 years. All presented with abductor muscle weakness, intractable trochanteric pain and MRI confirmed hip abductor discontinuity, which intra-operatively revealed unsuitable for direct repair. After a mean follow-up of 33 months, patient's benefit was evaluated using standardized questions, the WOMAC score, the Harris Hip Score and hip abductor strength measurements. Integrity of the reconstruction was evaluated by MRI. Possible donor site morbidity was evaluated in terms of quadriceps muscle strength and extension lag as well as MRI of the quadriceps muscle compared to the opposite side.
Results: Two patients died for reasons not related to the surgical procedure, leaving 9 patients for evaluation. Overall, six patients relevantly improved, one was indifferent and two unsatisfied. The use of pain killers diminished from regular use in 7 of 9 patients to 2 of 9 patients. In terms of use of crutches, gait relevantly improved in 4 and remained similar in 5 patients. The mean HHS and WOMAC improved and averaged 59 and 2.6, respectively. Hip abductor strength improved to M4 in 8 and M5 in 1 patient. On MRI reconstruction was successful in 8 of 9 cases. Compared to the opposite side quadriceps muscle strength and knee range of motion were the same and none of the patients had an extension lag of the knee. MRI evaluation of the quadriceps muscle showed similar Goutallier grades on both sides.
Conclusions: Proximal advancement of the vastus lateralis muscle has no detectable donor site morbidity. Overall, relevant improvement can be expected for the majority of patients and mainly affects pain reduction. Nevertheless, especially in terms of gait performance relevant deficits remain.

FM 8

Acetabular Retroversion as a Contributing Factor for Posterior Traumatic Hip Dislocation

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Traumatic hip dislocation is a rare injury in orthopaedic practice and typically occures in high energy trauma. The goal of this study was to analyze the hip morphology in patients with low energy traumatic hip dislocations and to compare it with a group hips with a normal morphology. We performed a retrospective comparative study. The study group included 45 patients with 45 traumatic posterior hip dislocation. The mean age at trauma was 34 ± 15 years (range, 11–68 years) and included 42% of male patients. A low energy trauma was defined as a traumatic hip dislocation without a fracture or with a simple acetabular rim- or head fracture (Pipkin I and II). Traumatic dislocations combined with other acetabular or femoral fractures were excluded. This resulted in 20 dislocations (44%) without a fracture, 14 (31%) with a acetabular rim fracture, 8 (18%) with Pipkin I or II fracture, and 5 (11%) with a combined acetabular rim and femoral head fracture. The control group consisted of 90 patients (180 hips) that underwent radiographic examination for urogenital indication and had no history of hip pain. Hip morphology was assessed on antero-posterior pelvic and axial hip radiographs and parameters describing acetabular coverage and orientation were computed using commercially available software called Hip[2] Norm. The study group showed significantly increased incidence of positive cross-over sign (82% vs. 27%; $p < 0.001$) with a increased retroversion index (26 ± 17 [0–56] vs. 6 ± 12 [0–53]; $p < 0.001$), positive ischial spine sign (70% vs. 34%; $p = 0 < 0.001$), positive posterior wall sign (79% vs. 21; $p < 0.001$), decreased posterior acetabular coverage (41 ± 10 [17–67] vs. 47 ± 9 [22–71]; $p < 0.001$), and decreased caudocranial coverage (77 ± 12 [42–96] vs. 83 ± 7 [64–100]; $p = 0.01$). Hips that underwent a low energy posterior traumatic hip dislocation show significanly more radiographic sign for acetabular retroversion compared to a control group. Therefore, acetabular retroversion seems to be a contributing factor for posterior traumatic hip dislocation.

FM 9

Minimum 5-Year Results of Joint-Preserving Surgery after Perthes Disease

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The goal of joint preserving surgery in patients after Legg-Calvé-Perthes disease (LCPD) is to improve hip pain and motion and to delay secondary osteoarthritis. The operative treatment at our institution includes Periacetabular Osteotomy (PAO) to correct femoral coverage as well as surgical hip dislocation (SHD). SHD allows to correct a potential asphericity of the femoral head and to achieve relative lengthening of the femoral neck (RLFN), distalization of the greater or lesser trochanter and/or head reduction plasties. We present the minimum 5-year results of a series of adolescents and adults after Perthes disease that underwent surgery. We asked (1) what is the minimum 5-year survivorship, (2) what is the clinical and radiographic outcome and (3) are there any factors predicting poor outcome.
We performed a retrospective case control study of 53 consecutive patients (53 hips) between 1997 and 2005 with painful hip motion after

previous LCPD. The mean age at surgery was 21 ± 10.1 (7–47) years and the mean follow up was 8 ± 2.1 (5–13) years. In 82% hip deformity was ≥3 according to Stulberg. Six patients underwent PAO, five patients combined PAO and SHD and 42 patients SHD. All patients were evaluated following a recently developed algorithm for functional analyses assessing surgical treatment options. Survivorship analysis according to Kaplan-Meier were performed with the endpoint set as total hip arthroplasty (THA), a Merle d'Aubigné score (MdA) ≤14 or progression of osteoarthritis. Demographic, preoperative and surgery related factors were analyzed using the Cox regression analysis to detect predictive factors for poor outcome. At 5-year follow up, the cumulative survivorship was 90% (95%-CI, 85-94). Zero hips were converted to THA, four hips had a progression of osteoarthritis and two presented with a MdA ≤14. The mean MdA improved from (p <0.001). The prevalence of a positive impingement test and a positive Trendelenburg sign reduced (p <0.001). Abductor strength improved significantly. Age at operation, preoperatively progressed osteoarthritis, and the degree of preoperative hip deformity were significant predictors for poor outcome. Joint preserving surgery in patients with hip deformity after LCPD provides an effective treatment option to prevent or delay the progression of osteoarthritis and to improve pain and hip dysfunction. A good long term result depends on the preoperative cartilage condition and the degree of hip deformity.

FM10

Five-year results of surgical hip dislocation for the treatment of femoroacetabular impingement

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Background/Aim: This study aimed to determine the results of surgical hip dislocation for the treatment of femoroacetabular impingement (FAI) in a large patient series at a mid-term follow-up.
Methods: We conducted a retrospective study including 185 consecutive patients (233 hips, mean age 30 years, 40% females) who underwent surgical hip dislocation for the treatment of FAI. The mean follow-up was 61 months. We determined clinical outcomes in terms of range of motion, patient satisfaction, the WOMAC, Hip Outcome Score, SF-12, and UCLA activity scale. Radiographs were analyzed for several criteria including alpha angles. All revisions and conversions to total hip arthroplasty (THA) were recorded.
Results: Hip flexion and internal rotation significantly improved. 82% of the patients were satisfied or very satisfied with the results of surgery and 81% would undergo the same surgery again. Alpha angles decreased from 60 to 43°. Conversion to THA was performed in seven hips (3%). Seven hips (3%) underwent major revisions and eleven (4.7%) minor revisions. Female patients had a significantly increased risk for conversion to THA (odds 10.7).
Conclusions: The present results offer evidence that surgical hip dislocation is a successful procedure for the treatment of FAI. More than 80% of the patients were satisfied with the results of surgery at a mid-term follow-up. The present data also suggest that older and taller female patients are at an increased risk for a worse outcome.

FM11

Pathological gait patterns in coxa retrotorta in pediatric population-supplementary examination for preoperative planning?

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Introduction: Coxa retrotorta is known as prearthrosis of the hip joint and therefore should be corrected operatively (1, 2). Clinical examination and conventional X-ray are diagnostic standard tools, whereas CT allows quantification of femoral retroversion leading to the precise diagnosis. Nevertheless children are rarely symptomatic and decision making for children and parents is difficult. Gait laboratory analysis gains relevance in diagnosis of unphysiological movement patterns in patients with coxa retrotorta. Reproducible analytic findings causing disadvantageous pathologic impact on the musculoskeletal system of the lower extremity may offer important information for surgical indication and preoperative planning.
Methods: We studied five patients (15.5 ± 2.8) with clinical and CT-diagnosed coxa retrotorta using gait analysis (VICON, 8 MX cameras, Plug-in Gait). Focused were changes and abnormalities of the patients gait pattern compared to the physiological gait pattern.
Results: All patients presented with reduced or nullified internal rotation of the hip joint (<10°) and CT-diagnosed pathologic reduced anteversion (<5°) or absolute femoral retrotorsion (<0°). Kinematics in gait analysis showed in all patients an increased adduction of the hip in the coronal plane. Three of five patients had an increased external rotation of the knee joint of the affected leg in the transverse plane according to the clinical picture of kneeing out. The analysis of kinetics indicated a pathologic external valgus moment in all patients and in three of five patients a pathologic external flexion moment within the first 20% of the stance phase.
Conclusion: We summarize the diagnostic pathway of coxa retrotorta including clinical examination, image-guided tools and gait analysis. Kinematics and kinetics of the gait analysis highlighted unphysiologic movement patterns in patients with coxa retrotorta. Bretin et al. showed in a cadaver study an increased valgus joint alignment in diminished anteversion of the hip joint (3). Our preliminary results support these findings showing increased valgus moment in the knee joint in all our patients. It might be discussed, if coxa retrotorta does also affect the knee joint. Taking these changes in account, gait analysis can serve as an important diagnostic and preoperative planning tool in coxa retrotorta. Further studies will be necessary to analyze the reproducibility of these observations in a larger patient population.

FM12

SCFE: Clinical Asssessment and Intra-operative Findings with special emphasis on slip instability

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Background: Clinical Classifications of SCFE attempt to identify hips with disconnected epiphysis, associated with a high risk of avascular necrosis (AVN) of the femoral head; however closed surgery makes confirmation difficult as well as the assignement of AVN to loss of physeal integritiy or to surgical aspects of stabilisation.
Questions: Are actual classification systems sufficiently accurate in detecting mechanical instability? Is epi-metaphyseal disconnection the main risk factor for AVN? Retrospectively clinical classification of physeal stability in 82 consecutive SCFE was compared with respective findings at open surgery; epiphyseal perfusion at surgery was recorded as well.
Results: Complete epiphyseal disconnection at open surgery was seen in 28 hips (34.1%). With the Fahey and O'Brien classification the sensitivity for disconnected epiphysis is 82.1% and the specificity 44.4%. With the Loder classification, the values were 39.3% for sensitivity and 75.9% for specificity. Epiphyseal perfusion could be demonstrated in 76 of 78 tested epiphysis. Both hips with lack of intraoperative perfusion were in the subgroup with disconnected epiphysis.
Conclusion: Actual clinical classifications are weak for the diagnosis of a disrupted epiphysis, Disruption per se can but does not necessarily lead to a stop of epiphyseal perfusion. High incidence of AVN may be more related to treatment modalities.
Level of evidence: Level III retrospective comparative study.

FM13

Persistenting growth after prophylactic single screw epiphysiodesis in upper femoral epiphysis

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Background: Prophylactic fixation of the contralateral hip in cases of slipped upper femoral epiphysis is controversial in North America, although in Europe it is more common. Using a single cannulated screw has been therefore widely accepted. However differing reports exist about the occurence of persisting growth after prophylactic epiphysiodesis. The aim of this retrospective study was to evaluate the presents of persisting growth of the upper femoral epiphysis after prophylactic fixation.
Methods: From 2006 until 2009 eleven children underwent prophylactic pinning using a single cannulated 6.5mm cancellous screw. Time to fusion, persisting growth as well as overgrowing of the screw was measured on plain radiographs taken postoperatively and at least after the growth plate was fused.
Results: All patients except one (91%) showed a persisting growing of the epiphysis and in 2 cases therefore actually a hardware replacement was necessary. The mean increase of the femoral neck length was 8.2% (sem 1.46%). Mean follow up was 32 months (range 12–49 months). All patient had a risser sign grade 0 at the time of surgery, and equal or less than grade 2, when the growth plate was fused.
Conclusions: Despite previous reports that a prophylactic fixation using a single cannulated cancellous screw is unproblematic and safe we showed that growth persistence is the rule and in some cases the physeal overgrowth necessitates a hardware replacement. Careful follow-up until fusion of the growth plate should be obligatory. Adjustment of the technique may be helpful to minimize further surgeries.

FM14

Not fully centered femoral head after closed reduction in children with developmental dysplasia of the hip: Immediate re-reduction is not necessary

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Introduction: Subluxed and fully luxated hips can be treated by closed reduction followed by immobilization in a spica cast. For these patients, avascular necrosis (AVN) of the femoral head is a serious complication. The incidence for avascular necrosis after this treatment varies between 6 and 47%. We present a series treated by spica cast that were not fully reduced at the initial MRI, but centred spontaneously over a period of two weeks.
Methods: Between 2008–2010, 16 patients (17 hips) underwent closed hip reduction and application of a spica cast. Age at time of reduction was between 5d and 5 m (mean 2 m). MRI control was made on the same day to confirm the reposition. If a correct and centered position was seen, spica cast was left for 4 wks. After removal, a sonographic control was done. Further treatment was a Düsseldorfer-splint for several weeks. If after primary closed reduction, a not optimal centering of the femoral head, without interposed labrum, was found, the position was tolerated. In those cases, a follow up MRI was done 2 wks later.
Results: In 6 patients MRI showed a fully centred femoral head after first closed reduction. In 3 patients it was not possible to perform a closed reduction. There was a inadequate centering because of interposed labrum. In 7 patients, a not fully centred femoral head without interposed labrum was seen in the control MRI after closed reduction. The femoral head was in a slightly dorso-cranial subluxated position. A follow up MRI was performed 2 wks later that showed now in all 7 hips a fully centred position of the femoral head.
Discussion: A remarkable observation was seen in those 7 patients (43%) who did not have a completely centred femoral head after the first closed reduction. The dorso-cranial subluxed position was 2 wks later seen in a spontaneously re-reduced perfect position while wearing the same spica cast. The follow-up examinations over a period of 6–27 m showed up to now no evidence of complications, such as AVN of the femoral head.
Conclusion: We showed that after closed reduction in DDH and initially not optimal centering of the femoral head, an immediate re-reduction is not mandatory given to the fact that obviously a spontaneous re-reduction can occur if no soft tissue is interposed.

FM15

The ?true? anteversion (AV-) angle of the acetabulum – 3D model versus 2D axial CT-cuts

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Background: Acetabular retroversion could be a cause in the development of femoro-acetabular impingement. A successful pelvic osteotomy includes reliable planning based on radiographs and CT scanning. However, we lack normative CT values in planning realignment of the osteotomized acetabulum. Also using 2D axial CT-cuts, different factors can lead to inconsistencies in measurement for acetabular version in this method.
Patients and methods: We retrospectively studied 260 hemipelvises that had been CT scanned for abdominal evaluation. We created 3D- surface models and the femora were removed for facilitate the detailed analysis of the acetabular area. Sex and age differences were also studied. We compared the results of our 3 D analysis vs. the cross sectional cuts of the same acetabula.
Results: The overall (n = 260) mean 3D- Acetabular AV-angle was 16.1° (SD = 5.6°) with a range of [0.2°, 31.2°]. In the case of the 3D-Acetabular AV-angle for male hemipelvises (n = 138) the mean acetabular AV-angle was 14.1° (SD = 5.3°) within a range of [0.2°, 28.8°] and for female (n = 122) the mean acetabular AV-angle was 18.4° (SD = 5.6°) within a range of [3.0°, 31.2°] accordingly. However, comparison of mean angles in women with those in men showed a difference for the Acetabular AV-angle, but we found no significant differences between the mean figures for right and left hips. The mean 2D axial analysed AV angle (n = 50) was 21.0° (SD = 5.8°), within a range of [9.8°, 35.0°]. The mean difference to the 3D analysis in the same acetabula (n = 50) was 4.8° (SD = 3.5°), within a range of [0.1°, 13.4°].
Discussion: Knowledge of the normal anatomy of the acetabulum is essential in the diagnosis of the type and severity of acetabular deformities, as well as in preoperative planning. Accurate estimation of the normal contact surface orientation permits correct realignment of the osteotomized acetabulum. These data are relevant for surgeons in providing targets for normal positioning of the acetabulum during pelvic osteotomies and acetabular recontouring procedures.

FM16

Developement of Bilateral Total Hip Arthroplasty during the last 10 years

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Background: Hip osteoarthritis occurs bilaterally in 42% to 54% of patients and current literature on bilateral total hip arthroplasty (THA) favours one stage procedures. Nevertheless, according to a review of 33'500 primary THA in Europe, only 3% were performed in a single stage procedure. During the last 10 years advances in terms of ease of recovery has been made and should have favoured bilateral one stage procedures. The aim of the present investigation was to evaluate the frequency of single stage bilateral THA during the past 10 years in our institution and to document their outcome.
Materials and methods: We reviewed our prospective database for patients undergoing bilateral THA within a 12 month period from 2000 to 2009. 99 patients were identified and their charts retrospectively reviewed in terms of Age, gender, BMI, ASA-score, surgical technique used, surgical time, blood loss, need of homologous blood transfusions, hospital stay, complications and outcome (WOMAC) after a minimum follow up of 1 year. Comparison between single stage versus two stage procedures were performed and the impact of surgical techniques analyzed.
Results: 14.3% of our patients in need of THA had a bilateral replacement. Frequency of single stage procedures increased from 1.9% in the 2000–2004 period to 3.7% in the 2005–2009 period. In our study group age and ASA-score were significantly lower in patients undergoing single stage procedures (55.4 ± 12.8 versus 66.7 ± 11.9 years, p = 0.001, ASA 1.8 ± 0.6 versus 2.2 ± 0.6, p = 0.009). 50 of 99 patients underwent a single stage procedure (50.5%). Significant lower surgical time (197.3 ± 51.0 versus 232.1 ± 55.7, p = 0.001) and hospitalisation time (9.5 ± 3.3 versus 14.1 ± 4.4, p = 0.001) was shown for bilateral single stage THA.
Conclusion: Several technico-medical improvements during the last 10 years increased safety and ease of postoperative rehabilitation after THA favouring single stage procedures. Our data showed an increase of single stage procedures in younger patients with a lower ASA score combined with a tremendous shorter hospitalisation time and surgical time for patients who underwent bilateral single stage procedures, that are equal to two stage procedures in terms of complications and outcome.

FM17

Total Hip Arthroplasty with a large diameter metal-on metal cup (Durom) and a standard stem. Short term results

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HUG

Introduction: Large diameter metal on metal cups have been used in total hip arthroplasty advocating superior results with respect to dislocation rates, range of motion and long term survival. The Durom cup used as part of the Durom hip resurfacing system has been incriminated with poor short term results sometimes correlated to incorrect positioning of either the femoral or acetabular component. Our objective was to evaluate short term results of the Durom cup used in conjunction with standard stems.
Methods: We prospectively followed all patients with a large diameter metal-on-metal articulation and a standard stem operated upon between 9/2004 and 9/2008. Patients were seen at follow-up for a clinical (Harris hip score = HHS, UCLA scale and patient satisfaction), radiographic and questionnaire assessment.
Results: 89 primary THAs in 80 patients (74% men) with a mean age of 52 (±12) years were included. Main diagnoses were primary osteoarthritis in 47% and aseptic necrosis in 35%. An uncemented stem was used in 79%. Overall, 80 THAs were controlled at a mean follow-up of 39 months (range 16–67 months), 4 patients were lost to follow-up and 5 patients refused or were unable to attend the visit. However, none of the 5 underwent revision. Overall, 8 THAs (8/85, 9.4%) were revised in mean 28 months (range 8–60) after the operation. One additional patient was awaiting revision for aseptic loosening of both cup and stem. The reasons for revision were aseptic loosening in three cases, presence of a granuloma in three, deep infection in one and impingement in one case. Radiographic analysis revealed linear (n = 2) and focal (n = 3) osteolysis as well as early cup migration (n = 2). In 5 revised patients no radiographic changes were found. 56 of the 80 patients with follow-up had a HHS between 80 and 100. Among those who were not revised, the mean HHS improved from 55.2 to 88.4. The mean activity level (UCLA scale) at follow-up was 6.4 (±1.8). Overall, mild to severe pain was reported in 14 cases and occasional pain in 22. Groin pain was present in 18 patients (22.5%), 7 of them belonged to the revised group. 61 (76.3%) of the 80 patients with follow-up were satisfied. Mean patient satisfaction on the VAS scale among those who were not revised was 9.0 (±1.3).This study confirms the increased

short-term revision rate of the large diameter metal-on-metal couple reported by others. In all revision cases the retrieved cups showed no osteo-integration.

FM18

Trochanteric Osteotomies for Primary and Revision Total Hip Arthroplasty: Risk Factors for Nonunion

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Introduction: Even if nowadays the indication of trochanateric osteotomies (TO) for complex primary- and revision total hip arthroplasty (THA) has declined it remains useful for some reconstructions. Nevertheless, non-union of the greater trochanter represents a relevant complication. The purpose of this investigation was to identify risk factors for trochanteric non-union.
Materials and Methods: According to our prospectively collected THA data base, 338 TO (310 patients) were performed between January 2000 and October 2009. From them 40 cases were excluded because of missing radiological follow-up of at least 6 months. For the remaining 298 cases we recorded 1) patient related factors such as gender, age, BMI, and nicotine abuse; 2) indication for TO, complex primary- or revision THA; 3) surgical technique related factors such as use of cement, distal trochanteric advancement, type of TO (extended versus anterior slide), and fixation of TO; 4) presence of previous TO (healed or not healed) and femoral component cementation; 5) complications such as intraoperative periprosthetic fracture or postoperative hip dislocation. Union of the TO was our primary endpoint and assessed on a.p. and crossable lateral views acquired at least 6 months after surgery.
Results: The overall trochanteric union rate was 80.5%. 5.4% showed a fibrous union only (i.e. visible osteotomy line without migration of the trochanter) and 14.1% a non-union (i.e. visible osteotomy line and migration). Non-union occurred in 40 of 247 anterior trochanteric slide osteotomies (16.2%) and in 2 of 51 extended trochanteric osteotomies (3.9%), respectively (p: 0.02). Non-union occurred in 35 of 195 cemented stems (17.9%) and 7 of 103 non-cemented stems (6.8%), respectively (p: 0.01). Non-union occurred in 16 of 130 primary THA (12.3%) and 26 of 168 revision THA (15.5%), respectively (p: 0.45). Multiple logistic regression analysis revealed patient's age (Odds: 1.03 per year and case, CI: 1.01–1.06, p: 0.016) and use of cement (Odds: 3.03, CI: 1.22–7.56, p: 0.02) as the only independent risk factors for non-union.
Conclusion: With respect of these results our current praxis has been changed as follows: The older the patient, the more the indication of a trochanteric osteotomy is restricted. If a trochanteric osteotomy appears indispensable non-cemented femoral reconstruction is prioritised.

FM19

Distal Femoral Cortical Hypertophy Using The Fitmore Stem©: Incidence, Risk Factor Analysis, And Clinical Implications

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Background: Stem design is an important factor influencing bone remodelling. The Fitmore Stem has a triple taper design with proximal Ti-Plasma coating. The design creates a press fit and proximal transfer of forces which is supported by apposition on the calcar region. However in some cases cortical hypertrophy in the distal femur has been observed with use of triple taper stems. The frequency, cause, and clinical relevance of cortical hypertrophy in the distal femur after hip arthroplasty with the Fitmore stem has not been previously documented.
Methods: A series of 99 total hip arthroplasties with a Fitmore tapered femoral component were performed in 96 patients between April 2008 and January 2010 at our institution. 10 hips (in 8 patients) were lost to follow-up. 89 hips in 88 patients were followed for at least 12 months. Clinical evaluation included Oxford, SF 12, and EQ-5D score, the incidence of thigh pain, and BMI. Radiographic examination at 6 (t1), 12 (t2) and 52 weeks (t3) postoperatively was used to evaluate cortical hypertrophy.
Results: Cortical hypertrophy was observed in 44 patients (49.4%). In 30 cases, the main site of hypertrophy was found in region 3 according to Gruen's classification. 8 cases of hypertrophy were noted in region 5, 6 in regions 3 and 5. Hypertrophy appeared on x-ray after 12 weeks in only 6 patients, whereas in the remaining 38 patients the hypertrophy was seen only after 1 year. Positive radiographic appearance of the hypertrophy did not correlate with subsidence, position of the stem, stem family, gender, age or BMI. No correlation of the radiographic findings with thigh pain at 6 weeks or one year postoperative was found.
Conclusion: Distal cortical hypertrophy was observed in nearly 50% of patients treated using the uncemented triple tapered Fitmore Stem. Neither subsidence nor stem positioning correlated significantly with the presence of cortical hypertrophy. Furthermore the presence of this radiological finding did not correlate at any time with thigh pain. The fact that in most cases the hypertrophy becomes present only after 1 year makes the role of a primary distal load transfer very unlikely. It is more likely that due to the fast proximal bone ongrowth to the short stem creates a secondary load transfer from the whole proximal fragment (which includes the stem) to the distal part of the proximal femur. Future studies should investigate how this hypertrophy might evolve over time.

FM20

The value of three-dimensional computerised planning of total hip arthroplasty

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Background: High accuracy was recently reported for three-dimensional (3D) computerised planning of total hip arthroplasty, comparing well with navigation regarding leg length and femoral offset. However, there is no randomised study comparing 3D planning to conventional 2D templating in terms of the accuracy and clinical relevance.
Material and method: A prospective comparative randomised study was carried out from 2008 to 2009, and included 2 groups of 30 patients who underwent THA for primary osteoarthritis. One low-experience surgeon performed all the surgical procedures using a minimal invasive direct anterior approach. In one group, the planning was made on calibrated X-Rays using 2D templates. In the other group, a CT-scan based 3D computerised planning was performed with dedicated software. The final hip anatomy was compared post-operatively to the preoperative planning and the accuracy was expressed as the mean difference (± SD) between the planned position and the final position of the implants.
Results: In the 3D group, the duration of the surgical procedure was 18% shorter and the bleeding was 34% lower. The prediction rate for the stem and the cup sizes were respectively of 100% and 96% in the 3D group versus 43% in the 2D group. When combining both components, the prediction rate was 96% in the 3D group versus 16% in the 2D group. The center of rotation, the femoral off-set and leg length were restored with twice as high accuracy in the 3D group
Discussion: The accuracy for leg length and offset restoration obtained with the 3D technique compared well with navigation, suggesting that this novel methodology is an attractive alternative to navigation to restore these parameters. Clinical benefits for the patients were also found, proving the clinical relevance of the 3D planning; the problems that may be encountered during surgery were detected and resolved before surgery. The high accuracy achieved by a low-experience surgeon suggests that 3D planning may help shorten the learning curve of the minimal invasive direct anterior approach.

FM21

FILMLESS TOTAL HIP ARTHROPLASTY TEMPLATING ON SURGEON'S OWN PERSONAL COMPUTERS: A RELIABLE & USER FRIENDLY SOLUTION AT NO COST

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Introduction: Xray films are progressively replaced by digital images. Preoperative arthroplasty templating using the traditional light-box, paper, pencil and templates will have to be replaced by digital, computerized, on-screen planning solutions. From the surgeon point of view, the software should allow accurate implants size selection, implant positioning, as well as accurate planning of length and lateral offset of the hip. Desirable extra-features are ease of use, possibility to transmit and save planned images on any support such as film, paper, JPEG etc.... Several commercial solutions, running on dedicated so-called "graphic stations" computers have been available for several years. These are expensive (€15'000–30'000) and are usually located within radiology departments. They are therefore not practical for daily use by surgeons. A special plugin, designed as an add-on to the OsiriX viewer (www.osirixviewer.com), allowing for preoperative hip arthroplasty templating has been developed within our institution. In this first report, we evaluate the use of this system in a prospective clinical study.
Method: A hip templating plugin for the OsiriX Dicom viewer was designed by the software's developer team in collaboration with members of the Geneva University Hospital orthopedics department. One digital image or preoperatively digitized AP plainfilm of the pelvis is required. The image can either be loaded into the software over the net or using a standard CD-ROM. The choice and positioning of implants is done by the surgeon himself, on the screen of his own Mac computer using the software. Choice of implants sizes, as well as positioning of those is planned on screen and lengthening as well as lateral offset variation is computed by the system. Each pre-operative plan regarding implant size including stem, cup and neck size as well as lengthening and lateral offset variations was recorded and compared to post-operative data in 60 consecutive patients.

Results: Perfect match for implant size was obtained in more than 60% of patients. In the remaining 40%, the variation was limited to 1 implant size. Planned lengthening and lateral offset displayed substantial to good correlation with post-operative recordings.
Conclusion: Filmless preoperative planning using the Osirix hip templating plugin represents a reliable, user friendly solution, available at no cost for any surgeon equipped with a standard Mac computer.

FM22

Internal rotation test for the clinical evaluation of stem stability

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Introduction: In many cases stem stability is difficult to assess and needs additional examinations such as a plain rx and/or a bone scan. Futhermore there are patients, where stem stability is doubtful in the absence of evident signs of loosening. It would although be helpful to be able to test stem stability postoperativly. We present a clinical test, which has proved to be very reliable with a very high sensitivity.
Method: In the internal rotation test the patient's hip and knee are flexed at 90 degrees. The patient is told to push his lower leg to the outside (thus doing an internal rotation of the hip). The examinator resists this motion and pushes abruptly against the leg. In a loose or unstable stem the patient experiences pain in the proximal thigh, the degree of pain corresponding to the degree of loosening. We evaluated the internal rotation test in 40 patients which were scheduled for hip revision. In 16 patients there were clear signs of stem loosening, in 4 patients stem stability was doubtful and in another 20 patients revision surgery was done for cup loosening with a stable stem. During surgery stem stability was tested by trying to extract the stem with a stem extraction system.
Results: In all 16 patients, where the internal rotation test was positive (painful), the stem was evidently loose. In the 4 patients with doubtful stability on plain rx and a positive test the stem was fixed macroscopically but could easily be extracted. In all patients, where the preoperative internal rotation test was negative the stem was well fixed and could not be extracted. Thus the sensitivity of the internal rotation test regarding stem instability or stem loosening was 100%.
Conclusion: The internal rotation test is a very valuable tool for the diagnosis of stem instability and loosening. We found it superior to plain rx or even to bone scans and it has become an important diagnostic tool in daily practice.

FM23

Survivorship of Second-Generation Metal-On-Metal Primary Total Hip Replacement

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Second generation metal-on-metal total hip replacements (THR) were introduced in the late 1980s and various studies reported conflicting data on their outcome. We retrospectively evaluated the implant survival of 1270 second-generation 28 mm metal-on-metal primary THR in 1121 patients followed prospectively at a mean of 6.8 years postoperatively. The probability of survival at ten years was estimated using the method of Kaplan and Meier and relative risk factors including age, gender, BMI, type of implant fixation and component size were calculated using the Cox proportional-hazards model. Sixty three (5%) THR were revised, these being 28 hips for aseptic loosening and 35 for reasons other than aseptic loosening. The probability of survival at 10 years, with revision for any reason as the endpoint, was 0.90 (95% confidence interval (CI) 0.86 to 0.94) for the THR as a whole, 0.91 (95% CI 0.87 to 0.95) for the cup, and 0.96 (95% CI 0.94 to 0.98) for the stem. No demographic factors or covariates were found to significantly affect implant survivorship. As there was no superior probability of survival and there have been concerns on putative local and systemic toxicity of metal debris, the use of second-generation metal-on-metal articulations for primary THR remains moot.

FM24

Metal on Metal Hipresurfacing: A cross-sectional analysis of Cobalt/Crom levels

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Introduction: Currently metal on metal (MoM) hip resurfacing is being scrutinized due to high failure rates, poor revision results, hip pain in relation to pseudo-tumors and concerns that those implants are at risk for cobaltism. On the one hand the failures are seen due to implant positioning and osseous changes such as thinning of the femoral neck. On the other hand there is a highly discussed immune and cytotoxic effect of periprosthetic metallosis. Cobalt inhibits cellular respiration and has the potential to adversely affect multiple organ systems. For reasons of quality management and safety for our patients we performed a cross sectional analysis of patients with hip resurfacing, analyzing the cobalt/chrome plasma levels in relation to outcome.
Methods: We analyzed 224 hip resurfacing arthroplasties in 172 patients (37 women, 135 men), mean age 54 years (range, 20y to 87y) in a cross-sectional study. Patients with a standardized follow-up 1, 2 and 5 years postoperatively in 2010 were included (mean implantation time 3 years, 11 month). All assessments included a clinical examination, radiographs and sonography of both hips. Blood plasma levels of cobalt and chrome were measured at the last-follow-up. Harris Hip Score and pain score are available preoperatively and at follow-up.
Results: The mean cobalt plasma level was 2.55 ug/l (range 0.2 to 74 ug/l, normal <1 ug/l), chrome 2.40ug/l (1 to 32 ug/l, normal <1 ug/l). Peak values were found 2 years postoperatively in all measured patients. Cobalt and chrome levels were significantly higher (CI 95%, r = 0.921) in bilateral resurfacing. Renal function was normal in all patients. Sonography at follow up showed no pseudotumors, 11 cases of capsular thickening and 15 hips with articular effusion were registered. Mean outcome Harris Hip Score was 95.4 (range 69 to 98), mean outcome pain score was 43.1 (range 20 to 44). No correlation was found between the Harris Hip Score and the Co/Cr plasma levels (r = 0.079, p = 0.05). No correlation was found between the pain score at follow up and the Co/Cr levels (r = 0.043, p = 0.05).
Discussion: The relevance of "cobaltism" remains controversial. As demonstrated, we found slightly elevated Co/Cr levels without clinical relevance for the outcome after hip resurfacing. Not negligible remains the fact that patients with bilateral hip resurfacing show significantly higher values in measured Co and Cr levels compared to unilateral resurfacing. Further analysis of clinical outcome as well as toxicological considerations will need to be specifically addressed.

FM25

Predictors for the need of a rehabilitation after primary hip replacement

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Introduction: In the last years the need of in-patient rehabilitation and fast-track surgery after joint-replacement operation has come in the focus of research activities but not all patients might be suitable for such a program. Retrospectively we looked up our database for criteria which might predict a discharge home or the need of rehabilitation after THA.
Methods: A total of 283 consecutive primary THA were operated via an anterior MIS approach from 3/09 until 12/10. Patients with femoral neck fracture, postoperative complications (infection, luxation, medical), simultaneous bilateral THA or bilateral THA within the same hospitalisation and all patients who lived preoperative in retirement homes were excluded. 191 THA remained. Demographical, medical and functional factors were analysed. 60 consecutive patients were selected for a questionaire based analysis of 30 social parameters.
Results: Patients with discharge home did not differ in the preoperative use of analgetics (p = 0.366), painscore (VAS) (p = 0.543) and Charnley-score (p = 0.335) but had a higher HHS [60.4 (SD 15.8) vs. 56.2 (SD 15.2), p = 0.065, n.s.]. They were younger [65.2 (SD 10.3) vs. 75.5 (SD 9.3) years, p <0.001), more male (58.5% vs. 47.1%, p = 0.144, n.s.) and had a higher BMI [27.5 (SD 4.8) vs. 26.0 (SD 4.0), p = 0.014]. There was no differences concerning diabetes (p = 0.815), depression (p = 1.000) and the use of cumarine-medication (p = 0.294) but patients with a history of backpain (p = 0.008) and an ASA 3 score (p = 0.002) had a higher probability for the need of rehabilitation. From all analyzed social parameters only the items "living alone" (p = 0.067, n.s.) and "have to climb stairs at home" (p = 0.098, n.s.) seemed to be predictive for the need of rehabilitation after THA.
Conclusion: Patients with a low preoperative HHS, higher age, a history of backpain and an ASA class 3 might need in-patient rehabilitation and do less qualify for a fast track rehabilitation concept. The social factors "living alone" and "stairs at home" are as important as the demographic and clinical factors to predict the need of rehabilitation.

FM26

Complications and five year clinical outcomes in metal-on-metal vs. PE-ceramic total hip arthroplasties

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Introduction: Recent review of literature concerning metal-on-metal total hip arthroplasty (THA) revealed the lack of large comparative clinical studies and inclusion of patient-reported outcomes.

Methods: We conducted a prospective cohort study including all metal-on-metal (group I) and conventional polyethylene (PE)-ceramic (group II) THAs with an uncemented press-fit cup, 28 mm head. Only THAs for primary osteoarthritis were included. The following outcomes were compared between the two groups: (1) Complication rates (infection, dislocation and revision) for patients operated upon between 1/1999 and 12/2008; (2) Radiographic outcomes (femoral osteolysis, loosening), and (3) Clinical outcomes (Harris Hip score, SF-12, activity, satisfaction) for patients operated between 1/1999 and 12/2004. Evaluation was performed five years postoperatively by an independent assessor. Cox regression analysis was used to compare incidence rates while adjusting for baseline differences.
Results: 1988 THAs were included**,** 544 with metal-on-metal and 1444 with PE-ceramic bearing. The two groups differed significantly with respect to sex distribution (men 55% vs. 41%, respectively), mean age (66 vs. 74 years), co-morbidities and type of stem (uncemented 16% vs. 2%). Crude incidence rates for complications were: 0.19 vs. 0.10 cases /100 person-years for infection; 0.35 vs. 0.36 cases/100 person-years for dislocation; and 0.31 vs. 0.14 cases/100 person-years for all-cause revision. Adjustment for baseline differences attenuated the higher rates for infection and revision in group 1. Osteolytic lesions were found in 3.5% vs. 3.8%. After adjustment for age, sex and activity the OR was 0.4 (95% CI 0.1;1.5). Five years postoperative, 181 THAs of group 1 and 697 THAs of group 2 were seen at follow-up. Clinical outcomes were similar with a mean Harris Hip score increase of 40 vs. 41 points. Patients in group 1 were significantly more satisfied (9.3 vs. 8.9 points) and reported higher activity levels (UCLA 6.5 vs. 5.3).
Conclusion: Mid-term results were similar among patients with metal-on-metal and PE-ceramic THAs for dislocation and clinical outcome. There was more infection in the metal-on-metal group, but there were higher satisfaction and activity levels and a slightly lower risk of femoral osteolysis. A larger study is necessary to precisely determine infection, revision and osteolysis occurrence.

FM27

Radiological comparative analysis of osseointegration in MIS-THR and postoperative full weight loading based on the comparison of 200 TIHA-coated and uncoated SL-PLUS-MIA-stems after one year

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Introduction: MIS-THR combined with immediate postoperative full weight mobilization demands modified implants. To get there we modified the well established Zweymüller SL-PLUS stem exclusively in the lateral proximal part to spare bone loss and to reduce soft tissue trauma. In certain cases we observed the appearance of RII's in the proximal part of the stem, probably due to share forces at the implant-bone-interface before completion of osseointegration. Thus we upgraded the stem with a bioactive HA-coating the proximal part. Aim of our study was how far the TiHA-coating influenced the occurrence of RII's despite postoperatively full weight loading.
Methods: From December 2005 to October 2008 we implanted the uncoated SL-PLUS-MIA stem in more than 1.000 cases. Since then the TIHA coated SL-Plus-MIA stem was used in our department. Each operation was performed in supine position via anterolateral MIS-approach followed by postoperative full weight mobilization. Clinical (HHS) and radiological follow-ups were performed after 6 weeks, 3, 6 and 12 months. Main focus of the radiological evaluation were RII's in the proximal Gruen zones and stem migration. The radiological evaluation was performed by digital image analysis.
Results: The radiological results after one year show in both groups a good osseous integration. The uncoated SL-PLUS-MIA-stem shows in 24% radiolucent lines in the proximal part versus 1.5% in the coated SL-PLUS TIHA-MIA-stem group. Regarding HHS there was no significant difference between the SL-PLUS TIHA-MIA and the SL-PLUS-MIA group. Concerning axial migration we observed a remarkable decline in the coated cohort.
Conclusion: To allow postoperative full mobilization not only a soft tissue-sparing technique, but also an adapted implant for MIS-technique are demanded. Our results show that Osseointegration improved significantly in the coated group. This is probably due to the osteoconductive effect of the TIHA coating. As a consequence only coated stems should be used in MIS-THA combined with post-operative full weight mobilization, as uncoated stems reach their limit concerning osseointegration.

FM28

Treatment of acetabular fractures in patients less and more than 50 years old

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HUG

Purpose: Standard treatment of displaced acetabular fractures is open reduction and internal fixation (ORIF). This study assessed outcome obtained in patients more and less than 50 years old, treated by initial surgical treatment
Methods: A retrospective study was done from our data base according to the ethic rules. Between 1991 and 2009, 160 patients were admitted with complex acetabular fracture.
Results: 104 were less than 50 years old (20 women) and 56 were more than 50 years old (20 women). Most of them had posterior lesions (89 mean age 40). Anterior lesions were found in 30 patients (mean age 40 years old). Both two columns lesions were rare: 13 patients mean age 47. 44 patients had transverse lesions (mean age 38). Most of the patients were treated by ORIF (150 patients) and 10 of them needed a primary total hip arthroplasty (mean age 68 years old). Only eleven patients from ORIF treatment need secondary THA (mean age 42) and osteonecrosis of femoral head was found in 9 cases (7 men and 1 woman). Osteotomy was performed in 25 cases (mean age 45 years old). The average delay for secondary THA is 82 months (1–180). All fractures healed and all patients recovered. No neurological complication was found but one sepsis occurred treated by intra venous antibiotics**.**
Conclusions: In our series, good results were obtained with ORIF in young people with anatomic reduction. Primary THA was provided in elderly patients or in selected young people with very comminutive. Poor results of ORIF occurred in elderly patients because of osteoporotic bone and the necessary period of bed rest. That's why in these cases primary total hip arthroplasty (THA) is the best issue.

FM29

A low radiation distal targeting device for Long Gamma Nail

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Introduction: Distal targeting for intramedullary nail is a mandatory part of all the procedure and radiation consuming. We report our experience with a new low radiation handle fixed targeting device adapted to the long gamma nail.
Material and Method: A prospective study was conducted by a senior surgeon. We compare the free hand technique (25 cases) to the new device (25 cases). Technical difficulties and radiation times needed for the distal targeting and locking were reported.
Results: One failure of locking screw was noted in each group. For the free hand technique the mean duration time of the irradiation was 25.8 seconds (6 to 38) and 8.6 seconds (6–18) for the distal targeting device group.
Discussion: The aim of the study was to demonstrate the accuracy of the new low radiation free targeting device and the reduction of irradiation in comparison to the free hand technique what was achieved. The failure rate is the same into the two groups. The bias of the study is due to the fact that the study was conducted only by a senior surgeon very familiar to all the tricks and tips of the intramedullary procedures. Unfortunately, the time used for the targeting and locking wasn't reported.
Conclusion: This new targeting device is promising in terms of low irradiation time and seems to give as good results as for the free hand technique in term of locking success rate.

FM30

Primary hemiarthroplasty for unstable intertrochanteric fractures in the elderly: A retrospective series of 101 cases

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Introduction: The objective of this retrospective case series study was to evaluate, short-term results of 101 unstable intertrochanteric fractures in the elderly treated by primary hemiarthroplastiy. We focused on morbidity, mortality and postoperative autonomy.
Materials and methods: The series consists of 101 patients, 87 women and 14 men, mean age 85.6 ± 7.2 years (68–102), operated between January 2003 and December 2008. According to AO/OTA classification we operated 86 fractures type 31A2.2, 6 fractures type 31A2.3 and 1 31A3.3 fracture. We used in 95% of cases a cemented reconstruction stem (TSF®, SERF, Décines) and in 93% of cases a bipolar head, all by a posterior approach. The greater trochanter was fixed if necessary by metallic wires. The average delay between the accident and surgery was 2 ± 1.65 days (0–9).The preoperative Parker score averaged 7 ± 2 (1–9). All patients were allowed full weight bearing immediatelly after surgery.

Results: Three pulmonary embolism were observed, 2 deep venous thrombosis, a massive ischemic stroke. 8 deaths occurred within 3 months after surgery. We found 4 early dislocations of which 2 required surgical revision. The first becuase of a stem malpositionning and the other because of default cementing default. No case of infection have been observed. The average time for sitting in a chair was 1.68 ± 1.12 days (1–10). At a mean follow up of 6 months (6–18) by 93 patients (8 deaths excluded), the Parker score was 4.60 ± 2.25 and the Postel Merle Dr. d'Aubigne score was 12.14 ± 2.96.
Discussion-conclusion: The treatment of unstable trochanteric fractures in the elderly by hemiarthroplastiy is an interresting alternative to the "gold standard" represented by the internal fixation. Still, there is a significant drop in the Parker score (p <0.0001) and PMA score does not correspond to a total hip athroplasty score for osteoarthritis. The study also reveals a longer learing curve to achieve this surgery. Further studies are needed to compare arthoplasty to internal fixation in this type of indication.

FM31

Is amoxicillin/clavulanic acid sufficient for preemptive antibiotic therapy in type III grade open fractures?

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The risk of infection after type III° open fractures is high (10–50%). Preemptive antibiotic therapy may prevent posttraumatic infection and improve the outcome. Recommendations about the type and duration of antibiotic vary among the institutions and it remains unclear whether gram-negative bacilli or anaerobs need to be covered. In Europe, the most commonly recommended antibiotic is amoxicillin/clavulanic acid. We retrospectively analyzed microbiology, characteristics and outcome of patients with open type III° fractures treated at our institution.
Methods: Between 01/2005 and 12/2009 we retrospectively included all type III grade open fractures of the leg at our institution classified after Gustilo into type IIIA, IIIB and IIIC. Demographic characteristics, clinical presentation, microbiology, surgical and antibiotic treatment and patient outcome were recorded using a standardized case-report form.
Results: 30 cases of patients with type III° open fractures were included (25 males, mean age was 40.5 years, range 17–67 years). 27 fractures (90%) were located on the lower leg and 3 (10%) on the upper leg. Microbiology at initial surgery was available for 19 cases (63%), of which 10 grew at least one organism (including 8 amoxicillin/clavulanic acid-resistant gram-negative bacilli [GNB], 7 amoxicillin/clavulanic acid-resistant Bacillus cereus), 11 were culture-negative. Preemptive antibiotics were given in all cases (100%) for an average duration of 8.5 days (range 1–53 days), the most common antibiotic was amoxicillin/clavulanic acid in 60% (n = 18). 11 cases just received preemptive antibiotic treatment, in 19 of 30 cases the antibiotic therapy was changed and prolonged. Microbiology at revision surgery was available for 25 cases and 22 grew at least one pathogen (including 32 amoxicillin/clavulanic acid-resistant gram-negative bacilli and 10 amoxicillin/clavulanic acid-resistant Bacillus cereus), 3 were culture-negative.
Conclusions: At initial surgery, most common isolated organisms were coagulase-negative staphylococci (43%), Bacillus cereus (23%), and gram-negative bacilli (27%), and others (7%) of which 48% were resistant to amoxicillin/clavulanic acid. At revision surgery, isolated organisms were gram-negative bacilli (64%), Bacillus cereus (20%), and others (16%) of which 88% were resistant to amoxicillin/clavulanic acid. The spectrum of amoxicillin/clavulanic does not cover the most common isolated organisms.

FM32

Infection rate of VEPTR©-Implants in children with severe spinal and thoracic deformities – a prelimary report

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Summary: Repetitive operative lengthening in VEPTR patients inheres a cumulating risk of infection. Before clinically apparent these infections may be detected by high-sensitive methods as sonication only. We found a 12% rate of such cases with a wide spectrum of bacteria. Questions arise whether all should be treated or dependent on the type and number of bacteria and if this would lower the high rate of associated soft tissue problems.
Background: Severe spinal and thoracic deformities in children can be treated with vertical expandable prosthetic titanium ribs (VEPTR©). The implants are lengthened regularly to compensate ongoing growth making many reoperations necessary before definitive spondylodesis. With each operation the risk of infection cumulates over time. Implant associated infections are often clinical unapparent. Sonication of removed implants can increase the sensitivity of microbiological analysis. To analyze the total number of infections, identify potential precursors and the relevance of asymptomatic infections we examined all during reoperations removed implants microbiologically.
Material & Method: Between January 2009 and June 2010 we performed 81 reoperations on VEPTR-implants. Preoperative a patient and a surgeon-based questionnaire were filled in, inquiring clinical signs of infection. Blood samples were analyzed for CRP and WBC. All during lengthening operation retrieved implants were sonicated and the fluid used for microbiological work up.
Results: 73 implants were analyzed by sonication. 9/73 (12%) showed bacterial growth, three after enrichment, two with a low germ count. Propionibacterium acnes was found in three, coagulase negative staphylococcus in five, staphylococcus epidermidis and streptococcus in one analyses respectively. In one child an infection was suspected preoperative and confirmed microbiologically. In another patient an infection was suspected intraoperative, but showed no bacterial growth, histology showed a histiocytosis.
Conclusion: Systematic analysis of retrieved implants after VEPTR-operation identifies clinical asymptomatic colonization of implants. These infections may become clinical relevant over time. The relevance and treatment of clinical inapparent infections have to be further evaluated.

FM33

Factors associated with rifampin resistance in staphylococcal periprosthetic joint infections (PJI): a matched case-control study

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Biofilms of rifampin-resistant staphylococci are considered difficult to treat and eradicate. Causing periprosthetic joint infections (PJI), a two-stage exchange with a long interval (at least 6 weeks) without a spacer is recommended for successful treatment. Only anecdotal reports of reasons for emergence of rifampin-resistance exist. In a multicenter case-control study (01/2000 to 3/2010), we retrospectively analyzed predetermined potential risk factors in patients with rifampin-resistant staphylococcal PJI. PJI was defined as periprosthetic purulence, presence of sinus tract or microbial growth in at least 2 specimens. Cases were defined as PJI caused by rifampin-resistant staphylococci, controls as those caused by rifampin-susceptible staphylococci. We matched at least one case with at least one control for each of the following groups: (i) infecting agent (*Staphylococcus aureus* or coagulase-negative staphylococci) and (ii) location of PJI (hip, knee, elbow, ankle, shoulder). Conditional logistic regression analyses were performed to estimate odds ratios (OR) with 95% confidence intervals (95% CI). We included 48 cases and 48 controls (median age 67 y; range 39 to 88 y) with hip (n = 58), knee (n = 26), elbow (n = 8), shoulder (n = 2) or ankle (n = 2) PJI. *S. aureus* was isolated in 20, coagulase-negative staphylococci in 76 patients. Rifampin resistance was associated with male sex (OR 3.4, 95%-CI 1.5–8.1, p = 0.005), repeated (>3) surgical revisions (OR 5.0, 95%-CI 2.1–11.8, p <0.001), no surgical debridement and/or inadequate intravenous treatment (OR 5.5, 95%-CI 2.4–13.0, p <0.001). Subgroup analysis of 56 patients treated with rifampin before emergence rifampin resistance identified no surgical debridement and/or inadequate intravenous treatment (OR 6.4, 95%-CI 1.9–21.5, p = 0.003) as an independent risk factor and a trend for the use of a cement spacer (OR, 7.9, 95%-CI 0.9–66.0, p = 0.057) in the prosthesis free interval and the administration of rifampin in presence of a sinus tract/fistula (OR 7.5, 95%-CI 0.9–62.3, p = 0.062). To prevent emergence of rifampin-resistance in staphylococcal PJI, bacterial density should be reduced by extensive surgical debridement and intravenous antibiotic treatment, before switch to peroral therapy. Moreover, indication for rifampin treatment should be carefully evaluated since any previous rifampin exposure predispose for occurrence of rifampin resistance, especially when given incorrectly.

FM34

Do osteo-articular infections due to Pseudomonas aeruginosa reveal more treatment failures than infections due to MRSA?

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HUG

Objectives: Osteo-articular infections due to methicillin-resistant *Staphylococcus aureus* (MRSA) are feared for their treatment failures. According to clinical experience, *Pseudomonas aeruginosa* reveals more treatment failures than MRSA; but there is no data available.

Methods: Case-control study comparing outcomes of osteo-articular infections due *P. aeruginosa* vs. due to MRSA at Geneva University Hospitals.
Results: A total of 37 osteo-articular MRSA infections and 20 *P. aeruginosa* infections were retrieved in 57 patients (median age; 71 y): arthroplasties (n = 17), other implant materials (28), native joint arthritis (7), and osteomyelitis without implant (5). The median active follow-up time was 3.5 years, range 1.2–8.9 y. Both microbiological groups underwent a median number of 2 surgical interventions ($p = 0.51$), while the median duration of concomitant antibiotic treatment was 87 days for *Pseudomonas* and 58 days for MRSA infections ($p = 0.36$). Overall, *Pseudomonas* patients showed tendency for more treatment failures than patients infected with MRSA (8/20, 40% vs. 7/30; 19%, $p = 0.09$). In multivariate logistic regression analysis adjusting for case mix, odds ratios with corresponding 95%CI regarding outcome cure were as follows: *Pseudomonas* vs. MRSA infection (OR 0.4, 0.1–1.6), number of surgical interventions (0.7, 0.5–1.1), duration of antibiotic treatment (1.0, 0.9–1.1), and age (1.0, 0.9–1.1).
Conclusions: Despite a similar number of surgical interventions and longer antibiotic treatment, osteo-articular infections due to *P. aeruginosa* tend to more treatment failures than infections due to MRSA. Our underpowered study warrants confirmation in larger prospective trials.

FM35

Lab-based Differential Diagnostics of Periprosthetic Joint Infection and Aseptic Loosening

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Introduction: Differentiation between periprosthetic joint infections and mechanical or wear-induced prosthetic loosening remains a key challenge. Correct diagnosis is essential to determine the adequate surgical strategy. Diagnosis of infection is usually based on the analysis of synovial fluid, including white blood cell count and microbiological analysis, but synovia cannot be acquired nor analyzed in all cases. In serum analysis, the quantification of the C-reactive protein (CRP) is recommended. It remains uncertain if procalcitonin (PCT) and interleukin 6 (IL-6) can also improve detection of an infection. Alkaline phosphatase (AP) as well as the serum levels of calcium and phosphate might support the diagnosis of a prosthesis loosening. We evaluated the potential of these laboratory tests to improve the differential diagnoses between periprosthetic joint infections and mechanical loosening.
Methods: In 2010, 68 Patients with revision total arthroplasty of the hip or knee were included in our study (44 f, 34 m, 39 hip, 29 knee). Excluded were any patients with malignant diseases, immune deficiencies, bone-turnover disorders or in cases of emergency. Preoperatively, levels of CRP, PCT, Ca, P, AP and bone specific AP were determined in the patients' serum. Intraoperatively, synovial fluid was obtained, cell count and microbiological analysis were carried out and IL-6, lactate and glucose levels were analyzed. Additionally, samples were analyzed histo-pathologically and correlated to the clinical findings.
Results: Pathogens could be detected microbiologically in 19 cases. In 51 cases, components of the prostheses were loosened macroscopically. IL-6 in the joint aspirate could be detected more reliably than the cell count, predicting an infection or the presence of germs with a specificy of 82% and sensitivity of 76% when >= 4000 pg/ml. WBC count in the aspirate was no valid index, most likely due to blood contamination. Serum CRP ≥10 mg/l showed a sensitivity of only 50% and 77% specificity for infections. PCT detected an infection with a specifity of 100% at a threshold as low as ≥0.2 µg/l, but lacks sensitivity. Neither AP, Ca nor P were suitable to predict an implant loosening.
Conclusion: Synovial IL-6 and serum PCT might improve the diagnostic reliability in differentiation between periprosthetic joint infections and aseptic mechanical prosthetic loosening. A lab-based differentiation of a loosened endoprosthesis was not possible in our study.

FM36

Failure of surgical treatment in 115 infected total hip arthroplasties – analysis of a 12-year prosthetic joint cohort study (1999-2010)

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Infection of total hip arthroplasties (THA) leads to significant long-term morbidity and high healthcare costs. We evaluated the different reasons for treatment failure using different surgical modalities in a 12-year prosthetic joint infection cohort study.
Method: All patients hospitalized at our institution with infected THA were included either retrospectively (1999–2007) or prospectively (2008–2010). THA infection was defined as growth of the same microorganism in ≥2 tissue or synovial fluid culture, visible purulence, sinus tract or acute inflammation on tissue histopathology. Outcome analysis was performed at outpatient visits, followed by contacting patients, their relatives and/or treating physicians afterwards.
Results: During the study period, 117 patients with THA were identified. We exclude 2 patients due to missing data. The median age was 69 years (range, 33–102 years); 42% were women. THA was mainly performed for osteoarthritis (n = 84), followed by trauma (n = 22), necrosis (n = 4), dysplasia (n = 2), rheumatoid arthritis (n = 1), osteosarcoma (n = 1) and tuberculosis (n = 1). 28 infections occurred early (≤3 months), 25 delayed (3–24 months) and 63 late (≥24 months after surgery). Infected THA were treated with (i) two-stage exchange in 59 patients (51%, cure rate: 93%), (ii) one-stage exchange in 5 (4.3%, cure rate: 100%), (iii) debridement with change of mobile parts in 18 (17%, cure rate: 83%), (iv) debridement without change of mobile parts in 17 (14%, cure rate: 53%), (v) Girdlestone in 13 (11%, cure rate: 100%), and (vi) two-stage exchange followed by removal in 3 (2.6%). Patients were followed for a mean of 3.9 years (range, 0.1 to 9 years), 7 patients died unrelated to the infected THA. 15 patients (13%) needed additional operations, 1 for mechanical reasons (dislocation of spacer) and 14 for persistent infection: 11 treated with debridement and retention (8 without change and 3 with change of mobile parts) and 3 with two-stage exchange. The mean number of surgery was 2.2 (range, 1 to 5). The infection was finally eradicated in all patients, but the functional outcome remained unsatisfactory in 20% (persistent pain or impaired mobility due to spacer or Girdlestone situation).
Conclusions: Non-respect of current treatment concept leads to treatment failure with subsequent operations. Precise analysis of each treatment failures can be used for improving the treatment algorithm leading to better results.

FM37

Duration of post-surgical antibiotic therapy for adult chronic osteomyelitis: a single-centre experience

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Purpose: The optimal duration of concomitant antibiotic therapy after surgical intervention for implant-free chronic osteomyelitis is unknown. No randomized data exist. Available recommendations base on expert's opinion. We evaluate the duration of post-surgical antibiotic treatment related to remission of chronic osteomyelitis.
Methods: Retrospective single-center study at Geneva University Hospitals with a minimal follow-up of two years after treatment. Multivariate logistic regression analysis with exclusion of pediatric cases and of implant-related chronic osteomyelitis.
Results: A total of 49 episodes of implant-free chronic osteomyelitis in 49 adult patients were studied. The median number of surgical interventions was 2 (range, 1–10). The median duration of post-debridement antibiotic treatment was 8 weeks (range, 4–14 weeks). Thirty-nine patients (80%) were in remission after a minimal follow-up of 2 years. In multivariate logistic regression analysis, one week of intravenous therapy had the same remission as 2–3 weeks (0.2, 0.1–1.9) or ≥3 weeks (0.3, 0.1–2.4). More than 6 weeks of total antibiotic treatment equaled ≤6 weeks (0.8, 0.1–5.2).
Conclusions: In chronic osteomyelitis in adults, a post-debridement antibiotic therapy beyond six weeks, or an IV treatment longer than one week, did not show enhanced remission incidences. Prospective randomized trials are required to confirm this observation.

FM38

Activity of polymethylmethacrylate (PMMA) bone cement loaded with daptomycin, vancomycin and gentamicin against Staphylococcus epidermidis biofilms

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Background: Local antibiotics may significantly improve the treatment outcome in bone infection without systemic toxicity. For impregnation of polymethylmethacrylate (PMMA), gentamicin, vancomycin and/or clindamycin are currently used. A new lipopeptid antibiotic, daptomycin, is a promising candidate for local treatment due to its spectrum against staphylococci and enterococci (including multi-resistant strains), and concentration-dependent rapid bactericidal activity. We investigated activity of antibiotic-loaded PMMA against *Staphylococcus epidermidis* biofilms using an ultra-sensitive bacterial heat detection method (microcalorimetry).
Methods: *Staphylococcus epidermidis* (strain RP62A, susceptible to daptomycin, vancomycin and gentamicin) at concentration 10^6 bacteria/ml was incubated with 2 g-PMMA block (Palacos, Heraeus Medical, Hanau, Germany) in 25 ml tryptic soy broth (TSB) supplemented with calcium. PMMA blocks were preloaded with daptomycin, vancomycin and gentamicin each at 2 g/40 mg (= 100 mg/block) PMMA. After 72 h-incubation at 35 °C under static conditions, PMMA blocks were rinsed in phosphate-buffered solution (PBS) 5 times and transferred in 4 ml-microcalorimetry ampoule filled with 1 ml

TSB. Bacterial heat production, which is proportional to the quantity of biofilm on PMMA surface, was measured by isothermal microcalorimetry. The detection time was calculated as the time until the heat flow reached 20 microwatt.
Results: Biomechanical properties did not differ between antibiotic-loaded and non-loaded PMMA blocks. The mean detection time (± standard deviation) of bacterial heat was 6.5 ± 0.4 h for PMMA without antibiotics (negative control), 13.5 ± 4.6 h for PMMA with daptomycin, 14.0 ± 4.1 h for PMMA with vancomycin and 5.0 ± 0.4 h for PMMA with gentamicin.
Conclusion: Our data indicates that antibiotics at 2 g/40 mg PMMA did not change the biomechanical properties of bone cement. Daptomycin and vancomycin were more active than gentamicin against *S. epidermidis* biofilms when all tested at 2 g/40 mg PMMA. In the next step, higher concentrations of daptomycin and their elution kinetic needs to be determined to optimize its antibiofilm activity before using in the clinical setting.

FM39

Virtual reconstruction of pelvic tumor defects based on a clinically applicable pelvis statistical shape model

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Preservation of the biomechanical characteristics of the pelvic ring after resection of large parts of the pelvis (including the acetabulum) because of malignant pelvic tumors presents a challenging problem. In this study we propose a novel planning method for virtual reconstruction of pelvis defects. Our approach consists in the use of a pelvis statistical shape models (SSM) in order to generate patient-specific implant geometries. This parametric pelvis model can be deformed (via a unique set of transformation parameters) towards the optimal match with the patient pelvic anatomy from the CT dataset. To our knowledge, there are no reconstruction oriented approaches of the pelvis SSM in the literature. The main objective of this study is to present and to evaluate a virtual anatomical reconstruction of five deformed or damaged pelvic bones using the pelvis statistical shape model. The geometrical data of the pelvises (called "training set") are obtained via segmentation and surface processing methods. Different stages of the data processing pipeline for the generation of the statistical pelvis shape model will be presented. The whole CT datasets collection has been subdivided into male (n = 50) and female (n = 50) pelvises and from each training set a gender oriented statistical shape model has been generated. We estimated the mean distance and the standard deviation between the preoperative pelvis surface and the reconstructed ones for each case. We achieved an overall mean deviation distance of 1.046 mm with a mean standard deviation of 0.825 mm (min distance = 0.0000098 and max distance = 6.823 mm). From the clinical point of view the achieved surface deviation error in the range of 1 mm is a very good result. It proves the hypothesis that the presented method is a valuable tool for planning of reconstructive surgery and implant design. It has been shown that with a reasonable number of datasets we are able to create a clinically applicable statistical shape model that gives an excellent basis for creating implants in the pelvic area.

FM40

Preoperative radiotherapy for the treatment of soft tissue sarcoma of the posterior thigh is associated with a low wound complication

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Introduction: Current standard treatment of soft tissue sarcoma of the extremities consists of surgery combined with radiotherapy. While it is generally accepted that radiotherapy helps preventing local recurrences, it is the topic of an on-going debate weather radiotherapy should be used pre- or postoperatively. Recent studies imply advantages of preoperative radiotherapy attributed to smaller radiation dosage and volume, and therefore fewer side effects, including less tissue oedema, fibrosis and joint stiffness. On the other side several studies report on the disadvantage of higher wound complication rates after surgical resection in patients who underwent preoperative radiation.
Methods: We identified and reviewed the charts of twelve patients that were treated for soft tissue sarcomas of the posterior thigh at our institution between October 2008 and December 2010. All underwent preoperative radiation therapy, followed by surgical resection of the tumour. Radiotherapy was applied on average 7 weeks before surgery (range from 4–16 weeks), with a mean total dosage of 50 Gy (range 16–50 Gy). Patients' mean age was 54 years (range 33–83 years). History and symptoms began on average 7 months before surgery (range, 1–24 months). Histological diagnosis was myxoid liposarcoma (6), lipoma like liposarcoma (1), pleomorph liposarcoma (1), spindle cell high grade sarcoma (2), epthelioid fibrosarcoma (1) and a highly undifferentiated pleomorphic tumour (1). Ten patients presented with primary disease, 2 patients presented with a recurrence after prior treatment at an outside institution. Average follow up was 13 months (range 1–24 months).
Results: In all 12 patients primary wound closure could be achieved without the necessity of vacuum assisted wound closure. Tumour size according to the preoperative CT-scan was on average 570 ccm (range 220–1021 ccm. The sciatic nerve could be spared in 10 out of 12 patients, a wide marginal resection could be achieved in four patients, a marginal resection in seven patients, while in one patient the resection was performed intralesional. One of the 12 patients, who had undergone surgery before, required surgical wound revision because of a wound break down 10 weeks after surgery, followed by a delayed wound closure.
Conclusion: Our data support the use of preoperative radiotherapy with a wound complication rate of 8%, compared to the reported wound complication rates in the literature, which are significantly above 20%.

FM41

Quill SRS – QuillTM Self-Retaining System – Description of orthopedic series – case report

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Background: The method of skin closure has become increasingly important in orthopedic surgery. Wound complications are one of the major sources of morbidity after orthopedic procedures and can prolong the time of hospitalization. The conventional wound suture by the Donati mattress suture is known for good results. The disadvantages are the time consuming tying of the knots and the need for assistance. The objective of good wound closure is rapid skin healing and an acceptable cosmetic result while minimizing the risks of complications such as wound dehiscence or infection. These are reasons for increasing costs. Since December 2010 we used the Quill SRS (Angiotech Pharmaceuticals, Vancouver, British Columbia, Canada) for the continuous superficial dermis suture. It is a knotless, absorbable surgical wound closure system that has tiny barbed hooks on its surface. When the suture is advanced, the hooks penetrate into the surrounding tissue and lock the suture in place without a knot. The aim of this study was to evaluate the benefit of the Quill SRS.
Material and methods: The superficial wound closure was done with the Quill SRS in a series of 30 elective and trauma patients. We investigated the durance of secretion after closure, dehiscence, signs for infection and operating time. The follow up was 1–10 days during the hospitalization and after 6 weeks.
Results: The 30 patients stayed 2–10 days in the hospital. The wound closure with Quill was done in 10 trauma cases and 20 elective interventions. Three of them were hip prosthesis and 4 knee prosthesis. None of them showed wound dehiscence or infection. One wound presented a reaction to the suture material with redness. There was no rising of the blood parameters for infection and no further treatment needed. There was no difference between trauma and elective interventions. The examination after 6 weeks showed very good results of wound closure. The operating time for wound closure was shortened by about 30%.
Conclusion: In our small case series we found comparable results to the Donati mattress suture. The operating time for superficial wound closure was shorter. In our opinion the Quill SRS suture material is a valuable tool for orthopedic surgeons. The material has the capacity for saving more cost because it allows the closure of several tissue layers with a single suture. Further investigations should be done.

FM42

Anatomic total shoulder arthroplasty: consequences of humeral head malposition

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Introduction: Third generation anatomic total shoulder prostheses offer a wide range of adaptability (size, thickness, retroversion and offset of the humeral head, cervico-diaphyseal angle) in order to reproduce anatomy and biomechanics of the shoulder as normal as possible. The large variability of the implants may also induce malposition. Our goal was to analyse the consequences of a humeral head malposition, which is one of the most frequent placement errors.
Methods: A 3D finite element model of the glenohumeral joint, including the rotator cuff muscles and the deltoid, was used with the Aequalis anatomic prosthesis. Active abduction was simulated. Three humeral head placements were compared: anatomic positioning (A), 5 mm inferior positioning (B), 5 mm superior positioning (C). The effect of humeral head malposition was evaluated through the following quantities: the range of motion free of impingements, the glenohumeral

contact pattern, and the stress within the polyethylene and the cement.
Results: Inferior positioning (B) of the humeral head produced a superior impingement before 90° of abduction, an inferior eccentric contact point on the glenoid, and 165% increase of cement stress. Superior positioning (C) of the humeral head produced a postero-superior eccentric contact point on the glenoid, 300% increase of glenohumeral contact pressure, 450% increase of polyethylene stress, and 207% increase of cement stress.
Conclusion: Malposition of the humeral head of anatomic prostheses induces biomechanical consequences that may preclude the glenoid survival. Particular attention must be paid to reproduce the humeral anatomy as normal as possible.

FM43

Acromioclavicular joint reconstruction: A comparative biomechanical study of three techniques

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Background: Acute acromioclavicular joint dislocations indicated for surgery can be treated with several reconstruction techniques. The purpose of this in vitro study was to evaluate the acromioclavicular joint stability after three types of validated reconstruction compared to the native situation.
Hypothesis: Acromioclavicular and coracoclavicular cerclages is a method of anatomical acromioclavicular joint reconstruction.
Methods: Nine pairs of intact cadaveric shoulder specimens were assigned into three study groups with randomly distributed samples according to the coracoclavicular joint distance. The study groups were instrumented with either acromioclavicular and coracoclavicular cerclages (CE), a Twin Tail TightRope (TR), or a LCP S-A Clavicle plate (CP). Intact and instrumented specimens were tested quasi-static non-destructively (superior; 70 N, anteroposterior; ±35 N, 10 mm/min) and cyclically until failure (superior, valley load: 20 N, initial peak load: 70 N, increment: 0.02 N/cycle).
Results: The TR study group showed the highest stiffness (superior: 73.77 ± 14.04 N/mm, anteroposterior: 29.58 ± 1.52 N/mm), followed by CE (superior: 59.73 ± 10.33 N/mm, anteroposterior: 24.31 ± 4.14 N/mm) and CP (superior: 24.08 ± 5.29 N/mm). Instrumentation generally led to increased superior and anteroposterior stiffness in each study group but to a significant superior stiffness reduction for CP ($p = 0.029$). Significantly lower CC distance at valley load after 1 and 500 cycles was observed for TR ($p = 0.018$) and CE ($p = 0.041$) compared to CP. Cycles to failure in CE (7298 ± 1244 cycles) and TR (4434 ± 727 cycles) were significantly higher compared to CP (1683 ± 509 cycles), $p = 0.011$ and $p = 0.031$, respectively.
Conclusion: The TR system provided the highest stability but failed earlier then the CE reconstruction. The CE reconstruction might mimic the native acromioclavicular joint stiffness better than the other two setups, leading to more physiologic reconstruction.

FM44

Outcome of rotator cuff repair with a new objective tool using inertial sensors during daily activities

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Introduction: Most scores assessing shoulder function are correlated to patient's subjectivity and clinician's appreciation at a given moment. Our aim was to evaluate the outcome of rotator cuff repair during daily activities according to kinematics parameters.
Methods: 41 healthy subjects (mean age 34 yrs [21–52 yrs]) and 23 cuff tears (mean age 54 yrs [29–67 yrs]) were studied. Two inertial modules were fixed on the dorsal side of distal humerus and thorax. Assessment consisted of scoring according to Constant (CS) with measure of the working level (WL), computed as the product of shoulder elevation and the time spent at each level. All operated shoulders were reviewed at 6 and 12 months. WL was measured during 7- hour of daily activities and a symmetrical index (SI) in percent was computed to reflect the behavior of one arm in comparison to the other.
Results: In the control group, the mean CS was 90.7 ± 6 pts. The WL of the more active shoulder was on average 8 ± 22% higher than the controlateral one. In the patient group, the mean CS improved from 45.1 ± 19 pts to 60 ± 14 at 6 and 70.1 ± 15 pts at 12 months, respectively.
Conclusion: The working level allowed an objective evaluation of the shoulder activity during free moving condition. It represents the real use of the shoulder during daily activities. For someone able to use both arm equally, the symmetrical index of working level should be close to the 0 value. The evolution of the working level in patients operated for cuff tear showed a progressive improvement after the operation. However, at a minimum follow-up of 12 months after surgery, the behavior noticed on the healthy subjects was still not reached.

FM45

EMG activity of the supraspinatus muscle during rehabilitation using a new dynamic abduction brace for the shoulder (DABS)

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Introduction: Many shoulder surgeons prescribe an abduction brace or a pillow for the postoperative immobilisation after rotator cuff surgery. The aim of such a device is to decrease the tension in the musculotendinous unit and to protect the tendon repair during the initial phase of healing. The disadvantage is that additional tendons and muscles, which must not be protected, are immobilized too. We therefore designed a dynamic abduction brace for the shoulder (DABS), which allows to place the arm in 40 to 70 degrees of abduction and to perform active and passive movements in the shoulder and the elbow joint. A spring mechanism was used for passive abduction against gravity.
Methods: Fine wire EMG of the supraspinatus and infraspinatus muscles was performed in 12 volunteers. The EMG data were synchronized with an electromic goniometer. Measurements were made during active ADduction and passive ABduction of the arm in the scapular plane and in the sagittal plane, with use of the dynamic abduction brace. EMG activity was also recorded during maximum isometric contraction of the respective muscles.
Results: The supraspinatus muscle showed almost no activity during active ADduction and passive ABduction of the arm.
Conclusions: The dynamic abduction brace may be a useful tool for active rehabilitation after isolated supraspinatus tendon repairs.

FM46

Tendon retracts more than muscle in chronic tears of the rotator cuff: MRI assessment of full thickness supraspinatus tears

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Musculotendinous retraction is the limiting factor when repairing long-standing rotator cuff tears. To what extent muscle and tendon each contribute to this process is however unknown and of importance when deciding if and how to reconstruct. MRI of 130 shoulders with intact (n = 20) or completely torn supraspinatus tendons were analysed. The quality of the supraspinatus muscle was graded according to Goutallier (Grade 0–4: n = 15, 25, 24, 25, 15 patients respectively). Retraction of the tendon stump and of the musculotendinous junction was measured at the articular side of the tendon. Retraction of the tendon end was 3, 21, 26, 37 and 41 mm for the corresponding Goutallier stages 0 to 4 and the length of the tendon stump (distance tendon end to muscle) was 19, 13, 12, 11 and 8 mm in Goutallier stage 0 to 4 respectively. Permanent musculotendinous retraction in chronic rotator cuff tears results from structural shortening of the muscle fibers and of the tendon tissue itself. The here presented data confirm, that the residual tendon stump in a tendon tear does not have the length of the original tendon, and further shortens over time. This may be due to active shortening and contraction of the tendon tissue or due to attrition. However, direct anatomic tendon reinsertion will force the muscle to a greater length than what it would have been before the tear. This finding may help in understanding the difficulties when repairing long-standing tendon tears and to find strategies how to address them.

FM47

A modified rabbit model for rotator cuff tendon tears: Functional, histological and radiological characteristics of the supraspinatus muscle

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Background: Large animal models are often used to investigate rotator cuff pathology. With current, smaller animal models, quantitative information is often difficult to obtain. A well-defined, reproducible small animal model that allows quantitative assessment of musculotendinous changes would therefore be desirable.
Methods: The supraspinatus tendon was released by osteotomy of the greater tuberosity in 7 New Zealand rabbits. The musculotendinous unit was then allowed to retract during 6 weeks. Measurements of retraction by computed tomography(CT) were validated with measure-

ment of total length of the unit at sacrifice and by correlation to functional and structural properties of the unit at tendon release and at sacrifice.
Results: Retraction of the musculotendinous unit was 1.8 ± 0.2 cm on CT, negatively correlated to the total length at sacrifice (r = –0.87, p = 0.011) but not correlated to CT measurements of atrophy (r = 0.20, p = 0.699) or fatty infiltration (r = 0.13, p = 0.78). Muscle work decreased from 1.6 ± 0.23 Nm to 1.2 ± 1 Nm (p = 0.056). Muscle fiber diameter decreased significantly and was correlated to the amount of fatty infiltration (r = 0.79, p = 0.033).
Conclusion: Tendon release using osteotomy of the rabbit greater tuberosity allows to precisely measure musculotendinous retraction and offers the possibility for functional muscular testing. Changes in the rabbit supraspinatus muscle caused by myotendinous retraction correspond to those in established sheep models.

FM48

Anabolic steroids prevent muscle damage caused by rotator cuff tendon tear – An experimental study in rabbits

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Background: Following tear of their tendon, rotator cuff muscles undergo retraction, atrophy and fatty infiltration. These changes are inevitable, considered irreversible and limit the potential of successful repair of musculotendinous units. It was the purpose of this study to test the hypothesis that administration of anabolic steroids can prevent these muscular changes following experimental supraspinatus tendon release in the rabbit.
Methods: The supraspinatus tendon was released in 20 New Zealand rabbits. The seven animals in group I had no additional intervention, six animals in group II had local and seven animals in group III had systemic administration of nandrolone deconate during six weeks of retraction. At the time of sacrifice, in-vivo muscle performance as well as radiologic and histologic muscle changes were investigated.
Results: Supraspinatus retraction was significantly higher in group I (1.8 ± 0.2 cm) than in group II (1.5 ± 0.3 cm, p = 0.044) or III (1.2 ± 0.3 cm, p = 0.001). Histologically, there was no fatty infiltration in the treated groups II (p = 1.000) and III (p = 0.812), but in the untreated group I (p = 0.0312). The work of the respective muscle decreased markedly in groups I and II, and also but less so in group III.
Conclusion: Experimental**,** systemic administration of Nandrolone deconate substantially prevents deterioration of muscle performance and structure after tendon release and muscle retraction.

FM49

Osteochondral glenoid allograft for biological resurfacing of the glenoid – biomechanical comparison of novel design concepts

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Introduction: Biological resurfacing of the glenoid has hitherto failed to adequately restore the geometry and biology of the glenoid. We present a new concept for a press-fit osteochondral allograft glenoid replacement intended to restore the anatomical geometry of the glenoid with primary stability guaranteed by the construct through press-fit fixation alone.
Material and Methods: Five sawbone models of human scapulae and five models using sheep scapulae were prepared for testing of three different interface designs (cross, rectangle and dovetail). Micromotion at the graft interface was assessed in response to 1000 cycles of 30N shear and 100N compressive load, and maximal craniocaudal force was determined under 500N compressive load.
Results: In sawbones, micromotion ranged from 38 µm (cross) to 208 µm (rectangle) and decreased to 29 µm (cross) to 104 µm (rectangle) after 1000 cycles of applied shear force. In sheep bone, the range of micromotion was 15 µm (dovetail) to 51 µm (cross) and decreased to 15 µm (dovetail) to 44 µm (cross) after 1000 cycles; with the rectangle design, it decreased from 32 µm to 16 µm.
Conclusion: The concept of an osteochondral glenoid allograft for glenoid reconstruction is both technically feasible and demonstrates adequate primary stability in vitro. Micromotion decreases with exposure to repetitive shear forces, and this “graft seating” is a desirable effect.

FM50

Amplitude and strength of muscle contraction are reduced in experimental tears of the rotator cuff

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Background: Chronic tendon tears lead to retraction, fatty infiltration and atrophy of the respective muscle. These muscle changes are decision-making criteria in rotator cuff tear management. It was the purpose of this study, to investigate the *functional* implications of these morphological changes in a sheep rotator cuff tear model.
Methods: We established chronic retraction of the musculotendinous unit accompanied with fatty infiltration and atrophy of the infraspinatus muscle in 20 sheep. The contractile force and passive tension of the muscle as a function of its length were measured and the active work capacity determined.
Results: After tendon release and chronic retraction (by 5.7 ± 0.9 cm), fatty infiltrated and atrophied infraspinatus muscles (with a density of 22.4 ± 10.4 Houndsfields (HU) and a cross-sectional area of 65 ± 16% of the contralateral control side) had a mean contractile amplitude and strength of 2.7 ± 0.4 cm and 235 ±71 N, compared to the contralateral control shoulder of 4.1 ± 0.7 cm and 485 ± 78 N (p <0.05), respectively. The mean active work of the muscle was 2.8 ± 0.9 Nm for retracted and 8.8 ± 2.4 Nm for control muscles (p <0.05). The correlation of total active work to fatty infiltration (r = 0.78, p <0.01) was significant.
Conclusion: Chronic tendon tears are not only associated with retraction, fatty infiltration and atrophy but also with loss of strength and contractile amplitude. The functional changes can only indirectly and approximately be predicted by CT and MRI findings.

FM51

Mineralisation and mechanical strength of the subchondral bone plate of the glenoid cavity

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Background: Mineralisation distribution of the subchondral bone plate can be used as a marker for long-term stress distribution in diarthrodial joints. Severe injuries or pathological changes of the glenohumeral joint often end in osteoarthritis, where shoulder arthroplasty has become the treatment of choice. Therefore, preoperative information about stress distribution in the shoulder joint is recommendable to evaluate the risk of postoperative complications such as joint instability and glenoid loosening. The CT osteoabsorptiometry is a non-invasive method to determine the mineralisation of the subchondral bone plate in vivo. The aim of this study was to investigate the correlation between the mineralisation of the subchondral bone plate and the mechanical strength.
Methods: A total of 32 glenohumeraljoints were determined by CT-osteoabsorptiometry and indentation testing. The linear regression was used to compare the mineralisation and the strength of the subchondral bone plate.
Results: Our results showed two patterns of mineralisation distribution. 28 cavities could be attached to bicentric distribution pattern, 4 cavities showed a monocentric maximum. The correlation coefficient was determined between 0.62 and 0.96. The determination coefficient in our analyses was found to be between 0.39 and 0.91. The obtained information was statistically significant (P <0.02).
Conclusion: We demonstrated the statistically significant (P <0.02) correlation between mineralisation and strength of subchondral bone plate. All information obtained about the mineralisation allows to make conclusions about mechanical quality. These can be of great importance regarding the progression in shoulder arthroplasty.

FM52

IMPLEMENTATION AND VALIDATION OF A SYSTEM TO SIMULATE THE BIOMECHANICS OF BASIC AND PITCHING SHOULDER MOTION USING A CADAVERIC MODEL

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The glenohumeral joint has the greatest range of motion of any joint in the human body, demonstrating little intrinsic stability based on the articular congruency, and thereby increasing its susceptibility to injury. Superior labrum anterior to posterior (SLAP) lesions are especially common among high-performance overhead athletes (i.e., pitchers, quarterbacks and swimmers). To advance our understanding of this condition and other clinical problems of the shoulder, we have designed and implemented a highly accurate and precise system capable of differentiating motion trajectories of the entire shoulder griddle in an automated and repeatable fashion. To that end, the objective of this project is to validate the implementation of a system designed to analyze the biomechanics of the shoulder during basic shoulder motions and simulated pitching. The data reported in the present study have confirmed that this dynamic testing apparatus can be used to study shoulder kinematics in relevant clinical scenarios. The testing system is superior to current methods, because it evaluates both the glenohumeral and scapulothoracic articulations. Additionally, this system can reproduce an infinite number of basic and complex shoulder motions with high accuracy and precision. Using five high-speed, motion tracking cameras, data are collected in real-time while the mechanically-driven, computer-programmable motion pattern is repeated several times. Sequential repetitions (3 repetitions) and experimental conditions are readily compared and contrasted for kinematic deviations.

FM53

Prediction of Acute Cervical Myelopathy after a Minor Trauma to the Cervical Spine

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Introduction: Spinal canal stenosis has been identified as a risk factor for acute cervical myelopathy following a minor trauma (i.e. no fracture, no disco-ligamentous injury) to the cervical spine. The spinal-canal-to-vertebral-body ratio (Torg-Pavlov ratio) is often used to assess canal stenosis on conventional radiographs. However, the ratio does not appraise soft tissue stenosis and canal narrowing at the level of the intervertebral disc. We have therefore investigated the Torg-Pavlov ratio and the spinal canal diameter at the level of the intervertebral disc in patients suffering from acute cervical myelopathy after a minor trauma to the cervical spine. Secondly, the relevance of these parameters to predict the risk of myelopathy and the severity and course of symptoms was investigated.
Methods: Conventional radiographs and T-2 weighted MR images of the cervical spine (C3 to C7) were analyzed to determine the Torg-Pavlov ratio values and the spinal canal diameters at the level of the intervertebral disc in 52 patients with acute cervical myelopathy following a minor trauma (i.e. no fracture, no disco-ligamentous injury) to the cervical spine and in 131 control patients. Receiver operating curves were calculated for evaluating the classification accuracy of these parameters for predicting the risk of myelopathy and the severity and course of symptoms.
Results: The Torg-Pavlov ratio values and the disc-level spinal canal diameters in the myelopathy group were significantly (pHowever, there was no significant (p >0.9) difference in any parameter between the different ASIA impairment score groups. A cut-off value of 8.0 mm for the minimal sagittal disc-level canal diameter yielded the largest positive likelihood ratio for predicting myelopathy.
Conclusions: Magnetic resonance imaging is recommendable for assessing cervical spinal canal stenosis. Patients at risk of acute cervical myelopathy following a minor trauma to the cervical spine can be identified by applying a disc-level canal diameter cut-off value of 8 mm.

FM54

Development and Treatment of Neuropathic (Charcot) Arthropathy of the Spine in Patients with Spinal Cord Injury

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Introduction: Neuropathic (Charcot) arthropathy of the spine is a rare, but severe, progressive, degenerative disease. It is characterized by the destruction of the intervertebral disc and vertebrae, hypertrophic ossification, ossification of soft tissue, hyperkyphosis, instability and in some advanced cases pseudarthrosis. Neuropathic arthropathy develops in the absence of deep sensation in a joint, which is subjected to repetitive overload. There is a lack of data concerning the early signs and risk factors of Charcot's disease of the spine and the complications and outcome of surgical treatment.
Methods: The case histories of patients suffering from spinal cord injury who were admitted to the Swiss Paraplegic Centre from January 1, 1999 to December 31, 2010 and who were diagnosed with Charcot's disease of the spine were investigated. A total of 25 patients (18 male, 7 female) with 31 Charcot joints of the spine were identified.
Results: The majority (n = 22) of affected patients were paraplegics with an ASIA A impairment score (n = 19). Spinal cord injury (SCI) had mainly resulted from trauma (n = 16) or infection (n = 5). The most common symptoms were back pain, sitting imbalance, kyphosis and pressure sores. High intensity sport or vocational activities and laminectomy were identified as potential risk factors. Charcot joints were observed in the lumbo-sacral (n = 14), thoraco-lumbar (n = 9) and lumbar spine (n = 8). All Charcot joints occurred below the level of SCI and in the trauma patients below the initial fracture site. Charcot joints were located within or below an instrumented area of the spine. The time from SCI to diagnosis of a Charcot joint was on average 22.4 ± 12.1 years (4.9–39.9 years). Three patients were treated conservatively. The other underwent instrumented, multi-level, postero-lateral spondylodesis with additional anterior spondylodesis in four patients. The mean follow-up was 6.4 ± 4.1 years (1.0–16.0 years). Implant loosening in sacral (n = 6) and lumbar (n = 1) vertebrae, formation of a second Charcot joint (n = 2), infection (n = 1) and increased spasticity (n = 1) were identified as complications. In one patient, pain relief after surgery was not satisfying.
Conclusions: Surgical treatment achieved satisfying pain relief and sitting balance in the majority of patients. Spondylodesis including the sacrum showed a high complication rate (60%).

FM55

Influence of pedicle screw placement on the development of the immature vertebra: a prospective study using an in vivo porcine model

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Introduction: There is increasing awareness of the need for pedicle screw constructs in the treatment of spinal deformities in very young children. However, the long-term effects of pedicle screws on the immature spine are still unclear. We used a porcine model to analyze the morphological changes of the spinal canal and vertebral body in response to the placement of pedicle screws.
Methods: Thirteen newborn pigs were operated on. Each pig received a single pedicle screw at the L2 level. After a 10-fold increase in body weight (7 months later) the symmetry of the spinal canal and vertebral body was measured on CT scans of the investigational (L2) and control (L3) levels in terms of the angulation in the axial plane of the instrumented and non-instrumented halves of the vertebral body and spinal canal.
Results: After 7 months, the vertebral body (VBa) angle had reduced on the non-screw side and increased on the screw side, indicating asymmetry in vertebral body growth in the axial plane. The difference was significant (p = 0.009). However, there was no significant difference between the screw and non-screw sides for the spinal canal (SCa) angles at the L2 level at either the intraoperative or 7-month follow-up assessment (each p >0.05).
Discussion: Pedicle screws in the immature porcine spine have a significant effect on the development of the vertebral body. However, no corresponding alteration of the morphology of the spinal canal is observed. Our results may serve to encourage spinal surgeons to make decisions in favour of using pedicle screw instrumentation in very young children when considering the treatment options and weighing up the risks of surgery and observation.

FM56

Does lumbar facet joint effusion on MRI reflect «instability» in lumbar degenerative spondylolisthesis?

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Introduction: The term "segmental instability" of the lumbar spine is not clearly defined, even for lumbar degenerative spondylolisthesis (LDS). This makes it difficult to compare outcomes after different types of surgical treatment. Facet joint effusion observed on supine MRI and its relationship to the difference in slip between standing and supine postures was investigated as a possible sign of instability in LDS.
Patients and Methods: Patients that had undergone decompression only or decompression with instrumented fusion for LDS with different degrees of narrowing of the spinal canal, were identified retrospectively from our spine surgery database, part of the SSE Spine Tango Registry. All had preoperative upright x-rays in ap and lateral views as well as supine MRI. The imaging studies were assessed for the following parameters: percent slip, absolute value of

facet joint effusion (separately on right and left sides), facet angles, degree of facet degeneration and spinal canal narrowing, disc height, and the presence of facet cysts.
Results: 160 patients fulfilled all admission criteria (119 female, 41 male, mean age 68.8 years, range 38.8 to 89.3 years). 40 patients showed no facet joint effusion, and in these the difference in the values for the percentage slip on upright x-ray and percentage slip on supine MRI was ≤3%. A further 12 patients also showed a difference ≤3%, but showed some fluid in the joints (0.44 ± 0.38 mm). In 108 patients, the difference in the % slip measured on x-ray and on MRI was >3% (mean 10.6%, range, 4 to 29%) and was associated with a mean facet effusion of 2.15 ± 0.85 mm. The extent of effusion showed a high, significant correlation with the relative slip difference between x-ray and MRI ($r = 0.82$, $p = 0.0001$).
Conclusion: Facet joint effusion is clearly correlated with spontaneous reduction of the extent of slippage in the supine position compared to the upright position. Where either of these signs might serve as an indication for fusion in LDS will be investigated in a subsequent clinical study.

FM57

Type II Odontoid Fractures in the Elderly Patient: Do we always have to operate?

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Introduction: Type II odontoid fractures have the tendency nearly always to develop a pseudarthrosis. Consecutive chronic mobility can lead to cervical myelopathy. Therefore this type of leasion is usually stabilized operatively by anterior screw fixation or atlantoaxial fusion. The risks of such operations are high, especially in the elderly population with a mortality rate of up to 10%. We therefore rise the question if a type II odontoid fracture in the elderly, particularly in inactive patients with several comorbidities, may as well be treated conservatively considering the fact, that a cervical myelopathy due to a dens pseudarthrosis evolves if at all with a latency of 10 or more years.
Material/Methods: In this retrospective cohort study, we followed up all patients with a type II odontoid fracture treated conservatively in our hospital from 2000 to 2009. All patients were at the time of the fracture (mostly falls) 70 years of age or older (70–93 years, average 84,5). The reasons for a conservative treatment at the time were inactive patients with comorbidities causing a high perioperative risk or a refusal of the suggested surgery. Treatment was with a SOMI-Brace, a Philadelphia collar or a soft collar for 8–12 weeks. For the radiologic evaluation, ap, lateral and open mouth as well as lateral radiographs in extension and flexion were done. The clinical assessment consisted of a clinical exam, the European Myelopathy Score, the Neck Disability Index.
Results: At the time of follow up in 2010, 19 of 32 patients had died of non fracturerelated causes (i.e. cardial, pneumonia, tumors, etc.). The mean survival time was 13,5 months (2 to 37 months). The mean follow up of the 13 patients who survived was 54 month (17–109 months). Only 3 patients reported some mild neck pain with no regular use of analgetics. All fractures developed a pseudarthrosis with a maximal translation of 6 mm. In none of the patients there was clinical evidence of a cervical myelopathy.
Conclusion: The conservative treatment of type II odontoid fractures in elderly, low demand patients especially with comorbidities and a high risk of peripoperative complications is acceptable even considering the fact that a more or less mobile pseudarthrosis will almost certainly develop. In all other patients an operative stabilisation should be the treatment of choice.

FM58

Influence of the morphology of the dural sac on surgical decision making in lumbar spinal stenosis

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Introduction: Surgical decision making in lumbar spinal stenosis (LSS) takes into account primarily clinical symptoms as well as concordant radiological findings. We hypothesized that a wide variation of operative threshold would be found in particular as far as judgment of severity of radiological stenosis is concerned.
Patients and methods: The number of surgeons who would proceed to decompression was studied relative to the perceived severity of radiological stenosis based either on measurements of dural sac cross sectional area (DSCA) or on the recently described morphological grading as seen on axial T2 MRI images. A link to an electronic survey page with a set of ten axial T2 MRI images taken from ten patients with either low back pain or LSS were sent to members of three national or international spine societies. Those 10 images were randomly presented initially and re-shuffled on a second page including this time DSCA measurements in mm^2, ranging from 14 to 226 mm^2, giving a total of 20 images to appraise. Morphological grades were ranging from grade A to D. Surgeons were asked if they would consider decompression given the radiological appearance of stenosis and that symptoms of neurological claudication were severe in patients who were otherwise fit for surgery. Fisher's exact test was performed following dichotomization of data when appropriate.
Results: A total of 142 spine surgeons (113 orthopedic spine surgeons, 29 neurosurgeons) responded from 25 countries. A substantial agreement was observed in operating patients with severe (grade C) or extreme (grade D) stenosis as defined by the morphological grade compared to lesser stenosis (A&B) grades ($p<0.0001$). Decision to operate was not dependent on number of years in practice, medical density in practicing country or specialty although more neurosurgeons would operate on grade C stenosis ($p<0.005$). Disclosing the DSCA measurement did not alter the decision to operate. Although 20 surgeons only had prior knowledge of the description of the morphological grading, their responses showed no statistically significant difference with those of the remaining 122 physicians.
Conclusions: This study showed that surgeons across borders are less influenced by DSCA in their decision making than by the morphological appearance of the dural sac. Classifying LSS according to morphology rather than surface measurements appears to be consistent with current clinical practice.

FM59

A high pelvic incidence and low lumbar lordosis predispose to adjacent segment degeneration after lumbar spinal fusion

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Introduction: Adjacent segment degeneration (ASD) is a commonly observed long-term consequence after spinal fusion. The significance of the spinal sagittal profile has been suggested before, but no correlation of spino-pelvic parameters such as pelvic incidence with ASD has been established so far. Here, we report on a pelvic incidence-lordosis imbalance in patients that developed ASD vs. patients without ASD over a 10 year follow-up period.
Methods: 140 patients were identified with a 10 year follow-up after lumbar spinal fusion. Out of the 140, 21 patients (15%) had revision surgery due to ASD. Of 13 patients with one or two-segment fusions radiographs could still be retrieved after 10 years and were therefore included in the study (ASD; n = 13). An age- and gender-matched control group was selected (CTRL, n = 13) in the remaining 119 patients which did not have lumbar revision surgery in the follow-up period, which was also matched according to preop MRI. The average age in both groups is 61 years and 9 patients are female in each group. Several radiographic parameters were measured on pre- and postoperative radiographs including lumbar lordosis (LL), pelvic incidence (PI) and tilt (PT) and lumbar sagittal balance. Statistical analysis was carried out using SPSS 18 for Mac.
Results: The patients in the ASD group underwent revision on average after 58 months (20-125). PI, LL and lumbar sagittal balance did not change from preop to postop in both groups. Significant differences between the groups were seen for PI (ASD 63.8° ± 6.3, CTRL 49.9° ± 13.0; $p = 0.004$) and sagittal lumbar balance (ASD 9.35 mm ± 10.2, CTRL 0.4 mm ± 11.6; $p = 0.02$). In the CTRL group, lumbar lordosis corresponded to pelvic incidence ($r = 0.56$; $p = 0.04$), which was not the case for the ASD group ($r = 0.07$; $p = 0.81$). The difference of PI and LL was significant between the two groups (ASD 20° ± 11.2, CTRL 4.75° ± 12.1; $p = 0.04$). If a difference of >=20° is chosen as a predisposing factor, 7 patients are identified in the ASD as opposed to 1 patient in the CTRL group (specificity 92%, sensitivity 54%, positive predictive value 88%, relative risk 14).
Conclusion: In degenerative disease of the lumbar spine a high pelvic incidence with low lumbar lordosis and positive lumbar sagittal balance seems to predispose to adjacent segment degeneration after spinal fusion. A pre-operative difference between pelvic incidence and lumbar lordosis >20° bears a higher risk of adjacent segment degeneration.

FM60

Direct Comparison of Two Biomechanically Different Total Disc Replacement Devices: 5- to 7 Year Followup Comparing ProDisc versus Charité

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Randomized trials have reported total disc replacement (TDR) to produce results similar or superior to lumbar fusion. Reported results for various TDRs appear to be similar, but differences in study designs and outcome measures make device comparisons difficult and inaccurate. The study was started in 2000 comparing the unconstrained Charité total disc with the semi-constrained ProDisc, and interrupted in

2003 due to a reimbursement stop. The moratorium resulted in the national mandatory SWISSspine registry for TDRs. This study was a prospective, randomized trial for comparison of two lumbar TDR devices. Seventeen patients received a Charité and 23 patients a ProDisc-L artificial disc. All patients were treated for single-level symptomatic disc degeneration by one surgeon. Outcome measures were VAS based pain assessment, the NASS scores and re-operations at the index and adjacent segment. Data were prospectively collected before surgery, at 6 months and at 5 to 7 years postoperatively. There were no significant differences between the groups regarding surgical characteristics. Significant and clinically relevant reduction of low back and leg pain from preop to 6 months and to 5–7 years followup was observed in both groups. In the ProDisc group back pain reduced from 66 preop to 21 at 6 months and 16 at 5–7 years followup and leg pain from 63 over 22 to 25 VAS points, respectively. Similarly, in the Charité group back pain reduced from 66 preop to 22 at 6 months and 25 at 5–7 years followup and leg pain from 52 over 16 to 20 VAS points, respectively. All NASS scores improved significantly at 6 month followup and remained with slight changes till 5–7 year followup. Re-operations at the index level were 1 secondary fusion in the ProDisc (4%) and 1 decompression and 1 early devise exchange in the Charité group (11.7%). Re-operations at the adjacent level were 1 TDR and 1 decompression in the ProDisc (8.7%) and 1 fusion and 1 decompression in the Charité group (11.7%). Comparison of two groups regarding all outcome measures showed no significant differences, though the power of comparisons was low due to low patient numbers. The long-term investigation found the devices producing both excellent and stable clinical outcome. The reoperation rates at the index and adjacent levels were comparable. No significant difference for comparison of any of the outcome measures was observed. Larger patient series are necessary for supporting these results.

FM61

Benchmarking across Spine Registries: Comparison of Pain Alleviation after Lumbar TDA and ALIF with stratification by Surgeon

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"Treatment success" may be influenced by a multitude of factors and is rarely defined. Physicians are doing their best according to knowledge and conscience. In this study back pain alleviation after total disc arthroplasty (TDA) in the SWISSspine registry was defined as success criterion and an anonymized benchmarking analysis stratified by surgeon was performed. In November 2010 15 of 49 documenting surgeons in the lumbar SWISSspine registry, who had ≥10 cases registered, had collected a total of 415 interventions with single level TDA. Mean age was 42 years (19-65yrs) for both genders, 59% were females. In the same time 51 cases with anterior lumbar interbody fusion (ALIF) were documented in the international Spine Tango registry and used as comparator group. Mean age was 47 years (21–80 yrs), similar for both genders, 37% were females. The average follow-up time in both samples was 1 year. Comparison of back pain alleviation for each TDA surgeon and the ALIF sample was performed. Generalized linear modeling adjusted and not adjusted after preop pain was used to calculate probabilities for achievement of minimum clinically relevant pain alleviation (MCRPA) of 18 points for each surgeon. Mean preop back pain in SWISSspine reduced from 69 to 31 points at one year (Ø Δ 38 points), and in the ALIF sample from 67 to 29 points (Ø Δ 38 points), respectively. The average back pain alleviation stratified by surgeon ranged between 12 and 61 points. The proportion of patients reaching MCRPA ranged between 36 and 100%. There was a considerable range of proportions of patients under the average preoperative back pain of 69 points (9–65%). The calculated probabilities for the achievement of MCRPA of 18 points without adjustment by preop back pain ranged between 42 and 100%, and with adjustment between 35 and 100%. There were surgeons who had good patient selection, indicated by lower adjusted probability which reflects worsening of their outcomes if they had treated an average patient sample. Some surgeons had higher adjusted probabilities indicative of lower preop pain values in their patient sample compared with an average patient value. ALIF had similar pain alleviation than TDA. Differences in surgeons' patient selection based on back pain were revealed. Some surgeons seem to miss the full pain alleviation potential by selection of patients with lower preoperative pain levels.

FM62

Changes in Health Related Quality of Life (HRQL) after Spinal Fusion and Scoliosis Correction in Patients with Cerebral Palsy

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Background: Literature is scarce on the impact of spinal fusion for scoliosis in patients with cerebral palsy (CP) regarding the health related quality of life (HRQL). The purpose of this study was to evaluate the outcome of surgical scoliosis correction measured by the subjective change in the HRQL and the objective radiological changes. Factors that could influence the subjective outcome were examined to investigate their correlation to the results of HRQL.
Methods: A retrospective review of 50 consecutive patients with CP, who had spinal fusion for scoliosis with minimal 2 year follow-up. Radiographic data were obtained from preoperative, postoperative and last follow-up examinations. The assessment of the HRQL was done through a modified version of the Caregiver Priorities and Child Health Index of Life with Disabilities»(CPCHILD) questionnaire, assessed by the caregivers of the patients.
Results: There was a significant improvement ($p = 0.001$) of HRQL after the operation. The satisfaction rate of the patients with the outcome of the operation was 91.7%. There was an average of 64.3% scoliosis correction, 57.7% pelvic tilt correction, 53% improvement of apical vertebral rotation, 67.2% improvement of apical vertebral translation. At the last follow-up the average scoliosis angle was 32.0°, pelvic tilt was 8.8°. Weak but not significant correlation between the amount of scoliosis correction and the subjective change in the HRQL could be established ($R^2 = 0.321$, $p = 0.078$). No correlation between the occurrence of complications and changes in the HRQL ($p = 0.122$) or the satisfaction rate with the outcome of the operation ($p = 0.764$) was found. Extension of spinal fusion to sacropelvis had no influence on the occurrence of complications ($p = 0.42$) or on the changes in HRQL ($p = 0.71$).
Level of Evidence: Therapeutic-level IV, retrospective study.

FM63

CT based patient-specific cutting blocks for total knee arthroplasty: technique and preliminary radiological results

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Introduction: Accuracy in component positioning for total knee arthroplasty (TKA) remains a major concern. Computer-assisted surgery improves the precision significantly compared with standard manual techniques. However, computer navigation has limitations such as investment costs, longer operation time and additional complication risks. The technology of polyamide laser sintering to create patient-specific orientation tools according to preoperative CT-data has been emerging. Here we present our experience with the MyKnee technique (Medacta International SA) which combines the guidance block and cutting block in one.
Methods: A preoperative CT scan is used to define simultaneously the hip-knee-ankle axis (HKA) and to create tridimensional bone model of the patient specific knee anatomy. By Internet, the surgeon can plan the operation according to his preferred landmarks. After a standard surgical approach the sterilized cutting blocks are mounted to the tibial plateau and the distal femur, adapted to unambiguous bony landmarks such as prominent osteophytes and an extramedullar position control can be performed. After pinning, the cuts are performed directly through that block. Further surgical steps are following according standard techniques. The first clinical and radiological control of the patient was six weeks postoperative. The radiographs are analyzed for the HKA and the positioning of the femoral and tibial components in comparison to the preoperative planning.
Results: Until January 2011, 49 patients (53 knees, 33w, 16m; mean age 69.9 years) have been operated with the new MyKnee technique by two experienced surgeons. In two patients the definitive implant size differs from the preoperative planning. The mean HKA preoperative was 181.6° (± SD 7.5°) postoperative a mean HKA of 179.6° (± SD 2.0°) was reached. The difference between the planned and the realized posterior tibial slope was on average 1.0° (± SD 2.8°). The flexion of femoral component differs from the planning 0.4° (± SD 1.8°) The mean operation time was 79 minutes (± SD 18 minutes).
Conclusion: Our preliminary experience indicates that the MyKnee technology of CT-based patient-specific cutting blocks represents a reliable and straightforward technique, equal in precision to computer-assisted total knee replacement. Through the reduced number of operating steps and instruments the operation time could be shortened.

FM64

Ligament balanced unicondylar knee prosthesis: first 5 year follow up results in a multicenter study of 178 cases

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Introduction: Advantages of unicondylar knee replacement surgery are reduced bone resection and better postoperative rehabilitation seen in Knee Society Score (KSS). But surgical technique is demanding and revision surgery often necessary. To simplify surgery a soft tissue balancing technique with use of a ligament tensor was established. Aim of this study was to prove if the intraoperative use of the tensor achieves constant and reproducible results in implanting unicondylar knee prosthesis.
Methods: A prospective study with 178 consecutive cases (160 patients) in 3 clinical centers in Europe and Australia was established. Surgical treatment was done between 11/2003 ? 12/2005, the indications were primary gonarthrosis (89%), secondary gonarthrosis (5%) and Mb. Ahlbäck (6%). Patients were treated with fixed (n = 54) or mobile (n = 124) bearing PE (balanSys® UNI, Mathys AG Bettlach). During implantation a calibrated ligament tensor was used, which allows osteotomy under defined tension force. To keep kinematic conditions during implantation the instrument takes over the extension gap into the flexion gap. Clinical and radiological results were reviewed 6 weeks, 3, 6, 12, 24 and 60 months postoperatively.
Results: 93 patients were clinically and radiologically reviewed 5 years postoperatively. The mean passive flexion gap did not change from pre- to postoperative (124° and 125°, respectively). KSS improved from 121 points (42–108) preoperative to 186 points (125-200) postoperative. Complications were seen in 6 cases with the mobile bearing system, 6 prostheses had to be revised. No clinical difference was seen after 2 and 5 years between the mobile and fixed bearing inlay. After 5 years there was also no significant difference in KSS between the clinical centers.
Conclusion: The soft tissue balancing technique with use of the unicondylar ligament tensor achieves satisfying and reproducible clinical results. No difference was seen between fixed and mobile bearing PE inlay. Long term results are required to analyse PE wear rates and survivorship.

FM65

The position and orientation of total knee components: a comparison of conventional radiographs, transverse 2D-CT slices and 3D-CT

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Routine assessment of component position after TKA is performed on radiographs or 2D-CT. The rotational alignment may be more accurately assessed on 3D-CT. The purpose of this study was to evaluate which of these methods were fit for the purpose of documenting the position and orientation of TKA. We therefore set out to establish the intra- and inter-observer reliability of tibial and femoral component measurements after TKA using radiographs, 2D-CT and 3D-CT. 30 knees after TKA were assessed using radiographs (TKA-RESS), 2D-CT and 3D-CT. For femoral sagittal TKA alignment the angle between the femoral midshaft and neutral line, for tibial sagittal TKA alignment the angle between the tibial midshaft and an anterior posterior tangent was determined. For femoral coronal the angle between the femoral midshaft and a tangent of the distal prosthesis and for the tibial coronal alignment an angle between the tibial midshaft and a tangent of the prosthesis plateau was measured. The rotational alignment of the femoral component was assessed on 2D-CT (Berger et al.). The sagittal, coronal and rotational alignment of the TKA was assessed on 3D-CT. The rotational position of the femoral component of the TKA was measured in relation to the epicondylar axis, of the tibial component in relation to the posterior tibial plateau axis. Measurements were performed three times by one orthopaedic surgeon for intra-observer reliability and then repeated by one orthopaedic surgeon and one radiologist. Sample size was calculated. The median differences and the inter- and intra-observer reliability (ICC) were determined. To be fit for the purpose, a method had to have an ICC >0.61 in all measures. Plain radiographs were highly reliable at measuring the tibial slope, but very variable in all other measurements. 2D-CT showed wide variability. 3D-CT was highly reliable, even when measuring rotation of the TKA. Inter-observer variability in the measurements on radiographs (0.65–0.82) and rotational measurements on 2D-CT (ICC 0.29) were variable. On 3D-CT they were near perfect (ICC 0.89–0.97) and significantly more reliable than 2D-CT. 3D-reconstructed images are sufficiently reliable to enable reporting of the 3D position of TKA. Rotational measurements in particular should be performed preferably on 3D-reconstructed CT. When faced with clinical decision making which may have profound consequences for the patient, we now recommend 3D-CT as the investigation of choice.

FM66

The impact of femoral component rotation on patellar tracking: Does internal rotation of the femoral component always lead to disturbed patellofemoral positioning? A prospective analysis?

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Introduction: Patellofemoral complications remain a very common post-operative problem in association with total knee arthoplasty (TKA). As malrotation of the femoral component is often considered crucial for the outcome, we analyzed absolute rotational femoral alignment in relation to patellar tracking pre- and postoperatively and matched the results with the two year functional outcome.
Methods: Femoral rotation and component rotation was assessed by axial radiography using condylar twist angle (CTA). The lateral patellar displacement, patellar tilt and Insall-Salvati index were measured on conventional radiographs. All assessments were done pre-operatively and at 2-year follow up. The series included 48 consecutive TKA (21 men, 27 women) performed at a single high-volume joint-replacement-center in 2008. All operations were performed using a tibia first? ligament balancing technique without patella resurfacing. The implant used was a condylar unconstrained ultracongruent rotating platform design. Outcome was assessed using the international knee society score (KSS) and the Kujala Score for anterior knee pain.
Results: Preoperative CTA showed 6.4°±2.5° (X±SD) of internal femoral rotation (IR) (range, 1° of external rotation (ER) to 12° of IR) compared to postoperative CTA of 3.9° ± 2.98° (X±SD) of IR (range, 9.5° IR to 3.8° of ER) Preoperative patella lateral displacement showed a mean of 1.1 mm (–2 mm, 6 mm), compared to postoperative patella lateral displacement with a mean of 1.7 mm (-3 mm, 6 mm). Postoperative mean patella tilt was 6.65° (1.8°, 11.7°) postoperatively compared to 8.55° (4.3°,11.5°) preoperatively. No correlation was found between CTA post surgery and patella positioning (r = 0.034, 95% CI). IR of the femoral component >3° did not show increased patella lateral displacement/tilt compared to 0° or ER. No correlation was found between the Kujala score and internal rotation of the component (r = 0.082, p = 0.05). At 2 year post OP KSS reached >185 of max. 200 points in over 82% of patients.
Conclusion: The influence of IR of the femoral component on patellofemoral kinematics remains controversial. As demonstrated, IR does not imperatively lead to patella maltracking and/or patellofemoral symptoms. Functional outcome in this series shows that relative rotation of the femoral component in accordance with natural variations as seen in the pre-operative assessment allows for good and excellent results.

FM67

Hot Patella And Secondary Patellar Resurfacing: Outcome, Risk Factors And Analysis Of Factors Predicting Outcome

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Abstract: The role of secondary patellar resurfacing in patients with persistent anterior knee pain following an unresurfaced total knee replacement (TKR) remains unclear. In an attempt to find factors predicting the outcome of secondary resurfacing we analysed the demographics, outcome and radiographic characteristics of 32 knees who had secondary resurfacing after an unresurfaced Innex TKR. 27 knees had a preoperative bone scan showing a hot patella in 26 knees. The rate of secondary resurfacing was 1.0%. The knees were compared to a matched control group of the remaining non resurfaced TKRs (n = 3470) and primarily resurfaced TKRs (n = 105). The secondarily resurfaced knees had hardly any benefit after the initial TKR (KSS pre TKR: 115 ± 27, post TKR: 125 ± 20), but had substantive improvement after secondary resurfacing (2ndyPR), achieving knee scores (173 ± 22) statistically not different to the remaining unresurfaced (180 ± 24) and primarily resurfaced TKRs (183 ± 22). Pain scores (1 to 5) on walking (post TKR: 4.1 ± 1.0, post 2ndyPR: 1.7 ± 0.9) and stair climbing (post TKR: 3.8 ± 0.9, post 2ndyPR: 1.7 ± 1.1) improved dramatically, but were slightly worse than the unresurfaced (post TKR Walking: 1.2 ± 0.5, Stairs: 1.3 ± 0.6) and primarily resurfaced knees (post TKR Walking: 1.1 ± 0.4, Stairs: 1.2 ± 0.4). 29 of 32 knees had an improvement in the KSS score of more than 20 points. The knees that benefitted from secondary resurfacing had a larger patellar tilt and overhang compared to a matched control group. No differences with respect to age, sex, BMI, valgus/varus alignment, height of joint line, patellar thickness and patellar height were found.

FM68

Early Results of 209 Consecutive Journey BCS® Knee Replacements

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Introduction: New designs in total knee replacement are expected to lead to better function with more flexion due to better biomechanics. Whereas this is still not proven the question remains if more aggressive kinematics in TKR could lead to more complications and a steeper learning curve.
Methods: In 178 patients (118 female, 60 male) with a mean age of 67.8 years with gonarthritis 209 Journey BCS® total knee arthroplasties were implanted (Smith & Nephew, Memphis, USA). All operations were performed by one single surgeon. The first 103 cases were operated with a conventional instrumentation. The following 106 knees were operated with computer navigation (PI Galileo®, Smith& Nephew, Aarau, Switzerland).
Results: The mean flexion increased from in mean 111° to 126.2° and 130.3° 2, 4 and 12 months respectively. The mean KSS was 115.6 points preoperatively and 174 points after 1 year. Overall 17 complications had to be registered. These consisted in 5 friction of the iliotibial band, 4 stiff knees (flexion
Conclusion: With a Journey BCS® knee one can expect a mean flexion of 130° one year after surgery. The complication rate overall was 8.1%, fell from 14.6% in the first series to 1.9% in the second one. The knee can be implanted safely with conventional or computer assisted navigation. The excellent Journey BCS® knee kinematics seems to lead to a less forgiving system which leads to a steep learning curve with an increased complication rate.

FM69

Radiological Evaluation of 194 Consecutive Journey BCS® Knee Replacements

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Introduction: The value of computer navigation in total knee replacement is still under discussion concerning precision and clinical outcome. Major interest would focus on the restoration of axis and a correct tibial slope as the rotational alignement of the femoral component is still debated.
Methods: In 178 patients (118 female, 60 male) with a mean age of 67.8 years with gonarthritis 209 Journey BCS® total knee replacements (TKR) were implanted (Smith & Nephew, Memphis, USA). All operations were performed by one single surgeon. The first 103 cases were operated with a conventional instrumentation. The following 106 knees were operated with computer navigation (PI Galileo®, Smith& Nephew, Aarau, Switzerland). In both groups femoral rotation was defined by combining bony landmarks with the use of a tensioner. Radiological controls were performed pre- and postoperatively and 2 and 12 months after surgery. Long leg stance x-rays were available preoperatively and 1 year after surgery.
Results: 194 TKR's could be included in this study. In the non-navigated group (99 TKR) the mean age was 68.8 years, in the navigated group (95 TKR) 65.6 years. The femoral component angle for varus/ valgus and flexion/ extension did not differ between the non-navigated and the navigated group. In 97% the medial femoral angle ranged between 95° and 100° and the flexion angle between 87° to 95°. The tibial components were placed with a medial angle from 89° to 91° in 82% of the cases in both groups. Even the tibial flexion angle did not differ significantly and ranged from 87° to 90° in 85% of the cases.
Conclusion: In 99 non-navigated and 95 navigated TKR the radiological results did not differ significantly for varus/ valgus or flexion/ extension alignment of the femoral and tibial components respectively. The conventional instrumentation with extramedullary alignment at the tibia and intramedullary at the femur seem to give consistently accurate results which could not be improved by the use of a time consuming CT-less navigation.

FM70

The Clinical Effect of Radiosynoviorthesis in Painful Total Knee Arthroplasty in mid term follow up

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Introduction: The painfull total knee arthroplasty is a problem influenced by many factors. In the last years chronic synovialitis was addressed as one of the mainfactors causing persisting postoperative knee pain. The radiosynoviorthesis of inflammatic joints is one of the standard procedures in rheumatology. It was the aim of this retrospective study to analyze the clinical effect of intraarticular radiosynoviorthesis in the treatment of painful total knee arthroplasties regarding to its postinterventionel ouctome.
Methods: At a mean follow-up interval of 3,6 years, we retrospective analyzed 38 knees in 38 patients with painful total knee arthroplasties treated with radiosynoviorthesis. In all cases the common reasons for persisting pain like infection, instability, malpositioning and subsequent mechanical problems (malrotation, component loosening) were excluded by clinical- and radiographical analyses (x rays and rotation-CT) and punction and of the joint. The history of persisting pain in all cases was longer than 6 months. Prior to invention all patients got an full body 3-phase-scintigraphy confirming the diagnosis of an synovialitis. All patients underwent radiosynoviorthesis with a standard protocol with Yttrium-90. Postinterventional complications, number of re-interventions and clinical outcome were analyzed.
Results: No complications were registered peri-and postinterventional. No full regression of pain could be achieved by radiosynoviorthesis. Patients were conducted for a triple injection therapy but they abandoned in 32 of the cases. There was a mean of 1,7 injections per knee and patient(In 6 cases (16%) 3 injections, in 14 cases (37%) 2 injections, and in 18 cases (47%) 1 injection). In 20/38 patients(53%), the knee was re-operated (18 x change of prosthesis, 2 x debridement) even if no mechanical problem was obvious. In 5/38 patients(13%) analgetics were extended, in 4/38 cases (11%) other reasons for persiting pain (1x psoriasis arhtritis, 3x component loosening) were later found up to mid-term follow up. In 9/38 patients(24%) we couldn't find any reasons for persisting pain.
Conclusion: The painful total knee arthroplasty is a multifactorial problem which has to be achieved precisely. In these patients, radiosynoviorthesis has no complications and no or little clinical effect. The reasons for the unsatisfying results even with proven synovialitis remain unclear and have to be investigated in further studies.

FM71

Reinforcement of the Extensor Apparatus with a Polyester Ligament in Revision Knee Arthroplasty

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Introduction: The failure of the extensor apparatus (rupture of the patellar ligament and or the quadriceps tendon) is a serious complication after a primary or revision total knee arthroplasty.
Methods: We report about 4 cases out of 27 revision knee arthroplasties operated between September 2008 and December 2010 where the extensor apparatus was reinforced or reconstructed with a polyester ligament (LARS, Vertriebs GmbH, Vienna, Austria). The proximal fixation was performed with non-resorbable sutures to the muscle belly and tendon of the quadriceps including 2 transosseous non-resorbable sutures at the level of the patella and at the tibial tuberosity respectively.
Results: In all 4 cases the reconstruction led to an excellent function of the extensor apparatus with an extension lag of less than 10° and regaining the capacity to walk and mount stairs.
Conclusions: The incidence of extensor apparatus problems (rupture, insufficiency of patellar ligament and or quadriceps tendon) in our small collective of 27 revision knee arthroplasties was 15%. A polyester ligament is an excellent option to reconstruct or reinforce the extensor apparatus at the knee level. A further augmentation with viable tissue is not necessary even when no other local structures are left. The ligament is expensive and can only be used in non-infected conditions. The distal fixation at the tibial tuberosity is more vulnerable than the ones at the patella or quadriceps.

FM72

Patellar tracking before and after a Patellofemoral joint replacement (Depuy Sigma) – a cadaveric study using computer navigation

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Introduction: Patellofemoral replacements (PFR) have had a recent resurgence in the treatment of isolated patellofemoral arthritis. The patellar tracking in total knee replacements has been extensively studied, but little is known about the patellar tracking in isolated patellofemoral replacements. To our knowledge there is only one limited study which looked at the tracking of four different patellofemoral replacements in one cadaver each (n = 1) and has thus a limited value (Amis et al. 2005). We compared patellar tracking and the position of the patellar groove in the natural knee, followed by implantation of the femoral component of the PFR (patella unresurfaced) and after implantation of the femoral & patellar component of the PFR.
Methods: Computer navigation was used to track the patella in eight whole lower extremities still attached to the torso of four cadavers in the natural knee, in the same knee with a femoral component of the

PFR (PFR-P) and in the same knee with the femoral and patellar component of the PFR (PFR+P, patella resurfaced) (Depuy Sigma PFR). The form and position of the trochlea in the natural knee and the patellar groove of the femoral component of the PFR was also analysed. Values are means+/-SD, two tailed Student's t-test for paired samples.
Results: With a PFR-P the patella had a slightly more lateral tilt than the natural knee (1.5 ± 0.9° to 2.8 ± 2.5° at 40–90° of flexion, pNo differences in patella rotation were seen between the three groups. In the PFR-P group the patella tracked a little more medially compared to the natural knee (1.1 ± 1.3 mm to 2.5 ± 2.6 mm, pWhen analysed relative to the patellar groove of the trochlea/femoral component the patella in the natural knee (2.0 ± 1.7 mm to 2.9 ± 2.0 mm at 50–100° pThe patella groove on the natural knee and the implanted femoral component of the implanted PFR had the same radius, inclination relative to the femoral mechanical axis, antero-posterior position and medio-lateral orientation.
Discussion: The patella groove on the femoral component of the PFR reproduces the natural trochlear anatomy well. Patella tracking in the PFR-P shows only minor differences compared to the natural knee. Resurfacing of the patella in the PFR+P group causes the patella to tilt a little more laterally and track a little more medially, but this allows the patella to follow the patellar groove on the femoral component better than in the natural knee.

FM73

3D representation of the articular surface topography of normal and dysplastic patellofemoral joint using MRI

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Background: The conventional imaging of the patellofemoral joint is in 2D (two-dimensional) or in 3D (three-dimensional) for osseous contours only. There does not exist a 3D representation of the articular surface topography of patellofemoral joint.
Objective: The aim of the study was to represent the articular geometry of both the normal and the dysplastic patellofemoral joint in 3D using magnetic resonance imaging (MRI).
Methods: The reconstruction was based on MRI scans. The 3D reconstruction of the distal femur and the patella was performed with the segmentation software AMIRA (Mercury Computer Systems, Inc., Chelmsford, USA). Bone and cartilage of the distal femur and patella were traced slice by slice in the acquisitioned dimension while the AMIRA program reconstructed the 3D model. This 3D model was then transferred to the Rinoceros 4.0 (Robert McNeel & Associates, Seattle, USA) software for measuring.
Results: Using this method, a non-invasive 3D representation of normal articular patellofemoral joint geometry and different types of malalignment or mismatch of the joint surfaces could be shown.
Conclusion: With this non-invasive MRI based 3D display of the articular cartilage and underlying bone of the patellofemoral joint a description and comparison of normal geometry and different types of trochlear dysplasia can be achieved. Improved preoperative planning according to the documented pathomorphology is possible. Furthermore, the pre- and postoperative joint alignment and with this the result can be compared.

FM74

3D representation of the surface topography of normal and dysplastic trochlea using MRI

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The three-dimensional (3D) image of the articular surface topography of the normal and the dysplastic trochlea has not been defined. The aim of the study was to represent both the normal and dysplastic trochlear geometry in 3D using magnetic resonance imaging (MRI). Using the segmentation software program Amira (Mercury Computer Systems, Inc., Chelmsford, USA) we created 3D reconstruction of the distal femur bone and cartilage using MR scans. Bone and cartilage of the distal femur were traced slice by slice in the acquisitioned dimension while the Amira program reconstructed the 3D model. This model was then transferred to the Rhinoceros 4.0 software (Robert McNeel & Associates, Seattle, USA) for measuring. Using this system a non-invasive 3D representation of the articular cartilage and bone of the normal trochlea and depiction of different types of trochlear dysplasia were possible. Potential advantages of these MRI measurements are assessment of the 3D articular cartilage of the whole trochlea and the bony contours on the same image, no imaging errors from joint malpositioning, no ionizing radiation, precise preoperative planning according to the documented pathomorphology, and comparison between the preoperative and the postoperative shapes. The disadvantages include higher costs compared to radiography or CT scans, and time consuming reconstruction, making them currently a research tool.

FM75

Osteosynthesis of distal femoral fractures by locking compression plates

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Introduction: Authors report a retrospective serie of distal femoral fractures. The goal is to evaluate the short term results of locking compression plate treatment in these complex fractures.
Material and methods: From January 2005 to December 2008, 45 patients (27 females, 18 males), accounting for 47 fractures have been treated. Mean age was 58 years old (24–94). Fractures were essentially type A and C according to the AO classification. 11 were open wound fractures and 12 concerned polytraumatized patients. Initial mechanism was a low energy trauma (20 cases of headlong falls). Osteosynthseis was performed using anatomical 4.5 distal femur locking compression plates (Synthesa).
Results: On revision, we report 6 deceased patients and 10 lost of follow up for a total of 29 patients (30 fractures), with an average follow-up of 33 months, and a minimal follow-up of 12 months. Osteosynthesis was done 33 times using a standard table and 14 times using a traction table. Approach was minimally invasive in 33 patients and classic in 14 times. Despite some pain, patients went back to their previous degree of autonomy, and could practice their sport, but a lower level. We report 3 pseudarthrosis, with a consolidation rate over 90%, 5 initial valgus deviations over 5° but none over 10°, 5 articular incongruities over 2 mm. There were 3 sepsis (1 pseudarthrosis), 1 common fibular nerve palsy that was completely reversible, 2 major joint stiffnesses, 2 early failures that were treated by a new osteosynthesis. 5 secondary surgeries were needed: 2 lavages, 3 decortications completed by bone graft and 2 mobilization under general aneshesia.
Discussion: The interest of this work resides in the use of locking compression plates using a minimally invasive approach, often associated to early mobilization and full weight-bearing, in extra-articular fractures. This technique combines closed reduction surgery and a stable assembling. The locking screws increase the stability, allowing early rehabilitation. Both functional and radiological results are satisfying and comfort us in our daily practice. However, infection rate and mechanical complication confirm the complexity of these fractures.
Conclusion: The use of this implant is efficient and gives a stable result through time. It allows a quick recovery by early mobilization.

FM76

Interprostetic femoral fracture: a retrospective case series and litterature review

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Introduction: The incidence of interprosthetic femoral fractures is yet not well quantified but it is increasing as does the population demand for total hip (THA) and knee arthroplasties (TKA). Among the general risk factors, steroid intake, rheumatoid arthritis and metabolic bone disease are often listed. More specifically, anterior femoral notching and stress shielding are considered as stress risers for TKA whereas noncemented stems or proximal femoral bone loss are listed for THA. The purpose of this presentation is to describe the specific fracture locations and treatment outcomes associated with a femoral plate fixation that is spanning the fracture site. The plating technique used preservs the soft tissue through indirect reposition techniques and reveals the difficulties associated with distal femoral poor bone quality and proximal plate locking complications due to an intramedullary implant.
Material and Method: The surgical treatment protocol consists of a plate fixation that is spanning the interprosthetic fracture and the use locking screws distally. The proximal plate fixation was done either with screws, wires or both. 31 patients with 32 interprosthetic femur fractures treated surgically in our institution were retrospectively reviewed between 2000 and 2009. There were eleven fractures of the femoral shaft just below the stem of a hip arthroplasty and 21 supracondylar fractures above TKA. All were low-energy closed injuries in elderly patients (average age 78 years; range, 56–98 years; 21 females and 11 males).
Results: Supracondylar interprosthetic fracture patterns were two times more common than proximal diaphyseal fractures. We reported 1 diaphyseal non union and two supracondylar non-union . One case of proximal fixation insufficiency leading to failure has been described. One patient developed a fracture above the proximal tip of the plate. All other implants remained well-fixed. The average time to full weight bearing was 12 weeks (range, 6–20 weeks).
Conclusions: Interprosthetic femoral fractures tend to occur more frequently in the supracondylar region (just above a TKA) than around a stem of a THA. The biologic plating techniques that span the entire interprosthetic zone tend to lower additional stress risers and show reliable union rates. Complication may occurs, essentially in supracondylar fracture raising the question of the systematic use of a medial accessory plating to support the medial femoral column.

FM77

Osteosynthesis by locking compression plate for periprosthetic fractures of the distal femur after knee arthroplasty

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Introduction: The authors present a continuous and retrospective serie of femoral fractures after knee arthroplasty.
Material and methods: From June 2002 to December 2008, 16 patients were treated, accounting for 17 fractures (1 bilateral case). The study concerned 15 females and 1 male, occurring in 15 TKAs and in 1 partially resurfaced knee. Mean age was 79,6 years old (58–89). According to the Sofcot classification, fractures were a B1 type 6 times and a C type 11 times. Osteosynthesis was performed using a locking compression distal femoral plate (Synthesa) overlapping the implant. Rehabilitation protocol consisted in immediate weight bearing, whenever possible.
Results: We report 1 deceased patient before the twelve months follow-up. The mean follow-up was 32 months(19-66); The implant used was a distal femoral plate each time. Our results are the following: surgery was performed 10 times on a standard table and 7 times on a traction table. Minimally invasive surgery was performed 12 times for 5 classic approaches (in 1 case for a cerclage fixation). Full weight bearing was authorized 11 times, partial weight bearing at 20 kg twice, and no weight bearing for a 6 week period in 4 cases. We report 1 case of pseudarthrosis. No general or infectious complications were reported. No axis default superior to 10° was observed. Knee implants were all stable on revision.
Discussion: The interest of this study resides in the use of locking compression plates through a minimally invasive approach, associated with full weight bearing rehabilitation whenever possible. This technique combines closed reduction surgery with hematoma preservation and a stable osteosynthesis implant. Rehabilitation protocol was the result of a reflection concerning the nature of the plate. The locking compression plate is an internal fixation with increased stability. Osteosynthesis was considered stable enough for early weight bearing.
Conclusion: The use of locking compression plates in periprosthetic femoral fractures is efficient and allows early weight bearing with a stable result through time.

FM78

Talar neck osteotomy to lengthen the medial column after malunited talar neck fractures

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Background: Malunited talar neck fractures can result in shortening of medial column, which, in turn, causes an adduction and supination position of forefoot. The patients complain typically painful overload of lateral foot and are significantly disabled in daily activities. Little is known about the feasibility and efficiency of talar neck osteotomy to address this deformity.
Questions/purposes: The purpose was to establish whether correcting osteotomy of talar neck is efficient in correct the forefoot supination and adduction deformity and to normalize the foot posture.
Material and Methods: Between 2002 and 2010, we treated seven patients (females, 2; males, 5; age 41.6 [17–60] years) by correcting osteotomy of talar neck for a malunited talar fracture. All but two patients had prior surgical treatment of talar neck fracture. A dorsomedial approach was used to expose and to do the osteotomy of the talar neck. The osteotomy was opened with the use of a distractor mounted over two K-wires until the forefoot got a normal position. An allograft (five patients) or autograft from iliac crest (two patients) was used for interposition. One or two fully threaded screws or a small plate was used for fixation. Patients were seen on a regular basis, with a mean follow-up of 2.7 (1–8) years.
Results: There were no perioperative complications. All but one talus healed within 2 to 3 months. The patient with non-union was successfully revised with a subtalar and talonavicular fusion. Radiographically, there was no evidence of avascular necrosis of talar head in no one case. All patients were satisfied with the result. The mean AOFAS Ankle Hindfoot Score was 80.9 (56–100) and for the subscale pain 31.4 (20–40). All patients were able to wear commercial shoes. Good or excellent results were obtained in all 7 patients indicating that reconstructive osteotomy of talar neck was effective in all, and there was no evidence that beneficial effects reduced over time.
Conclusions: We found that correcting osteotomies to lengthen the malunited talar neck fractures are effective in correcting the disabling and painful adduction and supination deformity of the forefoot. We did not encounter any complication, in particular not an avascular necrosis of talar head. We thus continue to use this approach to lengthen the medial column in the case of malunited talar neck fractures.

FM79

The minimal invasive fixation of displaced calcaneal fractures through a limited sinus tarsi approach – a controlled, prospective CT based study

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Introduction: The extended lateral approach is widely used for ORIF of displaced calcaneal fractures. Despite enforced fasciocutaneous flap retraction, subtalar joint vizualization may be limited, impairing posterior facet reduction. Furthermore, subperiostal flap preparation separates the lateral wall. These damages to the calcaneal vascularization and surrounding tissues may explain the frequently disappointing outcome after ORIF with regard to the obtained reduction. To minimize soft-tissue damage while optimizing reduction, we have routinely used a sinus tarsi approach for posterior facet exposure. We hypothesize that the limited sinus tarsi approach allows for anatomic posterior facet reduction through indirect calcaneal osseous reposition using the effect of ligamentotaxis. The goal of this prospective study was to assess postoperative reduction quality and to determine secondary loss of reduction.
Methods: 24 consecutive patients (21 male, 3 female, mean age 44 ± 16 years, range 16–74) with 25 calcaneal fractures underwent ORIF by using solely a limited sinus tarsi approach. This approach works with small lateral plate and percutaneous intramedullary screw fixation, followed by postoperative continuous passive motion in the subtalar joint. According to Sanders CT classification, there were 14 type III and 11 type II fractures. Postoperative and minimum one year follow-up CT imaging was obtained to assess quality and stability of reduction. Posterior facet reduction was graded excellent, good, fair or poor according to step, defect and angulation (Kurozumi 2003). Any negative change was considered secondary loss of reduction.
Results: Postoperative posterior facet reduction was good or excellent in 72%. At follow-up (mean 31±14 months, range 12–50), no secondary loss of reduction occurred. Moreover, evident posterior facet reduction improvement was observed, resulting in good or excellent reduction in 92%.
Discussion: The limited sinus tarsi approach provided sufficient view and control of anatomic posterior facet reduction, thereby restoring calcaneal geometry, while also providing enough secondary stability. Moreover, posterior facet reduction improved due to progressive bony adaptation. Most patients yielded good or excellent functional results, which may be a proof of minimal soft tissue damaging. Based on these encouraging results, we will continue to use this minimal invasive technique in the operative treatment of calcaneal fractures.

FM80

Achillotenotomy within Ponseti-Therapy – a safe method

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Introduction: Ponseti therapy suggests percutaneous achillotenotomy after achieved redression of the forefoot hindfoot varus-correction in case of insufficient dorsiflexion. The aim of this study was to survey prospectively the treatment results with and without achillotenotomy.
Materials and Methods: At the Children's Hospital of Eastern Switzerland, 56 clubfeet within 36 patients have been treated according to Ponseti therapy since 2004. In group A, 11 clubfoot patients were included, which achieved at least 15° dorsiflexion. These were not treated with achillotenotomy. Group B included 11 consecutive patients, which reached clinical sufficient dorsiflexion. These patients were treated with achillotenotomy. Classification and course evaluation were done with the Pirani-Score. Follow-up has been 2 years up to date. At beginning of the walking phase anteroposterior and mediolateral X-rays of the loaded foot were made. Inclusion criteria for therapy at our clinic were: clubfoot without any previous treatment.
Results: The mean age at the beginning of treatment was 44.3 ± 37.1 days in the non-tenotomised group (group A) and 18.4 ± 13.3 days in the tenotomised group (group B). By the time of the tenotomy patients achieved a passive dorsiflexion of 16.4 ± 9.5°. In group A patients reached dorsiflexion of 26.8 ± 4.6° at the end of cast-treatment. By the time of the last examination mean dorsiflexion of group A patients was 21.8 ± 8.4° and 28.2 ± 4.6° in group B ($p < 0.05$).
Conclusion: Due to the difficult assessment of the calcaneus-alignment in infant feet it is difficult to quantify the exact dorsiflexion. Hence, the indication for an achillotenotomy at dorsiflexions below 15° is difficult. In our collective it has been shown that patients with proper dorsiflexion improved their dorsiflexion when obtaining achillotenotomy additionally at transition to Denis Brown splint. Therefore we recommend a generous indication towards tenotomy within Ponseti therapy.

FM81

Hindfoot Joint Pressure in acute and recurrent sprains

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Hindfoot instability following acute or recurrent hindfoot sprains may lead to devastating ankle and subtalar arthrosis.
Methods: An acute and recurrent hindfoot supination sprains with successive dissection of ATFL, CFL, LTCL were simulated in cadaver specimens. The effect on the center of force (COF) and tibiotalar and subtalar peak pressure at 700 N (acute) and 150 N (recurrent) axial static and dynamic load were recorded using TekScan pressure sensors.
Results: At acute sprain peak pressure increased significantly in the ankle ($p = 0.042$) and in the subtalar medial facet ($p = 0.046$). The ankle COF migrated significantly medially and posteriorly (6 and 13 mm in average). At recurrent sprain peak pressure increased significantly in the ankle ($p = 0.036$, ligaments intact, $p = 0.006$, all ligaments cut). Subtalar peak pressure (medial facet) was found significantly higher at sprain ($p = 0.022$, intact ligaments, $p = 0.016$ all ligaments cut). The ankle COF migrated significantly towards medial and posterior when all ligaments were cut ($p = 0.047$ and $p = 0.027$).
Conclusions: Simulated acute and recurrent hindfoot supination sprains lead to increased ankle and subtalar (medial facet) joint pressure and posteromedial migration of the ankle COF. They may account for medial ankle OCL and arthrosis and for posttraumatic subtalar stiffness in patients.

FM82

Outcome of a Modified Broström-Gould Procedure for Lateral Ankle Instability

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Introduction: Ankle sprains affect 200'000 persons/year in Switzerland. Most incidences are successfully treated by conservative measures but 20% require reconstruction for symptomatic chronic lateral ankle instability. This study evaluates the functional outcome after a modified Broström-Gould technique as measured by different clinical scores and compares the functional outcome of this technique with other surgical treatments of ankle instability.
Methods: This retrospective cohort study evaluates 47 patients who underwent a modified Broström-Gould procedure using suture anchors to refix the lateral ankle capsuloligamentary structures at our institution from 2005 to 2009 with a minimum follow-up of one year (13–72 Mo). All patients were operated by one single surgeon and evaluated by an independent examiner. The function was assessed using 4 scores including: the AOFAS (American Orthopaedic Foot and Ankle Society's Score) hindfoot score; the FAAM (Foot and Ankle Ability Measurement); the CAIT (Cumberland Ankle Instability Tool); the CAIS (Chronic Ankle Instability Scale).
Results: Six patients were excluded leaving 41 patients for examination. 34 patients (83%) thought that their ankle was more stable after the surgery, 7 (17%) did not feel any difference. 27 patients were very satisfied, 11 satisfied and 3 not satisfied. Reasons for non satisfaction included persistent instability and pain. Ankle mobility returned to normal in 93% of patients. Five patients had transcient hypoesthesy in the area of the superficial peroneal nerve. One patient suffered from a superficial infection treated successfully by local measures. 80% had the perception of a normal ankle, 20% thought to be below normal. At follow-up the AOFAS was 89/100 (37–100), the FAAM 85/100% (35–100%), the CAIT 20/30 (5–30), and the CAIS 74/100% (27–100%).
Conclusions: The modified Broström-Gould procedure, which belongs to the anatomic ankle stabilizations is relatively simple and offers good outcome that satisfied 93% of the patients in the present study. No active stabilisator is sacrificed. Preservation of the ankle mobility is better and the complication rate is lower than after non-anatomical procedures described in the literature. The CAIT appeared as the most severe score compared to the other scales used in our study.

FM83

The radiological morphology of peritalar instability

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Introduction: Talar position may be highly confined by the talocrural, subtalar and talonavicular (peritalar) joints. *In vitro*, the talocrural joint provides up to 100% talar frontal weightbearing stability, implying that ligament incompetence will not affect talar position. However, patients with destabilized ankle joints, e.g. after sprains or fractures, often present with frontal weightbearing misalignment. Obviously, other factors must contribute to talar stability. We hypothesize that loss of peritalar stability allows the talus to shift on the peritalar calcaneonavicular surfaces, thus undergoing a 3-dimensional positional change. To understand this talar dislocation pattern, we assessed weightbearing X-rays in varus or valgus ankle osteoarthritis patients. The aim was to describe talar malpositioning patterns in all three planes.
Methods: After excluding patients with previous operative hindfoot procedures, 169 consecutive patients (111 male, 58 female, 64 ± 11 years) with 112 varus and 68 valgus osteoarthritic ankles were included. In 71%, a traumatic event (fracture or sprain) preceded. On weightbearing radiography, the amount of frontal misalignment was determined with the tibiotalar surface (TTS) angle. Lateral and horizontal talar position was determined with the lateral talocalcaneal inclination (TCI) angle and horizontal talometatarsal I (TMT I) angle, and compared to neutral ranges obtained in controls (mean ± 2 SD; TCI 22°-39°; TMT I -12°-19°). Talar malpositioning (plantar/dorsalflexion, exo/endorotation) was defined when outside any range.
Results: Mean TTS in the varus and valgus group was 74 ± 8° (51–95) and 101 ± 7° (90–126). While the talus was solely in varus or valgus in 74 ankles (41%), it was malpositioned in one additional plane in 73 ankles (41%) and in both additional planes in 33 ankles (18%). Nine out of possible 18 malposition patterns were found. The five predominant talar malposition configurations included 78% of all cases ([dorsalflexed] varus; [plantarflexed] valgus; endorotated varus).
Discussion: Although, in peritalar instability, the talus was found to move into various positions, there are five predominant malpositions. This may explain failures in obtaining correct talar position within the mortise after ligament reconstructions, re-aligning osteotomies and total ankle replacements as long as peritalar stability has not been addressed. Further studies are necessary to clarify the underlying pathophysiology.

FM84

Critical evaluation of outcome scales to assess outcome after lateral ankle ligament repair

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Introduction: Several scores are commonly used to evaluate patients' postoperative satisfaction after lateral ankle ligament repair, including: AOFAS, FAAM, CAIT and CAIS. Comparing published studies in the literature is difficult, as the same patient can have markedly different results depending on which scoring system is used. The current study aims to address this gap in the literature by developing a system to compare these tests, to allow better analysis and comparison of published studies.
Patients and methods: This is a retrospective cohort study of 47 patients following lateral ankle ligament repair using a modified Broström-Gould technique. All patients were operated between 2005 and 2010 by a single surgeon and followed the same post operative rehabilitation protocol. Six patients were excluded from the study because of concomitant surgery. Patients were assessed by an independent observer. We used the Pearson correlation coefficient to analyse the concordance of the scores, as well as scatter plots to assess the linear relationship between them.
Results: A linear distribution between the scores was found when the results were analysed using scatter plots. We were thus able to use the Pearson correlation coefficient to evaluate the relationship between each of the different postoperative scores. The correlation was found to be above 0.5 in all cases except for the comparison between the CAIT and the FAAM for the activities of daily living (0.39). We were, therefore, able to compare the results obtained and assess the relative concordance of the scoring systems. The results showed that the more specific the scale is, the worst the score is and inversely. So the CAIT and the CAIS appeared to be more severe than the AOFAS and the FAAM measuring the activities of daily living. The sports subscale of the FAAM demonstrated intermediate results.
Conclusion: This study outlines a system to compare different postoperative scores commonly used to evaluate outcome after ankle stabilization surgery. The impact of this study is that it makes comparison of published studies easier, even though they use a variety of different clinical scores, thus facilitating better outcome analysis of operative techniques.

FM85

Three- or six weeks of K-Wire Transfixation in lesser Toe Surgery?: A prospective and randomized Study

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Background: Prolonged percutaneous Kirscher wire (K-wire) transfixation after correction of lesser toe deformities has been associated with an increased rate of complications such as infection, wire

breakage or loss of correction. To date duration of wire transfixation is based mainly on expert opinion. We hypothesized that a transfixation time of three weeks when compared to six weeks would decrease complication rates without an increase in the rate of recurrent deformity.
Materials and Methods: A prospective and randomized study was performed. Fifty-two lesser toes were included into the study and operated on due to symptomatic hammer- or clawtoe deformity by means of resectional arthroplasty of the proximal interphalangeal joint. Patients were divided into two groups: Group 1 included patients who had a three week K-wire transfixation and Group 2 comprised of patients who had K-wire transfixation for six weeks. K-wire associated complication rates and incidence of early recurrence of malalignment were assessed after a short term follow up of three months. Forty-six toes, 23 for each group, were available for final follow up at 12 months.
Results: Pre- and postoperative AOFAS scores showed no statistically significant difference between the two groups. There were no complications found in either group. At three months a clinically more pronounced recurrence and loss of malalignment was seen in group 1 (11/23 toes, 47.8%) when compared with those in Group 2 (2/23 toes, 8.7%). Interphalangeal joint motion was significantly reduced with prolonged K-wire transfixation indicating more stable fibrous union ($p = 0.038$).
Conclusion: K-wire transfixation for a period of six weeks as opposed to three weeks shows a low recurrence rate of toe deformities and no complications.

FM86

Functional outcome after Hemiarthroplasty in the Treatment of Hallux rigidus: A 11 Year Retrospective Study

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Objectives: *The* Hallux rigidus is a restraining condition for the affected patient. When even walking is getting painful, surgery is the only valuable option. There are two common technical approaches: one possibility is to perform a débridement of the metatarsophalangeal (MTP) joint with or without a resection of osteophytes (Cheilectomy). The other one is to perform a first MTP joint arthrodesis. The aim of our study was to assess whether hemiarthroplasty of the first MTP joint could be a valuable alternative to the established methods.
Materials and Methods: From January 2000 to December 2010 we evaluated retrospectively a series of 65 cases of hemiarthtroplasties (Great Toe Swanson Prosthesis) for the treatment of hallux rigidus. We assessed the functional outcome using the AOFAS and VAS score.
Results: The average preoperative AOFAS was 45 and the VAS score 4.3. There were no significant perioperative complications. At the last follow up the AOFAS had significantly increased and significant pain relieve could be shown (VAS score 9,2). We observed radiological loosening of the hemiarthorplasty in 10 cases. All these patients being painfree, without any intervention necessary.
Conclusion: Swanson Prosthesis hemiarthroplasty is a valuable alternative approach for surgical treatment of hallux rigidus. After this surgery patients will regain a good range of motion of the first MTP-joint and profit from reduced pain.

FM87

Radiographic evaluation of osteoarthritis of the ankle: adaptation of the Kellgren-Lawrence scale

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Introduction: A validated scale for radiographic assessment of ankle osteoarthritis (OA) is not currently available, different classifications have been used, making comparisons between studies difficult. In other joints, the Kellgren-Lawrence (K&L) scale, based on radiological features of OA and chosen as reference by the World Health Organizations is widely used. Our objectives were: (1) to assess the overall reliability of the K&L scale as applied to the ankle joint; (2) to assess those features specific to the ankle joint that would enhance the reliability and reproducibility by introduction of a modified scale; and (3) to design a radiographic atlas based upon this modified K&L scale.
Design: Cross-sectional study of 75 patients who were 10 to 20 years post ankle open reduction and internal fixation. Each patient had standardized weight-bearing radiographs of both ankles, the operated ankle and the normal contralateral ankle. Grading of OA according to K&L criteria was realized by four physicians,and intra- and inter-observer reproducibility was determined. Specific features of OA of the ankle were identified, and minimal joint space width (minJSW) and sclerosis were additionally quantified by digital measurements using dedicated software.
Results: Inter- and intra-observer reliability in OA assessment according to K&L was good (ICC 0.61 and 0.75), comparable to data in other joints. Medial osteophytes were present in 88% and lateral osteophytes in 82% of the ankles with K&L grade 4. Computerized analyses revealed that minJSW significantly decreased ($p = 0.04$), and sclerosis indexes significantly increased with increasing K&L grades (0.02 and 0.02). A minJSW cut-off of 2 mm distinguished well between early (normal, 1–2) and late grades (3–4) of ankle OA.
Conclusions: The K&L scale is a reliable clinical tool for ankle OA assessment and its use would facilitate comparison among studies. In addition, we have described those specific features of OA of the ankle which need to be more clearly elucidated, and thus propose a modified K&L scale. And finally, for ease of application of this modified scale we have developed an atlas of standardized radiographs.

FM88

SALVAGE ARTHRODESIS AFTER FAILED TOTAL ANKLE REPLACEMENT

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Background: Total ankle replacement has regained increasing interest for the treatment of symptomatic end-stage ankle arthritis. However, longevity is limited and in case of failure ankle arthrodesis might be warranted. There is only a few data in literature available regarding salvage arthrodesis after failed total ankle replacement. We present the short and midterm results in a series of patients that have been treated due to either septic or aseptic failure of total ankle replacement. The specific focus is put on technical influence regarding union rate and complications.
Methods: Within the period between November 2002 and October 2010 eighteen patients underwent salvage ankle arthrodesis after failed total ankle replacement. All patients were retrospectively analyzed regarding clinical outcome, radiological union and complications.
Results: The mean age of these patients was 58 (range 26 to 79) years. There were 13 females and 5 males included into the study. Thirteen patients had aseptic loosenig of the ankle prosthesis while five revealed septic loosening. The following techniques were used to convert them into arthrodesis: Five times screw fixation, 6 tibiatalocalcaneal fusions with an intramedullary rod, 3 blade plates and 4 times an anterior double plating system. All but one ankle arthrodesis were done with either an auto- or an allograft. Complete union as confirmed by CT was achieved in 16 (89%) patients after a mean time of 49 (range 12 to 116) weeks. One i.v. drug addicted patient had 6 revision surgeries because of an infection and after 3 years he established a partial but rather fibrotic union. Another patient needed a second revision arthrodesis and finally achieved complete union. The complication rate requiring further surgery (hardware removal not included) was 28% (5 patients). All patients who had undergone anterior double plating arthrodesis were clinically satisfied and showed complete union after a mean of 15 (12 to 20) weeks.
Conclusion: Revision arthrodesis after failed ankle replacement has a high revision rate and surgeons should be aware of a possibly prolonged time until union when compared with primary ankle arthrodesis. Comparing the different salvage procedures best radiographic and clinical results were achieved in patient who underwent anterior double plating arthrodesis.

FM89

Cavovarus foot realignment to treat anteromedial ankle arthrosis

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Adult patients with cavovarus feet were seen with symptomatic anteromedial ankle arthrosis. Cavovarus foot realignment was performed in an attempt to redistribute joint contact pressures and thus to relieve patients' symptoms.
Methods: Fourteen patients with cavovarus feet and anteromedial ankle arthrosis (7 neurogenic, 7 idiopathic) were treated by soft tissue procedures, osteotomies, and anteromedial cheilectomy of the ankle.
Results: Failure in two patients was most likely due to postoperative persistent ankle varus tilt. The AOFAS Ankle-Hindfoot Score of the remaining 12 patients improved from preoperative 45 to postoperative 75 (follow-up 69 months), ankle dorsiflexion improved 8°. There was no progression of anteromedial ankle arthrosis at latest follow-up.
Conclusion: Cavovarus foot realignment reliably relieved patients'symptoms and stabilized the extent of anteromedial ankle arthrosis when correct postoperative ankle alignment was achieved. Realignment and anteromedial cheilectomy improved dorsiflexion and reduced anterior ankle impingement.

FM90

Dorsal 2.4 mm locking plate fixation of intra-articular fractures with articular impaction and dorsal displacement of the distal radius: a propos of 21 cases

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Introduction: Intra-articular fractures of the distal radius with articular impaction often result from high energy trauma, are difficult to treat and have an elevated risk of post-traumatic arthritis. Often the volar approach and fixation, usually associated with an arthroscopy, is described. The purpose of this retrospective survey was to determine the outcome of intra-articular fractures with articular impaction and dorsal displacement with minimal volar metaphyseal injury operated by dorsal approach in 2008 and 2009.
Methods: Twenty-one patients with a mean age of 44 years were included. A single dorsal approach and a posterior interosseous nerve denervation were carried out in all cases. Sixteen required bone graft. Two low profile locking 2.4 mm plates were used. A first plate was placed between the 3rd and 4th extensor compartments and the second between the 1st and 2nd compartments. Immobilization (antebrachial or brachio-antebrachial, depending on associated lesions) lasted 2–4 weeks and was followed by progressive mobilization.
Results: The minimum follow up was 12 months. In seven cases the plates were removed for dorsal pain or stiffness at a mean delay of 7.7 months. No tendon ruptures were observed. For subjective evaluation, the QuickDASH and PWRE scores were used. Objective evaluations included wrist range of motion, grip strength and preoperative and postoperative radiographs. There was no secondary displacement of the plates. Five patients developed a premature post-traumatic arthritis, of which 3 where symptomatic.
Conclusions: The dorsal approach and stabilisation with locking plates plating is technique to consider for treatment of this type of intra-articular fracture. Direct visualization of the articular surface ensures anatomic reduction to prevent post-traumatic arthritis. Eventual associated carpal lesions or dorsal extrinsic ligament lesions (not viewed by arthroscopy) can be repaired. The use of locking plates allied with the buttress effect of dorsal plating improves stability and permits early mobilization to help avoid stiffness. Our results are similar to those in the literature.

FM91

Management of chronic distal radioulnar joint instability in the setting of complex wrist trauma

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Introduction: Instability of the distal radio-ulnar joint (DRUJ) can be isolated or combined with complex wrist pathologies, further they can be acute or chronic. Substantial ongoing disability can arise should these injuries go unrecognized and untreated. Clinical examination is the best method of evaluating trauma and instability of the DRUJ. An adequate knowledge of the stabilizers of the DRUJ is essential in understanding treatment options.
Patients and Methods: In 2010 we treated 3 patients for chronic distal DRUJ instability following treatment of complex wrist injuries. All patients had an ulnar foveal detachment of the triangular fibrocarilage complex (TFCC) according to an injury pattern Palmer 1B which was evaluated in 2 cases by MRI and arthroscopy and by open surgery in 1 case. The first patient sustained a transstyloidal-transstyloidal carpal fracture dislocation which was anatomically reduced and fixed. One year later the DRUJ remained unstable with discomfort. The second patient was treated for a Galeazzi-type radial fracture with initial immobilization of the DRUJ. 5 months after the DRUJ remained unstable and troublesome. The third patient presented with a persisting instable DRUJ after corrective intraarticular osteotomy of an intraarticular malunion of the distal radius with displaced nonunion of the ulnar styloid. In each case the TFCC was accessed via a dorsal approach through the 5th extensor compartment and a bony refixation of the TFCC to the ulnar fovea was performed with an anchor with the wrist in neutral position. A radioulnar pin transfixation was carried out once. Pronosupination was prohibited for 6 weeks with an above elbow cast.
Results: Intraoperatively the DRUJ was clinically stable in all positions after refixation of the TFCC and remained stable after 3 months. Grip strength, pain relief and patients' satisfaction improved in all patients. No further complications were noted.
Conclusion: In cases where injuries and instabilities to the DRUJ were not detected or initially could not be treated adequately due to the complexity of the wrist injury a stabilizing procedure can still be performed within a year after the initial trauma with good improvement in stability, power grip and hand function. A prerequisite for a direct repair is a repairable TFCC and reducible and congruent DRUJ while arthroscopy is the best tool to evaluate the integrity of the TFCC.

FM92

Non-Surgical Treatment of Mallet Finger Fractures involving more than one third of the joint

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The purpose of this study was to evaluate the clinical and radiological outcome of nonsurgical treatment of mallet finger fractures involving more than one third of the joint surface of the distal phalanx without concomitant initial subluxation of the DIP joint. We retrospectively reviewed a consecutive series of 35 patients with a mallet fracture involving one third up to two thirds of the DIP joint surface. There was no initial subluxation of the distal phalanx. They were treated with dorsal padded aluminium splints during 4–6 weeks. In 2 cases a thermoplastic custom-made splint was made by the handtherapist, and in 2 cases a long dorsal splint including the PIP joint in 50 degrees flexion was used during the night. Splinting during the night continued for 8 weeks totally. Mean follow-up time was 12 months. Functional results were very good, with a mean extensor lag of 3 degrees (0–10 degrees). 13 patients (43%) did not show any extensor lag at all. Flexion was excellent with a mean flexion of 80 degrees (60–90 degrees). All patients were highly satisfied. Radiologically there is remodelling of the DIP joint surface with excellent joint congruency even in cases with initially up to 3 mm fragment displacement and 1.5 mm step off due to fragment rotation. There is a slight irregularity of the joint surface in most cases, but no case shows a step off of more than 1 mm. There was no secondary palmar subluxation of the distal phalanx. We conclude, that the nonoperative treatment of mallet finger fractures involving a third or more of the joint surface shows excellent clinical and radiological results. No secondary palmar subluxation occurs in correctly splinted fingers.

FM93

Can clinical examination cause a Stener lesion in patients with skier's thumb?

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Background: Approximately one third of all injuries of the upper limb and 7% of all injuries in alpine and cross country skiing are injuries to the ulnar collateral ligaments of the thumb metacarpophalangeal joint, also known as "skier's thumb". In some patients the collateral ligaments are displaced proximally over the adductor aponeurosis, resulting in the so-called Stener lesion and surgical treatment is indicated in these cases. We hypothesized that a Stener lesion could be provoked by clinical stability testing in patients with a skiers thumb and wanted to investigate this in a cadaver study.
Methods: We performed an anatomical study on 10 Thiel fixated cadaver hands. Previous instability was ruled out by clinical testing on intact cadaver hands. The clinical stability testing consisted in manual radial deviation of the thumb to stress the ulnar collateral ligament of the 1st metacarpophalangeal joint in 30° flexion and in extension. It was performed by two hand surgeons after sequential detachment of the ulnar collateral ligaments: first the proper ulnar collateral ligament was detached distally, then the accessory ulnar collateral ligament was cut followed by the adductor aponeurosis. After every sequence it was assessed if the clinical stability testing had caused a Stener lesion in these cadaver hands.
Results: All of the 10 cases showed the same results while testing the stability. A decreased stability was only found after cutting both parts of the ulnar collateral ligament. Interestingly a pseudostability was noted, which was related to the adductor aponeurosis. Cutting of the aponeurosis resulted in a total instability. A Stener lesion could not be provoked in any of the cadavers at any time by performing clinical stability testing of the thumb MP joint.
Conclusions: This study indicates that a proper performed clinical examination of thumb MP joint stability is safe and is not causing a Stener lesion in patients with skier's thumb. However, the stability testing should be repeated in a more standardized way.

FM94

The painful TMC-joint of the thumb treated by a modified Brunelli – APL capsuloplasty

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From 1994 to 2010, 29 painful, hypermobile and/or unstable thumb basal joints in 24 patients were stabilized by a slightly modified Brunelli-type ligamentoplasty to reconstruct the I-II intermetacarpal ligament, using one third of the long abductor tendon of the thumb. The study includes the 21/25 joints in 18/21 patients treated from 1994 to 2007. 3 patients were lost for follow up, the more recent cases not included because of a follow up of only 1 year. Preoperatively, the

patients were investigated by a fluoroscopic stress test and an intraarticular infiltration of Xylocaïne. Radiologically all joints were classified without or only slight (stage Dell I) arthritic changes. The outcomes of the 21 capsuloplasties were evaluated by a further fluoroscopic stress test as well as an adapted Dash-type questionnaire filled out by all patients after a mean period of 4.1 (1.5–11) years after the operation. The double tendineous sling between the first and second metacarpal bone produces encourageing results concerning pain relief, daily living activities and strength and the initially obtained stability did not seem to get lost over time. Few complications were noted. However, the ability of such operations to prevent degenerative osteoarthritis in these joints cannot be definitively answered.

FM95

Should aspirin be stopped before carpal tunnel surgery? A prospective study

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Aim: There are no studies on intra- and postoperative complications of hand surgery in patients who take aspirin per-operatively. To investigate the effects of aspirin in patients undergoing hand surgery, we performed a prospective study to determine whether patients who continued to take asprin during carpal tunnel release (CTR) had an increased incidence of clinically significant complications.
Materials and method: Between January 2008 and January 2010, 100 patients, taking regularly and since at least 1 year aspirin 100 mg/day, undergoing standard open CTR under intra-venous-regional-anaesthesia and tourniquet control were the study groups: 50 patients stopped aspirin, for at least 5 days before surgery, and resumed it 3 days postoperatively (GROUP 1), while 50 patients continued to take aspirin (GROUP 2). The control group (GROUP 3) comprised 50 patients never anti-aggregated who had undergone a similar procedure. Incidence of clinically significant per- or post-operative complication was recorded and divided in local and cardio-cerebro-vascular complications. Local complications were successively divided into minor and major according to Page and Stern. Local haematoma was evaluated at 2 (before resume aspirin) and 14 days (after resumed aspirin) after the operation. The patient portion (PP) of the Patient and Observer Scar Assessment Scale (POSAS) was used at the final control at 90 days for a subjective and numerical evaluation of the scar.
Results: A total of 3 complications (1 minor, 2 major complications) and 27 haematomas (19 minor/8 major) were recorded. There was no significant difference in the incidence of complications and/or haematomas in the groups. The PP-POSAS score is uninfluenced by continuation or suspension of aspirin.
Conclusion: Our study demonstrates that continuation of aspirin did not increase the risk of local or general complications. Continuation of aspirin did not influence the subjective scar assessment. It is concluded that it is unnecessary to stop aspirin before CTR when good meticulous surgical techniques are used.

FM96

The patient's point of view about informed consent (IC): a prospective study in carpal tunnel surgery

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Aim: the patient's perception of IC is not well know known and our experience suggested that many patients tend to view consent as an administrative act, neglecting the rule of decision making instrument as a way of making their wishes known. For further improvement of IC procedure it is crucial to understand the patient's attitude and the emotional impact about IC.
Material: Prospective study. Within one month after carpal tunnel release a questionnaire was sent to 188 consecutive patients. Questions focused on patient's recall information about risks, benefits, alternative options, preferences about decisions process and global satisfaction with IC. Patient's understanding of the legal consequences of the IC was analysed.
Results: A total of 137patients (73%) responded. Information was rated excellent or good in more than 90% of cases. 87% of patients didn't need more information about surgery. Risk's recall rate was 59%. IC reduced preoperative anxiety in 65% and the influence of IC in patient's decision was relevant in 55% of cases. Patients have limited understanding of the legal consequences of the consensus and 29% of patients believed that primary function was to protect hospital. 10% believed that IC remove patients right to compensation in case of claims.
Conclusion: Patient involvement in medical decision care is a key aspect of patient centred care. The actual form of combined written and oral preoperative information presented is adapted to patient's wishes and needs, provide an adequate legal proof and allows a structured conversation. There is a substantial uncertainty about legal implication of IC, leading to potential discord. We strongly recommend to explain to patient that consensus serve primarily their interest.

FM97

Reconstruction versus Conservative Treatment after Rupture of the Anterior Cruciate Ligament – A cost effectiveness analysis

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Background: The decision whether or not to surgically reconstruct a torn anterior cruciate ligament (ACL) of the knee is an ongoing subject of debate. A critical evaluation of benefits and expenditures of both treatment options as in a cost effectiveness analysis providing valuable information for treating physicians and health care policy makers seems emerging.
Methods: A systematic literature review identified 4 out of 7410 articles providing sufficient outcome probabilities on simultaneously both treatment options for modeling. A transformation key based on expert opinion of 27 orthopedic surgeons was used to derive utilities from available evidence. Cost data were based on average figures of the first author's institution and reinforced by the Swiss national statistics. A decision tree was constructed to derive cost effectiveness of each strategy and tested for robustness using Monte-Carlo simulation.
Results: Decision tree analysis revealed a cost effectiveness of 16'038 USD/ 0.78 QALY for ACL reconstruction and 15466 USD/0.66 QALY for conservative treatment which resulted in an incremental cost effectiveness of 4890 USD/QALY for ACL reconstruction. Sensitivity analysis of utilities did not change the trend.
Conclusion: ACL reconstruction for reestablishment of knee stability seems cost effective in the Swiss setting based on the currently available evidence. This, however, should be reinforced with randomized controlled trials comparing both strategies.

FM98

A concept to avoid dislocations of total hip prosthesis

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The dislocation of a hip prosthesis is a dramatic incident for any patient, usually connected with an narcosis for reposition purposes. Literature claims that the frequency of such complications with primary hip prosthesis is between 1–9%. According to Blom et al. 58% of these first luxations tend to repeated luxations which lead to revision-operations. After the infects, dislocation is the most frequent reason for re-operations – which are connected with high costs. The op-approach, the head-ball-diameter, the alignment of the cup and the stem influence the luxation-rate. The risk of a dislocation rises with a patient's inadequate behavour, increasing age, with neurologic disorders and under influence of drugs and alcohol. Since March 2007, our THP are being implanted according to a new concept in order to avoid dislocations: 1. Patients selection according to age, mental condition, drugs, neuro-muscular status, co-morbidities. The risk-patients are being treated with a constraint prosthesis. 2. Preoperative instruction of the non-risk patient. 3. Anti-dislocation op-technique (antero-lateral MIS or Baur approach, navigation of cup and stem, choice of the largest possible head-ball-diameter). This concept has been tested with this underlying prospective, consecutive study. 408 primary THP (2007–2010) have been implanted by one single orthopaedic surgeon. 38 risk-patients have received a constraint prosthesis (9.3%). 370 Patients (90.7%) have received a non-constrained cementless THP. 405 patients have been inspected radiologically and clinically after 6 weeks, 3, 6, 12 months. 3 patients of the risk-group have died within the first 3 months after the operation. During the observation period, 407 patients (99.76%) stayed clear of any luxations. One patient of the non-risk-group, due to circulatory collapse, tumbled on the fifth post-op-day and luxated the THP. After reposition, the patient did not suffer relapse. This equals a luxation-rate of 0.24%. There were no re-operations due to dislocations. The risk-group as well as the non-risk group, after recovery time, showed equal leg-lengths and regained ample mobility. The cost-saving amounts to aprox. CHF 50.000 per 100 primary THP. The consistent appliance of this concept (1. patients' selection, 2. preoperative instruction, 3. anti-dislocational OP-technique) has proved to be of great value. Dislocations have nearly disappeared in our hospital. The economic benefit is significant.

FM99

Do non-scientific factors influence citation rates of orthopedic journal articles?

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Introduction: The number of scientific articles is immense and the reader often relies on the prestige of a journal to identify the most relevant articles in his field. One factor defining the prestige of a journal is the impact factor, which is calculated on the base of citation rates of its published articles. We studied associations of scientific and non-scientific criteria with the citation frequency of articles in the orthopedic literature.
Methods: The most (76 citations /5 years) and least cited (1.7 citations /5 years) articles published between 2000 and 2004 of a general orthopaedic journal were identified and the impact of scientific (e.g. study design and type, sample size, quality of statistics etc.) and non-scientific determinants (e.g. industry favouring results, industrial funding, structural characteristics of the article, etc.) on the citation rate was quantified.
Results: RCTs, cohort studies as well as multicenter studies with large sample sizes were clearly more frequent in the high citation group. High-cited articles had a 4.8 times higher odds to be sponsored by industry than low cited articles. The role of the orthopaedic speciality seems to be relevant only for hand and knee surgery, for which particularly low and high citation rates were noted, respectively.
Discussion: The results of this study suggest that beside scientific factors, non-scientific factors such as industrial sponsorship influence the citation rate of published articles.

FM100

Intra-operative safety checklist – No effects on postoperative morbidity and mortality in high-risk surgical patients

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Introduction: Implementation of an intra-operative checklist has been associated with lower death rates and complications in a heterogeneous population. High-risk surgical patients may get the highest benefit from this measure. The aim of this study was to assess the efficiency of an intra-operative checklist in high-risk surgical patients living in a high-income country.
Methods: Design: prospective cohort study of pre- (I) and post-implementation (II + III) periods (II: immediate, III: 9 months after implementation); duration: 3 x 3 months. Inclusion criteria: >16 years, ASA >2. Exclusion: low risk surgery, obstetrical/gynaecologic surgery, vital surgery. Main outcomes: unplanned returns to operating theatre (OT), unplanned admissions to intensive care unit (ICU), death, and overall complications within 30 days. Changes in outcomes through checklist implementation were evaluated by calculating absolute risk reduction (ARR) and 95% confidence intervals (CI).
Results: 609 patients were included before and 1110 after implementation (552 in period II, 558 in III). Demographics were not statistically different between the groups (age, sex, BMI, ASA, surgery). Sixty-four percent had a completed checklist in II and 63% in III. No wrong patient or wrong site operation was observed during these periods. Unplanned return to OT was observed in 45 patients (7.4%) before and in 67 (6.0%) after implementation (ARR 1.4% (95% CI –1.2; 3.9)). Return related to surgical site infection was found in 18 (3.0%) before and in 18 (1.6%) after implementation (ARR 1.3% (95% CI –0.2; 2.9)). Unplanned admission to ICU was observed in 17 (2.8%) before and in 31 (2.8%) after implementation (ARR 0 (95% CI –1.5; 1.7)). Main reason for unplanned readmission to ICU was respiratory failure (1.5% before and 1.1% after implementation; ARR 0.4 (95% CI –0.7; 1.5)). In-hospital death occurred in 26 (4.3%) before and in 68 (6.1%) after implementation (ARR –1.9% (95% CI –4.0; 0.3)).The number of overall complications was 81 (13.3%) before and 146 (13.2%) after implementation (ARR 0.2 (95% CI –3.2; 3.5)).
Conclusion: Implementation of the intra-operative checklist was not associated with significant effects in high-risk surgical patients when living in a high-income country. However, a trend towards decreased unplanned returns to OT for surgical site infection was observed.

FM101

Evaluation of the economical efficiancy of health economists as specialists in DRG coding in orthopedic and trauma surgery

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Introduction: The DRGs will provoke fundamental changes in swiss health system. Aim of our study was to quantify the effectiveness in DRG coding of health economists in comparison to coding residents, this especially regarding maximum care hospitals of orthopaedic and trauma surgery.
Materials & Methods: In a prospective study, 200 in-patient cases were reviewed by a health economist. Primary coding was blinded to avoid a Hawthorne effect. Outcome of the review coding was compared to previous results and between the two groups. Especially the pre- and post-coding DRG weight and the time of optimisation were analysed.
Results: The proceeds per patient generated by the health economist were significantly higher than the contol group with 2472.5 ± 337 Euro ($p < 0.05$). Overall cumulized increase was 494 500 Euro with an average time of optimization of 11 min. This means higher proceeds of 218 ± 38 Euro per minute due to better coding.
Discussion & Summary: For university clinics and maximum care hospitals with a wide medical range and widely spread DRGs, health economists as specialists for DRG coding are without doubt very necessary for economic well-being of the hospital. The data of the current study proves, for the first time, the high efficiency of health economists for optimizing DRG coding of in-patients. CMI and total revenue per case could be increased significantly by a review coding. To reflect the high standard of care of maximum care hospitals in their reimbursement, health economic professionals showed significantly better results than the average resident.

FM102

Prevention in Geriatric Fracture Patients? More than Osteoporosis Treatment!

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Hypothesis: Geriatric hip fracture patients are at risk to suffer from postoperative complications. Dementia and malnutrition are risk factors towards postoperative delirium and towards decline of serum albumin respectively, and therefore for worse overall outcome. Our geriatric fracture centre offers prevention programmes to geriatric fracture patients in order to reduce the frequency of these complications. We investigated efficacy of the prevention measures by documentation of risk factors and of the related negative postoperative conditions and by comparison of our results with the literature.
Patients & Methods: N = 183 geriatric hip fracture patients aged 65+ were included into the prospective cohort study: Age [average ± standard deviation]: 84.2 ± 7.4 years; gender m:f [%]: 26:74; fracture type femoral neck:pertrochanteric [%]: 43:57. In the emergency department we checked for dementia and we evaluated the patient's nutritional status by means of the Mini Nutritional Assessment (MNA). During the postoperative phase, the «Postoperative Delirium Prevention» programme assures documentation of the patient's cognitive status by means of the Delirium Observation Scale (DOS). Risk factors known to cause postoperative delirium were identified and stopped if possible. The prevention programme «Malnutrition» identifies such patients with an MNA score below 12 points. Protein enriched food is offered to them. The effect is monitored by means of serum albumin levels.
Results: Dementia was found in 39% of our patients on admission. While being in hospital, 26% of our patients suffered from a postoperative delirium. 44% of our patients were found to have an MNA <12 points indicating preoperative malnutrition. Serum albumin level declined from 34.1 g/l preoperatively to 24.0 g/l postoperatively.
Discussion: The risk factors frequently occur amongst the study population. This confirms our prevention programmes are applied to a high risk population. In the literature, postoperative delirium is reported to occur as frequent as in 5% to 62% of patients. The rate observed in our population therefore is relatively low. Serum albumin below 35 g/l is looked upon as a marker for malnutrition. This means more than 50% of our patients suffered from malnutrition already preoperatively. Prevention programmes described above can only reduce the number of postoperative complications but do not succeed to prevent them in a 100% of geriatric hip fracture patients.

FM103

Clinical Midterm Outcome of combined Reversed Shoulder Prosthesis and Latissimus Dorsi Transfer

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Introduction: In elderly patients with rotator cuff arthropathy reverse shoulder prosthesis is a standard treatment with reliable pain relief and regain of shoulder function. However, often an external rotation lag due to infraspiatus insufficiency can not be restored by reverse shoulder prosthesis with the deltoid as the only remaining muscle. Latissimus dorsi transfer provides a functional benefit for active external rotation in

irreparable infraspinatus tears. Therefore the senior author concluded that in combination with reverse total shoulder prosthesis the latissimus dorsi transfer can help to regain the active external rotation in patients with rotator cuff arthropathy and relevant external rotation lag. In this study we report the complication rate after this procedure and present the clinical outcome at 2 and 5 year follow up time.
Methods: From 2003 until 2008 forty patients with a mean age of 70 years underwent this combined procedure for a total of 41 shoulders. 7 patients (8 shoulders) were not available for follow up and 2 patients were excluded from the study due to revision surgery with implant removal. All the remaining 31 patients have complete clinical follow up data (constant score) at 2 years and 10 patients additionally at 5 years.
Results: There were 8 orthopedic complications for the 41 procedures: 2 infection (1 with implant removal), 2 transient partial plexus paresis, 2 dislocations, 1 glenoid component loosening (conversion to a hemiarthorplasty) and one shoulder stiffness in one of the two patients with transient neurological complication. The age related constant score improved from preoperatively 44% to 91% at 2 year follow up time and the subjective shoulder value from 32% to 72%. For the 10 patients with a follow up time of 5 years the postoperative constant score remained stable on a high level (41% preoperatively, 95% at two and 96% at five years respectively) as did the subjective shoulder value (30%, 91%, 91%). The active external rotation improved from 6° to 27° in the 2 year collective and in the 5 year collective from 13° to 25° at 2y and 27° at 5y.
Conclusion: Even though it has a high complication rate, the combined reversed shoulder prosthesis and latissimus dorsi transfer restores active external rotation and yields to good and stable clinical and subjective results in patients with rotator cuff arthropaty with relevant infraspinatus insufficiency.

FM104

Revision of Reversed Total Shoulder Arthroplasty. Indications and Outcome

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Background: The complications of reversed total shoulder arthroplasty (RTSA) requiring surgical revision, their treatment options and outcome are poorly known. It was therefore the purpose of this retrospective study, to identify the reasons for revision of RTSA and to report outcomes.
Methods: 441 consecutively performed RTSA implanted between 1999 and 2008 were screened. Sixty-seven of these cases had to be revised to treat a complication. Causes for surgical revision were identified in these 67 cases and the outcome of the first 37 revised patients who could be followed for more than 2 years after their first revision was analyzed.
Results: Of 441 RTSA, 67 cases (15%) were revised at least once, 30 of them needed a second, 11 a third and 4 a fourth revision. The most common complication requiring a first intervention was instability (18%) followed by hematoma or superficial wound complications (15%) and complications of the glenoid component (12%). Patients benefitted from RTSA despite the need of revisions as indicated by an average increase in total Constant Score from 23 points before reverse total shoulder arthroplasty to 46 points at final follow-up ($p < 0.0001$; 95% CI: 17, 13).
Conclusions: Instability, hematoma or superficial wound complications and complications of the glenoid component are the most common reasons for revision after RTSA. Patients undergoing a revision as treatment of these complications profit significantly as long as the prosthesis remains in place.

FM105

Early outcomes of proximal Humerus Fractures treated with reverse total shoulder arthroplasty

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Introduction: In the primary care of complex proximal humeral fractures there's still no standard procedure if decided to treat surgically. In four-part and comminuted displaced fractures of the proximal humerus the controversies about the proper treatment are enormous, moreover because they occur in elderly patients. Up to now different reconstructive techniques had been used. The purpose of the current study was to evaluate early outcomes of reverse total shoulder arthroplasty for four part humerus fractures and proximal comminuted displaced humerus fractures.
Methods: Between July 2008 and February 2010, 19 patients underwent reverse total shoulder arthroplasty with the use of Delta X-Tend shoulder prosthesis (Depuy). All patients were evaluated clinically and radiologically using the Constant & Murley score.
Results: All patients, 9 man, 10 woman, were seen at clinics. The mean age was 79 years (71–89 years). Mean duration of follow up was 18 months with a range of 12 month to 29 months of follow up. The gender and age corrected Constant Murley Score was above 75. No complications have been observed.
Discussion: In our study we have shown that the reverse total shoulder replacement might be a successful alternative method for the treatement of complex fractures of the proximal humerus in elderly patients.

FM106

Inverse Total Shoulder Arthroplasty as primary treatment for complex proximal humerus fractures in the elderly

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Background: In elderly patients with complex proximal humerus fractures and osteoporotic bone reconstruction is very challenging and not always possible. Although hemiarthroplasty is an alternative, non-union or tuberosity migration can lead to inferior functional results. Implantation of a Reverse Total Shoulder Arthroplasty (RTSA) seems to be an interesting alternative. In the present study we retrospectively analyzed the short-term results of RTSA for complex proximal humerus fractures in the elderly.
Methods: From 2005 to 2010 RTSA was performed in 30 patients (average age 80 years [67;90], 26 women, 4 man) with subcapital, three- or four-part fracture of the proximal humerus as a primary treatment. All procedures were performed using the Anatomical Inverse Shoulder (Zimmer) with a fracture stem. A deltopectoral approach was used in every case with reattachment of the posterior greater tuberositiy including the infraspinatus. Pain, range of motion, subjected shoulder value (SSV) as well as the Constant score (CS) were used to evaluate shoulder function. Implant positioning and signs of loosening were analyzed on standard x-rays.
Results: Included were 24 patients with a minimal follow-up of 12 month. The average follow-up was 22 month (12 month to 5 years). The mean SSV was 82% [40;100]. The absolute CS averaged 66 points [34;83] and the relative CS 98 % [52;139]. The mean pain score (VAS) was 13.5 of 15, the mean activity score 18.3 of 20, the mean mobility score 28.3 of 40 and the mean strength score 4.9 of 25. The mean active anterior elevation was 130° [80;160], the mean active abduction 126° [20;170] and the mean active external rotation in 0° abduction 20° [-30;70]. All patients reached the same activity level as before surgery and could return to independent living. The results after 12 month were already comparable to those after 24 month (12 patients). Radiographically no signs of loosening were detected. There were a total of 3 complications and reoperations, two due to a hematoma and one because of a periprosthetic fracture.
Conclusions: In elderly patients with complex proximal humerus fractures and osteoporotic bone RTSA seems to be a very satisfactory procedure. The short-term clinical results are excellent and predictable with a rapid postoperative recovery of daily comfort. The complication rate is low and acceptable.

FM107

REVERSE TOTAL SHOULDER ARTHROPLASTY IN PATIENTS WITH ADVANCED PARKINSON'S DISEASE

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Background: The results of reverse total shoulder arthroplasty (RTSA) in patients with Parkinson's disease are poorly known. The purpose of this case series was to report our experience with RTSA in patients with cuff tear arthropathy (CTA) and advanced Parkinson's disease.
Method: Between 2000 and 2009, all patients with Parkinson's disease treated with a RTSA for CTA were reviewed after a minimum follow-up of 12 months. All patients had advanced Parkionson's disease of at least stage III according to Hoehn and Yahr. Outcome was assessed clinically (active mobility and visual analogue scale for pain) as well as radiographically with standard X-rays. All complications and revision procedures were noted.
Results: The ten shoulders in eight patients were reviewed at a mean follow-up of 43 months. There were no differences in terms of pain from preoperatively to last follow-up (7 vs. 9 points; $p = 0.251$). While flexion increased significantly from 50o to 68o ($p = 0.028$), abduction did not ($p = 0.061$). Internal rotation improved from reaching the greater trochanter to reaching the sacral bone ($p = 0.046$), but external rotation did not ($p = 0.749$). More patients were able to reach their mouth ($p = 0.057$), but the difference was not significant. Radiographically six shoulders demonstrated scapular notching and humeral radiolucency was seen in one patient without evidence of humeral subsidence. Seven of the ten shoulders had a complication (70%). Five shoulders underwent revision after a mean of 29 months (50%), two due to recurrent instability, two due to failure of the glenoid

component and one after a fracture of the scapular spine. In two other shoulders a fracture of the scapular spine was treated conservatively. In terms of pain, the seven shoulders with complications showed higher pain levels compared to the three shoulders without complications (6 vs. 15 points; p = 0.012) at the time of last follow-up.
Conclusion: Overall, the results of RTSA for CTA in patients with advanced Parkinson's disease are disappointing. Firstly, pain relief was not successful. Secondly, except for the gain in active flexion and internal rotation, the functional improvements were limited and clinically probably not relevant. Thirdly and most important, the complication and revision rate was unacceptably high.

FM108

Conversion from hemiarthroplasty for fracture to inverse arthroplasty of the shoulder. Can the humeral stem be left in place?

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Introduction: Hemiarthroplasty for fracture or other conditions may occasionally lead to unsatisfactory results. Revision to inverse arthroplasty seems to be a logical option in selected cases. However, removal of a firm implanted humeral stem may prove difficult. Some modular implants ? such as the Affinis® Fracture / Articula® / Affinis® Fracture Inverse system – now provide the possibility to convert the implant into an inverse one without removal of the stem. Special consideration should then be given to the soft tissue balance and the working length of the muscles, while adjusting the length of the combined implant. This presentation will analyze our cases of attempted conversion, including revisions.
Material and methods: The Affinis® Fracture (1st generation called Articula®) hemiarthroplasty is a modular system which consists of a humeral stem, an intermediate metaphyseal element, and a prosthetic head. For conversion cases, the head and the intermediate element are removed, and a new inverse intermediate element is mounted on the retained stem. The retroversion can be changed and adjusted intraoperatively to local conditions. A standard base-plate and glenosphere must be mounted on the glenoid. A revision was attempted in 20 patients for various reasons.
Results: In 8 cases (group A), the stem could be retained. In 12 cases (group B), the stem had to be removed and replaced by a new one. In group B 5 patients were included with an Articula® or an Affinis® Fracture stem which could not be converted. The other primary implants were of other designs and stem removal was therefore indispensable. Mean age was 79.2 years in group A and 68.6 years in group B. Constant score increased by 50.8 points in group A (76.2 adjusted for age and gender) and 50.8 points in group B (adjusted 70.7). Mean operating time was 93.8 min. in group A, and 152.5 min. in group B. There were no complications reported. Radiological results showed no signs of loosening or notching in either group.
Conclusion: For conversion, the ability to shorten the humeral construct and to reset the retroversion are crucial elements for success. In 8 out of 13 suitable Affinis® Fracture or Articula® cases, the humeral stem could be left in place. Operating time was then considerably reduced, while clinical and radiological results remained similar.

FM109

Do inferior scapular osteophytes have an influence on the outcome following reversed shoulder arthroplasty?

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Introduction: Osteophytes developing at the inferior aspect of the scapular neck following reversed shoulder arthroplasty (RSA) are rarely described in the literature. In addition, the impact of these osseous formations on the clinical outcome remains unclear. The goal of this study was to identify the incidence of scapular osteophytes within a 2-year follow-up period in two cohorts with different designs of RSA, and to evaluate their influence on the clinical outcome.
Material and Methods: Two prospectively followed cohorts with more than 100 patients in each were radiographically and clinically evaluated at the 2-year follow-up after RSA implantation. Radiographic assessment was performed by two independent observers including identification of osteophytes distinguished from heterotopic bone ossifications, classification of scapular notching, and measurement of the prosthetic scapular neck angle. Clinical assessment included the Constant Score (CS) in combination with patient-reported outcome values (Quick-/DASH, SPADI) and was stratified for radiological findings.
Results: Scapular osteophytes were identified at the 2 year follow-up in both cohorts: in 36% of the cases and in 22%, respectively. No significant differences were seen between the patient groups with and without osteophytes regarding shoulder function and pain (SPADI), function of the upper extremity (Quick-/DASH), range of motion or in the CS (p >0.05). In one of the cohorts, a higher scapular angle was significantly associated with the development of osteophytes (p <0.01) Glenoidal notching was also frequently seen (50% and 37% resp.) and correlated significantly with the presence of osteophytes (both cohorts p = 0.01).
Conclusion: Inferior scapular osteophytes can often be detected after RSA but apparently without any significant influence on the functional outcome in the short-term. A higher scapula-prosthesis angle and the presence of scapular notching seem to be associated with a higher incidence of osteophytes. The underlying etiology remains unclear: it appears that osteophytes can evolve directly by traction forces but also as a secondary ossification of the inferior capsule with adhesion to the scapular neck. A longer follow-up is needed to exclude any influence of this radiographic phenomenon on the clinical outcome.

FM110

Comparison of Clinical outcomes of Reverse Total Shoulder Arthroplasty performed with 36 mm standard CoCrMo, 36 mm eccentric CoCrMo and 44mm cross-linked UHMWPE Glenospheres? a multicenter study

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Background: Early outcomes of reverse total shoulder arthroplasty have been encouraging, but the procedure is not without its complications, scapular notching and instability, correlated with poorer clinical outcomes. SMR Reverse minimises these limitation with new designs and materials (SMR HP), reducing the prosthesis-scapular neck angle (PSNA) with a distal eccentric overhang and the polyethylene debris with the inversion of materials. The aim of this multicentre retrospective study is to compare range of motion, pain level, incidence of scapular notching and implant stability of reverse shoulder arthroplasty (RSA) performed with 36-mm standard CoCrMo, 36-mm eccentric CoCrMo and 44-mm eccentric X-UHMWPE glenospheres.
Methods: Between 2003 and 2008, 133 patients (average age 69.2 years, 31% male, 69% female) treated with a reverse shoulder prosthesis in 5 hospitals were divided in 3 groups: 63 (45%) patients treated with a 36 mm standard CoCrMo glenosphere (Group A), 21 (16%) with a 36 mm eccentric CoCrMo glenosphere (Group B) and 52 (39%) with a 44 mm X-UHMWPE glenosphere (Group C). The average follow up was 38.3 ± 17.4 months. Mainly primary diagnosis were: cuff tear arthropathy (Group A: 85%, B: 76%, C: 75%), secondary osteoarthritis (Group A: 3%, B: 14%, C: 15%) and cuff tears in endoprosthesis (Group A: 8%, B: 0%, C: 8%).Clinical assessment included Constant score (CS), pain relief and ROM; radiographic analysis was performed to detect scapular notching, instability, loosening and mechanical failure.
Results:The average CS significantly increased from preoperative assessment to all postoperative time-points for all 3 groups (Wi-test: P <0.001. Nevertheless the preoperative average CS of Group C was significantly lower than Group A and B (WI p = 0.003), Group C showed an average CS percentage increase much more relevant than the other two groups (Group A: CS: +31%, Group B CS: +43% and Group C: CS +50%; WI: p<0.001) at the last follow-up. Furthermore, 44 mm X-UHMPWE glenospheres confirmed higher ROM.After 12 and 24 months, patients of Group C and B had less pain than Group A (p<0.05). Group C had a significantly lower scapular notching than Group B (WI-test: p = 0.001) and Group A (WI-test: p = 0.009) at 12 and 24 months. The same trend was confirmed after more than 30 months from surgery. No progressive radiolucent lines have been observed. Group A had 5 (8.3%) early complications and Group C had 4 (7.6%) in Group C.
Conclusions: We found significantly higher scores, better outcomes and a lower rate of complications with the use of 44 mm X-UHMWPE and 36 mm eccentric CoCrMo glenospeheres than with the 36 mm standard CoCrMo one. We attribute these results to the decrease of the inferior notching with eccentric design (36 mm and 44 mm glenospheres) and to the inversion of the materials in the 44 mm glenosphere that allows to get higher ROM, faster functional recover even with an initial worse preoperative conditions. Additional, long-term studies are needed to evaluate the survivorship of the implants.

FM111

Total Shoulder Arthroplasty: Importance of the Thickness of the Polyethylene Glenoid Component

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Introduction: Wear of the articular surface of the glenoid polyethylene (PE) is related to the production of debris and may eventually lead to the component loosening. The effects thickness of the PE component used in total shoulder arthroplasty (TSA) are not wellknown. Therefore the goal of this study was to analyze the effect of the thickness of the PE glenoid component on the cement and PE stress.
Methods: A numerical musculoskeletal model of the shoulder was used. The model included the scapula, the humerus and 6 scapulo-humeral muscles: middle, anterior, and posterior deltoid, supraspinatus, subscapularis and infraspinatus combined with teres minor. Arm motion and joint stability were achieved by muscles. An anatomic prosthesis (Aequalis, Tornier Inc) was inserted. The effect of the thickness of the glenoid component was evaluated by comparing three glenoid components with different thicknesses: 2 mm, 4 mm (reference) and 6 mm. For the 3 configurations, a movement of abduction in the scapular plane was simulated. The gleno-humeral force and contact pattern, the stress developed within the glenoid PE and cement mantel were evaluated.
Results: The contact pressure was was about 150% higher with the 2 and 6 mm compared to the reference 4 mm thickness and consequently induced an increase of stress within the PE for both configurations. In the cement mantel, the stress was about 160% higher with the 2 mm PE, but 60% lower with the 6 mm PE.
Conclusion: This work confirms that the thickness of the PE is also a parameter implicated in the mechanisms of glenoid wear and loosening after TSA. Based on the results of this biomechanical study we recommend avoiding polyethylene component thinner than 4 mm.

FM112

Arthroscopic Hill-Sachs Remplissage: Anatomical and Functional Results

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Background: Large defects of the posterior-superior humeral head, commonly known as Hill-Sachs lesions, can engage the glenoid rim and be a cause of recurrent instability after arthroscopic Bankart repair. Filling of the humeral head defect with the posterior capsule and infraspinatus tendon (i.e., Hill-Sachs "remplissage"), is an additional arthroscopic procedure recently proposed.
Hypothesis: The capsulo-tenodesis heals in the humeral bone defect without severe adverse effect on shoulder mobility, allowing return to pre-injury sporting activity.
Methods: Forty-seven consecutive patients with recurrent traumatic anterior shoulder instability underwent arthroscopic labral repair combined with posterior capsulo-tenodesis using suture-anchors. Nine patients represented failures of prior instability surgery: 3 failed Bankart repairs and 6 failed open Latarjet. At arthroscopy, all had a large Hill-Sachs lesion (Calandra Grade III), engaging over the glenoid rim, without glenoid bone loss. Age at the time of surgery was 29 ± 5.4 years. Postoperatively, patients were prospectively evaluated. The mean follow up was 21 months (12–42). Comparative shoulder motion was precisely measured using digital photographic images. Capsulo-tenodesis healing was assessed at least 6 months after surgery in 42 patients (38 CT-arthrograms, 4 MRI).
Results: Healing of the capsulo-tenodesis was observed in all 42 cases. In 31 cases (66%), remplissage of the defect was ≥75%. Only one patient (2%) had a recurrent dislocation and was disappointed. Compared to the normal contralateral side, the mean deficit in external rotation was 8° ± 7 with the arm at side (ER1) and 9° ± 9 in abduction (ER2). There was a mean reduction of 2° ± 6 in active forward elevation, 5° ± 6 degrees in IR2, and 0.5 points in IR1. Of 41 patients involved in sports, 37 (90%) were able to return at the same level, including overhead activities.
Conclusion: The posterior capsulo-tenodesis heals predictably in the humeral defect. Despite a slight limitation of external rotation, return to sporting activity is possible in 90% of the cases. The procedure is indicated for patients with isolated humeral bone loss. It may also be useful for revision of previous failed instability surgery in patients without glenoid bone deficiency.

FM113

One technique for 3 problems: open suture anchor stabilization for lateral clavicular fractures and severe acute and chronic AC joint dislocations

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Background: There is no well established technique for the operative treatment of lateral clavicle fractures and AC joint dislocations. We use an open suture anchor technique for all these injuries. Preliminary results are presented.
Method: Retrospective analysis included all patients after surgical treatment with this technique for Neer type II fractures and acute and chronic Rockwood type III–VI AC joint dislocations from 2004 to 2010.
Results: 26 patients (mean age 38 years) were included. In the 6 patients with a lateral clavicle fracture radiological consolidation was achieved after a median time of 18 weeks. One patient with additional AC joint arthritis was secondarily addressed with arthroscopic joint resection. Twenty patients (8 acute, 12 chronic) had Type III and V AC joint dislocations. Satisfactory and stable reduction could be achieved in all but one patient who failed early after surgery and was reoperated. At follow-up the lateral clavicles were found to be symmetrical in 16 (80%) patients and a mild elevation without clinical/cosmetic complaints in 3 (15%) patients. At latest follow-up 18/20 patients had no or mild pain and normal shoulder function.
Discussion: Open suture anchor stabilization seems to be a good option for treatment for lateral clavicle fractures and AC joint dislocations. It provides reliable radiographical and good clinical results with a low complication and revision rate. The presented technique can be used for three different problems without the need for implant removal.

FM114

Hook plate fixation for lateral clavicular fractures – Does it really harm?

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Introduction: Management of displaced lateral clavicle fractures is controversial. Operative intervention reduces non-union rate observed with conservative treatment, but some techniques are reported to induce AC-arthropathy or rotator cuff lesions. However, there is only sparse literature regarding long-term results of operative treatment in these fractures. This retrospective study reviews the long-term results of 24 patients treated with hook plate.
Methods: Between 1998 and 2007, 24 patients (age at operation 13–56 yrs, average 46 yrs, 20 male) with isolated lateral clavicular fracture (n = 23) and one with a floating shoulder (n = 1) were treated with hook plate fixation. 22 patients were treated primarily and two were treated because of symptomatic delayed union (4–8 months). Median time to surgical treatment was 3 days (range 0–249 d). Plate removal was performed after 3.7 months (range 1.2–18.0) in all patients. All patients were evaluated by clinical examination, the Constant Score (CS) and Oxford Shoulder Score (OSS) and comparative bilateral shoulder MRI (without contrast medium). The mean follow-up was 8 years (range 3.6–12.4 years).
Results: Three patients (12.5 %) were lost to follow-up, of which one was operated after failed conservative treatment (after 8 months) and another one suffered a peri-implant fracture after 6 weeks. All fractures healed except one, which needed a second intervention due to non-union after 8 months. We observed one plate displacement despite fracture healing. No surgical-site infections occurred. The average satisfaction score was 9.2 (10 = very satisfied, 1 = very dissatisfied, range 7–10), the score for the cosmetic result was 7.2 (range 3–10). The operated shoulders had an average CS of 90 compared to 96 for the contralateral shoulder. The mean OSS was 14 compared to 13 (OSS 12–20 = good function). MRI scans revealed no full thickness rotator cuff tear and only mild posttraumatic/postoperative alterations of the AC-joint.
Conclusion: The hook plate fixation is a reasonable treatment option for displaced lateral clavicular fractures with a low complication rate, although plate removal is recommended. At 8 years, there were only mild AC-joint changes and no full thickness rotator cuff lesions detectable by clinical and MRI examination.

FM115

Complications after Locking Plate Fixation of Fractures of the Proximal Humerus

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Introduction: Locking plates for open reduction and internal fixation (ORIF) of proximal humerus fractures are widely used. An unusually high number of patients with complications has been referred to our institution in recent years. It was the purpose of this study to report these complications and their treatment options.
Material and methods: From 2003 to 2010 all patients treated with complications after ORIF of proximal humeral fractures with locking plates were prospectively collected and retrospectively analyzed. In patients necessitating revision surgery the clinical outcome was assessed with the Constant Score (CS), the radiographic evolution with standardized radiographs.
Results: 121 consecutive patients (67 women, 54 men) with an average age of 59 years were referred at an average of 15 months after primary locking plate ORIF. 80% of these patients initially had a 3- or 4-part fracture. The complications observed were (% of patients): initial malreduction (55%), malunion (63%), avascular necrosis (68%), nonunion (13%) and infection (6%). Perforation of screws into the glenohumeral joint was seen in 69% (83 patients) with (partial) destruction of the glenoid in 40 patients. There was an average of 3 (1 to 6) complications per patient. 107 patients needed a mean of 1.5 (1 to 6) revision surgeries, anatomical hemi- or total shoulder arthroplasty (n = 37) improved the mean CS from 27 to 49 points and reverse shoulder arthroplasty (n = 29) from 20 to 44 points after a mean of 24 months ($p < 0.05$). In 6 patients implantation of a glenoid component was no longer possible due to glenoid destruction by perforated screws, so that hemiarthroplasty was performed.
Conclusion: An intriguingly high number of patients with complications after ORIF of proximal humerus fractures using locking plates has been referred to our center. Most complications are major, needing single or multiple revision surgeries including arthroplasty in more than 50% of the cases. Shoulder function can be improved but no longer restored in the vast majority of patients. Complete destruction of the glenoid by locked perforating screws was the most devastating and previously almost unseen complication. ORIF of proximal humerus fractures with locking plates should be carried out with the awareness that at least one large referral center observes an intimidating number of often severe complications using this technique.

FM116

Intramedullar Bone Graft for Medial Support in Locking Plate Fixation of Proximal Humeral Fractures – an in vitro Study

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Introduction: In comminuted proximal humeral fractures, missing medial support can result in varus malalignment and cut through of the proximal screws when using locking plates. The aim of the present study was to assess the influence of an additional intramedullar bone graft on the biomechanical characteristics of proximal humeral fractures stabilized by locking plate fixation in a synthetic bone model.
Methods: Standardized proximal humeral fractures were created in 20 osteoporotic Synbone® humeri, and fixed with either a locking plate alone (group F-; n = 10) or using an additional fibula graft inserted intramedullarily (group F+; n = 10). Active abduction was performed for 400 cycles in an experimental setup with a simulated rotator cuff. Fragment gap distance was measured by induction and intercyclic motion, fragment migration and residual plastic deformation were determined.
Results: Locking plate fixation with additional intramedullar fibula graft resulted in five times lower intercyclic motion, two times lower fragment migration and two times less residual plastic deformation. Screw pullout, cut through or implant failure were not observed.
Conclusion: *In vitro* an intramedullar bone graft for medial support in locking plate fixation of proximal humeral fractures increases overall stiffness of the bone-implant construct and reduces migration of the head fragment. This technique might provide a useful alternative in the surgical treatment of displaced proximal humeral fractures, especially when there is medial comminution.

FM117

Self-healing of Anterior Cruciate Ligament Rupture by Dynamic Intraligamental Stabilisation (DIS) – 12 Month Results of the first 10 Patients

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Introduction: The anterior cruciate ligament (ACL) has limited self-healing potential. To date a torn ACL is removed and replaced by a graft. The drawbacks of this treatment is diminished proprioceptivity, secondary instability and donor-site morbidity. We developed a Dynamic Intraligamental Stabilisation (DIS) technique that successfully induced self-healing of ACL ruptures in a large animal model. In this study we adapted the DIS system for treatment of the human knee and present the results of the first 10 patients.
Patients and Methods: In a prospective study, the clinical and radiological results in 10 sportive patients with acute ACL rupture (2 women, 8 men, mean age: 26.4 years; range: 19-41 years) were followed for at least 12 months following DIS treatment. Knee function was documented using the Lysholm and Tegner scores. Anterior/posterior (AP) translation was measured with a standardized rolimeter. The healing course was evaluated by an indipendant senior radilogist performing an magnetic resonance tomography (MRT) at 3, 6 and 12 months.
Results: None of the 10 patients experienced intraoperative complications. One patient ruptured the same ACL while playing soccer 4 months postoperative and was excluded from the study. All patients reported normal knee joint function prior to ACL rupture, with a Lysholm score of 100 and a Tegner score of 6.3 (range: 4–9). Twelve months postoperative all patients had regained a Lysholm score of 100 and a Tegner score of 6.1 (range: 5–9). The average increase of AP translation was +1.2 mm (range: +0–3 mm) compared to the healthy contralateral side. In only 3 patients did the anterior movement have a hard endpoint. The MRI studies showed a continuous ligamenteous structure in all injured knees after 12 months indicating the healing of the acl.
Conclusion: The first results using the DIS sowed a contineous ligamenteous healing of the acl. Clinically the patients returned to full sportive activity with normal knee function scores. We consider this novel technique as a promissing new pathway to treat acl injuries.

FM118

Anatomic restoration of anteroposterior translation in ACL reconstruction failed at midterm

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Introduction: The outcome after reconstruction of the anterior cruciate ligament depends on the initial tension applied to the graft at the time of fixation. Anteroposterior translation (APT) of the transplant was adjusted intraoperatively to that of the contralateral healthy ACL. A loss in APT with time, the clinical and radiological outcome were evaluated.
Methods: In a consecutive series of 28 patients [28 knees, age 32 ± 11 (yrs, mean ± SD), 24 male], chronic ACL deficiency was treated by reconstruction (bone-patella-tendon-bone, BTB). APT was measured in 20° knee flexion in affected and healthy contralateral knees by Rolimeter preoperative, intraoperative, immediately after ACL-reconstruction, 3, 6 and 12 months postoperatively in triplates. Twenty-three of twenty-eight patients (82%) were retrospectively re-evaluated with APT measurement at a mean follow-up of 5.2 ± 1.5 years. Two patients moved overseas, two patients refused re-evaluation and one was lost to follow up. Clincial assessment included IKDC-, Tegner-, Lysholm- and SF12-Scores. Radiographically, the medial anterior tibial translation in a monopodal stance test (MATT-MS) in conventional x-rays and the integrity of the transplant in MRI scans were assessed.
Results: Statistically significant decreases of APT were observed between pre- and intraoperative measurements due to ACL reconstruction (BTB: 11 ± 2 to 6 ± 1 mm). No differences in APT between contralateral healthy and reconstructed knees were observed intraoperatively (anatomic restoration). At midterm, APT was not statistically significant compared to the index preoperative values (9 ± 2 to 11 ± 2 mm). Values (mean ± SD) for assessed scores were: 6 ± 2 (Tegner), 89 ± 9 (Lysholm), 56 ± 8 (SF12, physical), 54 ± 7 (SF12, mental). In the total IKDC score patients showed only "abnormal" or "severely abnormal" results in 87% and 13%, respectively. The MATT-MS (mean ± SD) was 1.3 ± 1.9. MRI scans confirmed morphological intact ACL transplants in all patients.

Conclusion: The presented technique provides ACL reconstruction with intraoperative anatomic restoration of the APT. APT, if measured by Rolimeter, was not maintained at midterm. However, in the monopodal stance test, when the perigenicular musculature was activated, an increased anterior tibial translation was not confirmed. Patients might have learned to muscular compensate the ligamentous laxity. In terms of APT restoration, the indication for ACL reconstruction has to be reconsidered.

FM119

Comparison of All-Inside Meniscal Repair Devices with Matched Inside-Out Suture Repair

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Background: All-inside meniscus repairs are performed with increasing frequency due to the availability of newly developed devices. A comparison of their biomechanical characteristics may aid physicians in selecting a method of meniscal repair.
Hypothesis: All-inside meniscal repairs will be superior to their inside-out controls in response to cyclic loading and load-to-failure testing.
Methods: In a controlled laboratory setup, sixty-six bucket-handle tears in matched porcine menisci were repaired using the Ultra FasT-Fix, Meniscal Cinch, Ultrabraid No. 0 and FiberWire 2-0 sutures. Initial displacement, cyclic loading (100, 300 and 500 cycles) and load-to-failure testing were performed. The displacement, response to cyclic loading, and mode of failure were recorded. The stiffness was calculated. Camera displacement measurements using ImageJ: An Ultrabraid repair measured after 1, 100, 300 and 500 cycles (left to right) as an example.
Results: The Meniscal Cinch demonstrated a significantly higher initial displacement than the other methods tested ($p = 0.04$). No significant difference was found among the methods in response to cyclic loading. The inside-out FiberWire repair demonstrated the highest load-to-failure (120.8 ± 23.5 N) and was significantly higher than both the Meniscal Cinch (64.8 ± 24.1 N, $p < 0.001$) and the Ultra FasT-Fix (88.3 ± 14.3 N, $p = 0.002$). It was not significantly higher than the inside-out Ultrabraid suture repair (98.8 ± 29.2 N). The inside-out FiberWire repair had the highest stiffness (28.7 ± 7.8 N/mm). It was significantly higher than the Meniscal Cinch (18.0 ± 8.8 N/mm, $p = 0.01$). The most common mode of failure in all methods was suture failure.
Conclusions: An inside-out suture repair affords surgeons the best overall biomechanical characteristics of the devices tested (initial displacement, response to cyclic loading, and load to failure). For an all-inside repair, the Ultra FasT-Fix reproduces the characteristics of its matched inside-out suture repair more closely than the Meniscal Cinch.
Clinical Relevance: Initial displacement demonstrates the degree of contact at the level of the repaired tear. This is difficult to evaluate arthroscopically and hence needs to be evaluated in biomechanical testing.

FM120

Lacking re-Innervation of the ruptured ACL-graft – a cause of failure?

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Introduction: Rupture of the ACL after reconstructive surgery is multifactorial. Surgical technique such as tunnel mal-positioning, graft preparation and tensioning, or material failure are possible causes. Metabolic factors are discussed, however only re-vascularization partially understood. Re-innervation of the graft has been found in animal models, and ACL-hamstring arc to be re-established in humans. However, re-innervation as a potential cause of ACL re-tear has never been analysed.
Methods: 17 patients (28.8 ± 8.2 years) and 20 knees, at least 5.6 years (range 0.3 to 16.3) after primary ACL reconstruction, were included. Several biopsies were taken 43.8 days (range 8 to 101) after re-tear from the proximal, the mid and the distal portion of the failed graft. Immuno-histo-chemical analysis (HE and S-100) were performed to assess for nervous tissue in the graft.
Results: nerve fibres were inexistent in 17 grafts, 3 grafts showed only little signs of re-innervation. The three patients with re-innervation of their torn graft suffered high-energy contact injury. No significant difference was found for time between primary surgery and re-rupture, graft choice, and time between re-rupture and biopsy with regard to re-innervation.
Discussion: only patients with high energy contact injury of their ACL graft showed re-innervation. In all other patients, no nervous tissue could be detected. Hence, lacking re-innervation of the ACL-graft may contribute to increased risk of re-tear due to missing sensory feed-back mechanism such as the acl-hamstring arc. Future studies will have to show, whether this factor may be influenced by either surgery or rehabilitation methods.

FM121

Precision of tibial tunnel placement under arthroscopic control alone in posterior cruciate ligament reconstruction: A radiological study

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Introduction: Accurate and reproducible tibial tunnel placement minimizing the risk of neurovascular damage is a crucial condition for successful arthroscopic reconstruction of the posterior cruciate ligament (PCL). This step is commonly performed under fluoroscopic control. Hypothesis: Performing the tibial tunnel under exclusive arthroscopic control allows accurate and reliable tunnel placement according to recommendations in the literature.
Materials and Methods: Between February 2007 and December 2009, 108 arthroscopic single bundle PCL reconstructions in tibial tunnel technique were performed. The routine postoperative radiographs were screened according to previously defined quality criterions. After critical analysis, the radiographs of 48 patients (48 knees) were enrolled in the study. 10 patients had simultaneous ACL reconstruction and 7 had PCL revision surgery. The tibial tunnel was placed under direct arthroscopic control through a posteromedial portal using a standard tibial aming device. Key anatomical landmarks were the exposed tibial insertion of the PCL and the posterior horn of the medial meniscus. First, the centre of the posterior tibial tunnel outlet on the a-p view was determined by digital analysis of the postoperative radiographes. Its distance to the medial tibial spine was measured parallel to the tibia plateau. The mediolateral position was expressed by the ratio between the distance of the tunnel outlet to the medial border and the total width of the tibial plateau. On the lateral view the vertical tunnel position was measured perpendicularly to a tangent of the medial tibial plateau. All measurement were repeated at least twice and carried out by two examiners.
Results: The mean mediolateral tunnel position was 49.3 ± 4.6% (ratio), 6.7 ± 3.6 mm lateral to the medial tibial spine. On the lateral view the tunnel centre was 10.1 ± 4.5 mm distal to the bony surface of the medial tibial plateau. Neurovascular damage was observed in none of our patients.
Conclusion: The results of this radiological study confirm that exclusive arthroscopic control for tibial tunnel placement in PCL reconstruction yields reproducible and accurate results according to the literature. Our technique avoids radiation, facilitates the operation room setting and enables the surgeon to visualize the anatomic key landmarks for tibial tunnel placement.

FM122

Determination of tunnel position and metabolic activity – a novel standardized algorithm for evaluating patients after anterior cruciate reconstruction using combined single photon emission tomography and conventional computerized tomography (SPECT/CT)

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Purpose: 3D-CT is used to accurately evaluate the tunnel placement in patients after ACL reconstruction. SPECT/CT additionally promises the potential assessment of the biology of the joint and particularly the bone-graft-fixation complex. The purpose of this study is to introduce a novel standardized SPECT/CT algorithm in these patients and evaluate its clinical application and reliability.
Methods: A novel SPECT/CT localization scheme consisting of 9 tibial, 9 femoral and 4 patellar regions on standardized axial, coronal, and sagittal slices, is proposed. The tracer activity on SPECT/CT was recorded in 15 consecutive patients using a color coded scale (0–10). The inter- and intra-observer reliability was assessed for localization and tracer activity. The tunnel position and attachment areas of the graft was assessed in 3D-CT using standardized frames of reference and the modified quadrant method introduced by Bernard and Hertel (femoral) and modified Stäubli technique (tibial). The median inter- and

intra-observer differences and ranges of the measured angles were calculated along with the ICC values for inter- and intra-observer reliability.
Results: The localization scheme showed very high inter- and intra-observer reliabilities for all regions. The measurement of tunnel position and attachment sites was highly reliable in all cases with sufficient visibility of anatomical landmarks. The ICC value of tunnel measurements was at any time above 0.80. In all knees with a stable knee an increased tracer uptake of the medial and/or posterior tibial tunnel wall was observed.
Conclusion: The SPECT/CT algorithm presented is highly reliable and clinically feasible. Combining the mechanical information on tunnel placement and attachment areas and the metabolic data it might open a new horizon evaluating patients after ACL reconstruction. The clinical value of SPECT/CT in these patients should be further investigated.

FM123

Vitamin C plasma values reduced after orthopaedic surgical intervention in patients with total knee arthroplasty and prosthesis revision operation

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Introduction: Vitamin C is the specific agent in the formation of intercellular substance and is needed in the collagen synthesis activating the enzyme prolyl-hydroxylase. It is involved in the process of wound and bone healing. Its deficiency is linked to wound healing complications, diseases of connective tissues and hypothetically to arthrofibrosis after total knee arthroplasty (TKA) (1, 2). To our knowledge no data exist concerning perioperative vitamin C concentrations in orthopedic patients. The aim of this study was to investigate whether a decrease in vitamin C plasma levels can be observed in patients undergoing orthopedic surgery depending on the extent of the surgical intervention.
Material and methods: Twenty patients were divided into four same-size groups. Group A underwent ORIF for an ankle fracture, group B unterwent primary TKA, group C had hip or knee revision surgery for aseptic loosening. Five healthy volunteers (group D) without any surgical intervention were sampled as reference group. Vitamin C plasma values were measured one day preoperatively (d-1) and on day 1, 3 and 7 (d1,3,7) postoperatively.
Results: Mean age and operation time was 54y and 34 min in group A, 73y and 94 min in group B, 77y and 122 min in group C. Healthy volunteers were on average 52 years old. Patients undergoing primary TKA showed significant lowering of vitamin C levels in the postoperative course compared to preoperative values (d-1: 10.0 ± 6.7 mg/l, d7: 1.7 ± 2.6 mg/l, p-value = 0.007). A strong tendency of vitamin C depletion of almost 80% was observable in patients after revision intervention (d-1: 5.5 ± 3.0 mg/l, d7: 1.1 ± 0.3 mg/l, p = 0.05). Patients with ankle fractures already reached the preoperative level of vitamin C (d-1: 4.1 ± 2.1 mg/l, d3:3.9 ± 1.4 mg/l, p >0.05) on day 3. Healthy volunteers did not show any lowering during the examination period.
Discussion: Vitamin C values were significantly lowered in patient groups with large operative interventions and longer operation time (TKA, revision surgery). The results of this study show a pronounced vitamin C depletion in patients after extended orthopedic surgical intervention. Hypothetically this is associated with accumulated oxidative stress and higher metabolic activity. Further studies are necessary to examine the role of vitamin C in the healing and rehabilitation process and its effect on improved postoperative function of musculoskeletal system in orthopedic patients.

FM124

The Lausanne Experience with the Wichita Fusion Nail for Arthrodesis of the Knee

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Background: Arthrodesis of the knee by intramedullary fixation has been reported to have a higher rate of success than external fixation or compression plating. Antegrade nailing however can lead to complications due to the different diameters of the medullary canals, fractures during insertion, poor rotational stability, breakage of the IM-nail and insufficient compression at the fusion site.
Method: This retrospective study reports all knee fusions performed by the same orthopaedic surgeon with the Wichita (Stryker) fusion nail (WFN) from 2004 to 2010. The Wichita nail is a short nail with a device at the knee which allows for coupling of differently sized and interlocked femoral and tibial components and at the same time for compression.
Results: We report of 18 patients with a mean follow up of 28 months (range 3–71 months). Infected TKA was the most common indication for arthrodesis in 9 cases. The remaining reasons included aseptic failed TKA in 3 cases, 2 patients after fracture, 1 patient with neurological instability after knee dislocation, 1 patient after tumoral resection and 1 non union after failed arthrodesis with long antegrade nail. Finally 1 patient with bilateral congenital knee dislocation operated on both sides. As expected, patients receiving the WFN had undergone a large number of previous knee surgeries with a mean of 3.8 (range 0–8) procedures per patient. The complication rate was 27% (5 of 18). Two patients had persistent pain requiring revision surgery to increase stability with plating. One case of periprosthetic fracture needed open reduction and internal fixation. 2 patients with superficial hematoma were treated one with open drainage and the other with physiotherapy. Infection was erradicated in all septic cases, we found no new infection and the fusion rate was 100%.
Conclusion: The results in these often difficult cases are satisfying and we think that this technique is a valid alternative to the other known techniques of knee fusion in patients with a poor bone stock and fragile soft tissues.

FM125

Rupture of the popliteal artery complicating medial opening wedge high tibial osteotomy

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Introduction: The popliteal artery is vulnerable to injury during surgeries performed around the knee joint. Pseudoaneurysm of the popliteal artery following a high tibial osteotomy is rare, but has been published in literature yet. Complete rupture as a complication after a lateral closing wedge high tibial osteotomy has never been reported so far.
Case report: Our patient underwent an uneventful medial opening wedge high tibial osteotomy for medial osteoarthritis of the knee which was fixed with a Tomofix plate. The procedure was performed under tourniquet, which was released for five minutes before closing the wound in order to produce a blood clot within the osteotomy gap. After wound closure we routinely checked the distal pulses which were significantly decreased. Twelve hours postoperatively, the patient experienced strong pain and a swelling of the entire lower leg. The sensation over the sole was decreased and the motor function of the foot was impaired. A femoral angiogram revealed a complete rupture of the popliteal artery at the level of the osteotomy site (pars III). Open vascular surgery with resection of the stumps and end-to-end anastomosis using a reversed contralateral saphenous vein interposition graft was performed. During the vascular surgery, a sharp transsection of the popliteal artery could be revealed, which undoubtedly occurred while using the oscillating saw during opening wedge high tibial osteotomy.
Discussion: Vascular complications during or after lateral closing wedge high tibial osteotomy are rare, but range from vascular thrombosis over compartment syndrome to lazeration of the popliteal artery. This complication may be a rarity, nevertheless it is severe and should be kept in mind when performing this procedure. Careful placement of retractors around the osteotomy site during sawing and flexing the knee to lesser the stretch on the popliteal artery and keep it away from the operation site are recommended to prevent this complication. To our knowledge, this is the first report of a complete rupture of the popliteal artery occurring after a medial opening wedge high tibial osteotomy.

FM126

Gait modifications in osteoarthritis patients waiting for a total knee arthroplasty

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Introduction: It is well recognized that patients with knee osteoarthritis (OA) present an altered gait pattern secondary to pain and structural changes within the joint [1–3]. Although most studies have focused their research on lower extremity alterations, recent literature has shown the importance of the role of proximal compensation [2–3]. The aim of this study is to analyze gait modifications in patients scheduled for a total knee arthroplasty (TKA), with special emphasis on altered trunk movements.
Method: 26 subjects with advanced knee OA who were waiting for TKA (68 ± 6 years) and 13 control subjects (66 ± 8 years) were recruited for a 3D gait analysis. Kinematics and kinetics were obtained from PlugInGait model, Vicon Mx3+ (12 cameras –100 Hz) and two force plates (AMTI ?1000 Hz). The following parameters were analyzed: the peak value of the knee flexion angle, the peak value of the knee adduction/abduction moment during the mid-stance, the peak value of the knee flexor/extensor moment during the loading phase, the maximal trunk flexion/extension and the mean trunk lean in the frontal plane. Results were compared between groups using ANOVA and Tukey post-hoc tests.

Results: Results showed a significant reduction of knee motion (46 ± 9° vs 55 ± 4°, *P* = 0.001) and knee extensor moment (0.23 ± 0.17 Nm/kg vs 0.38 ± 0.19 Nm/kg, *P* = 0.01), with an increase of lateral trunk lean (2 ± 1° vs 0 ± 2°, *P* = 0.0001) in the OA group. Though slightly superior for patients with OA, no significant difference between groups was observed for the knee adduction moment (0.61 ± 0.17 Nm/kg vs 0.52 ± 0.14 Nm/kg, *P* = 0.1).
Discussion: Pain and decreased knee motion in patients with knee OA induce substantial compensations during gait. The recognized quadriceps weakness in knee OA, essential during the loading phase of gait, might lead to the reduction of knee extensor moment. The increase in lateral trunk lean as a compensation to diminish pain will act to displace the center of mass laterally and thus reduce the knee adduction moment. This study brings new insights leading to a better understanding of gait modifications in patients with advanced knee OA. Moreover, the data presented might be helpful for rehabilitation and follow-up process of patients after TKA.
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FM127

Comparison of electromyographic temporal analysis during gait in patients after total knee arthroplasty receiving a midvastus or mini-midvastus approach

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Introduction: Quantitative gait analysis including surface electromyography (SEMG) is a recognized and valuable tool in the assessment of gait disorders. The aim of the study is to compare the midvastus and the mini-midvastus approach by means of SEMG in patients after total knee arthroplasty (TKA) at comparable walking speeds.
Material and methods: In this prospective study 18 patients resp. 22 patients (66.1 ± 8.3 yrs, 61.2 ± 7.8 yrs) with symptomatic unilateral gonarthrosis who underwent TKA (Journey®, smith&nephew) using a mini-midvastus (MIS) resp. midvastus (standard) approach were compared. A healthy control group of 20 subjects (59.6 ± 6.3 yrs) was sampled. For each patient 20 gait cycles were averaged preoperatively, 6, 13, and 26 weeks postoperatively. Bilateral SEMG was obtained from 3 muscles (M. vastus medialis (Med), M. vastus lateralis (Lat), M. biceps femoris (Bic)). To compare the longitudinal results a step frequency of 90 steps/minute was given by a metronome. For statistical analysis unpaired t-tests and linear mixed models were used.
Results: Walking speed at a given frequency of 90 steps/minute did not differ significantly between the three groups at any of the time points. There were no significant differences in temporal electromyographic analysis of the parameters 'Bic' (p = .824), 'Lat' (p = .275), 'Med' (p = .202) between the MIS and standard group 6, 13, and 26 weeks postoperatively. Bic, Lat, and Med of the operated side showed significantly longer activities in all patients during stance phase compared to the control group 26 weeks postoperatively (Bic, Lat, Med: p
Conclusion: There were no significant differences in electromyographic analyses at comparable walking speeds between the MIS and the standard group. However, patients showed significantly longer muscle activities during stance phase than the healthy control group even six months postoperatively. It is important to better understand patients' utilisation of the major muscles surrounding the knee joint in order to evaluate gait rehabilitation after minimally invasive TKA.

FM128

Long-term cyclic muscle induced submaximal joint loading leads to chondrocyte death and accelerates cartilage degeneration in an in vivo rabbit model

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Background: Excessive mechanical load is thought to be responsible for the onset of osteoarthrosis (OA). In clinical studies, heavy labourers and long-distance runners were shown to be at high risk for OA. Fatigue failure, which includes chondrocyte death, is a possible mechanism. In vitro and animal studies seem to support these findings, but no study has ever examined the effects of long-term cyclic application of joint loading with a physiologic amplitude and loading parameters but excessive duration and no study has ever quantified the amount or type of force applied. The aim of this study was to evaluate the effects of such loading on histological appearance and cell death in a long term rabbit model.
Methods: 23 rabbits were implanted with a nerve cuff electrode on the right femoral nerve connected to a subcutaneous multiuse interface and were divided into 3 groups (50 mins of cyclic eccentric, concentric or isometric submaximal muscle stimulation, 3 times a week for 4 weeks = 19500 cycles). All joint surfaces were analyzed for cell viability with confocal microscopy and histologically for Mankin Score, cellularity and cartilage thickness. 16 joints were used as independent confocal controls while the contralateral joints served as histological controls.
Results: All loading groups showed significantly higher chondrocyte death rates than controls (0.78–1.39 vs 0.19%; p <0.001). Cell death was highest for inferior groove and patella as well as the tibial plateaus. Eccentric and isometric joint loading resulted in the highest cell death rate while concentric loading was lowest. All groups showed significantly higher Mankin Scores for the loaded joints compared to the contralateral non-loaded joints (p = 0.017–0.042). Cartilage thickness was not significantly different between loaded and non-loaded joints.
Conclusion: This is the first study to show that long-term cyclic application of muscle-induced joint loading of physiologic amplitude and loading parameters but excessive duration leads to chondrocyte death, increased Mankin scores and decreased cellularity. Our findings may help explain the higher OA incidence in endurance athletes and heavy labourers.

The numbers refer to the pages of this supplement.