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FM 1

Durom® hip resurfacing arthroplasty: Five-year results of the first 50 consecutive patients

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Introduction: Concerns recently arose regarding hip resurfacing arthroplasty (HRA), mainly referring to the metal-on-metal articulation that results in increased metal ion concentrations and that may be associated with weird soft tissue reactions. Although a number of short-term reports highlighted excellent and encouraging outcomes after HRA, mid- to long-term follow-up studies are sparse in the current literature. This study aimed to determine the five-year results of HRA using the Durom® prosthesis in the first consecutive 50 cases.
Methods: We prospectively assessed clinical and radiographic data for all patients undergoing HRA with this implant. Follow-ups were scheduled at six weeks, one year, two years and five years after surgery. All complications, revisions and failures were noted. Harris Hip Scores (HHS) and the range of motion (ROM) were determined preoperatively and at each follow-up. Oxford Hip Scores (OHS) and University of California at Los Angeles (UCLA) activity levels were determined at the last control. Comparisons were performed using paired t-tests after testing for normal distribution.
Results: The cohort comprised 13 women and 36 men (50 hips) with a mean age of 53.3 ± 10.7 years and a mean BMI of 25.9 ± 3.7 kg/m^2. After a mean follow-up of 60.5 ± 2.3 months five hips had to be revised, corresponding to a failure rate of 10%. Four failures were related to the femoral component, and one implant was exchanged due to symptomatic malpositioning eight months after HRA. A neuropraxia of the sciatic nerve occurred in one of the cases. Clinically, ROM significantly improved after surgery. Hip flexion increased from 91.1 ± 15.8° to 98.9 ± 6.5° (p = 0.0007), internal rotation from 5.5 ± 6.9° to 11.1 ± 8.1° (p = 0.0005), external rotation from 19.2 ± 12.5° to 28.8 ± 9.1° (p = 0.0001), and abduction from 27.3 ± 10.5° to 40.2 ± 11.0° (p <0.0001). The HHS significantly increased from 55.9 ± 12.3 points to 96.5 ± 8.5 points. The OHS averaged 14.3 ± 3.0 points, and UCLA activity levels averaged 7.7 ± 1.7.
Conclusion: The present results demonstrate that despite excellent clinical outcomes in terms of patient scores and ROM, the failure rate in HRA using the Durom® implant is high after a mid-term follow-up, mainly related to the femoral component.

FM 2

Surgical hip dislocation for the treatment of femoroacetabular impingement in high level athletes

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Introduction: Mid-term outcome studies show that symptomatic femoroacetabular impingement (FAI) can be successfully treated by addressing the underlying pathomorphology with open or arthroscopic surgery. Although athletes may be particularly vulnerable to hip injury from impingement, little information is available regarding the results of open surgery in this group. This study investigated if professional and semi-professional athletes with FAI can resume to their sports after surgical hip dislocation and continue their career up to a mid-term follow-up.
Methods: We identified twenty-one consecutive professional and semi-professional athletes (28 hips, all cam-type or mixed-type FAI, mean alpha-angles of 67.1°) operated between 2003 and 2008 by one single surgeon. All athletes were evaluated by postal survey at a mean of 43 months (range, 12–79) after surgical hip dislocation for treatment. The evaluation included the type and level of sports, subjective ratings, and clinical outcomes [Hip Outcome Score (HOS), SF-12, UCLA activity scale, Hip Sports Activity Scale (HSAS), VAS pain].
Results: At follow-up, 20 of the 21 patients (95%) were still competing professionally. Eighteen athletes maintained their previous level and two were active in minor leagues. Seventeen patients (81%) were satisfied with their hip surgery and their sports ability. Mean activity levels were 7.6 according to the HSAS and 9.8 according to the UCLA scale, respectively. Mean scores of the HOS ADL and Sport subscales were 93.2 and 87.2, respectively. Mean scores of the SF-12 PCS and MCS were 50.9 and 56.8, respectively. Pain levels during sports were rated to be 1.9 according to the VAS.
Conclusion: Surgical hip dislocation for the treatment of FAI allows athletes to resume sports and to continue a professional or semi-professional career at the same level for up to several years. Clinical outcomes in terms of subjective ratings and scores were very satisfactory.

FM 3

10-Year Follow-Up of Bernese Periacetabular Osteotomy

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Introduction: The goal of the Periacetabular Osteotomy (PAO) is to correct the deficient acetabular coverage in hips with developmental dysplasia (DDH) to prevent secondary osteoarthritis. We present the 10-year survivorship, the clinical and radiographic outcome, and factors predicting poor outcome.
Methods: A retrospective study of 90 hips (83 patients) treated with PAO for DDH between January 1997 and January 2000 was performed. Surgery included an arthrotomy to check impingement-free range of motion after reorientation of the acetabulum In 33 cases (36.7%) an offset-correction of the femoral neck was performed. The mean age at surgery was 30 ± 9.5 (11–49) years and the mean follow-up was 11.0 ± 1.5 (9.4–13.0) years. There was one patient with one hip lost to follow-up at 0.6 years postoperatively. Survivorship analysis was performed according to Kaplan and Meier and the endpoint was defined as a conversion to a total hip arthroplasty (THA). Demographical, clinical and radiological parameters were analyzed using the Cox regression analysis to detect predictive factors for poor outcome.
Results: Twelve hips converted into a THA after 7.6 ± 3.5 (1.3–12.3) years. This resulted in a cumulative Kaplan-Meier survivorship at 10 years of 91.6% (95%-confidence interval 85.6–96.6%). The pre-operative osteoarthritis score according to Tönnis was a significant predictor for poor outcome. Hips with a preoperative score of 0 and 1 showed a 10-year survivorship of 94.4% (95%-CI 89.1–99.7%) whereas hips with a preoperative score of 2 had a survivorship of (95%-CI 29.6–90.4%). At last follow up, the patients with preserved hip joints presented with a mean Merle d›Aubigné score of 16.5 ± 3.1 (14–18).
Conclusion: The PAO is an effective and successful technique for the treatment of DDH to preserve or at least to decelerate the progression of secondary osteoarthritis. A good long term result depends on the preoperative cartilage condition.

FM 4

The "Zweymueller" stem. Follow-up of 20 years and more. One single surgeon study

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Introduction: The distal fitting stem called "Zweymueller" has been on the market since more than 25 years. Results of follow-up of 20 years and more are very rare, a respective publication could not be found. The assignment at hand shows the results of the follow-up results of implanted Zweymueller stems over 20 years by one single surgeon.
Methods: From 1987 until 1990 a total of 102 cementless stems (Alloclassic™) have been implanted on 93 patients. 9 patients have been operated on both sides. 57 Zweymueller – and 45 Balgrist cups, have been implanted, both cementless types came with PE-inlays and ceramic balls 32 mm. With equal distribution between genders, the average age was 66.4 years. Indication for the implantation: 86% primary osteoarthritis, 9% femurhead necrosis, the remaining 5% are due to dysplasia or posttraumatic reasons. Standard approach: transgluteal (Bauer approach). Until such time as the follow-up examination started, 37 (40%) of the patients were still alive. 27 patients, resp. 32 hip-implants could be examined clinically as well as radiologically. 6 patients have not been able to leave their home anymore and have therefore been interviewed and examined at their home. 2 patients declined a follow-up examination though it was possible to interview them. From the deseased, information could be gathered trough relations and/or their respective house doctors.
Results: Early complications: 6 trochanter avulsions, 3 thrombo embolies, 2 secondary haemorrhages. No infections and no dislocations. 99 Zweymueller stems have "survived" until the patients death or until the follow-up examinations in September 2009, this is a respective survival rate of 97%. There was one stem revision 3½ years postoperative because of a periprothetic fracture, and two stem revisions after 16 resp. 20 years because of a loosening. The clinical results after 20 years and more show a HHS of 88. The x-rays show an average wear of 0.08 mm per year, 70% show ectopic ossifications, 23% show radio lucent lines.
Conclusion: This follow-up study over 20 years of the Zweymueller stem, implanted by one single orthopaedic surgeon shows an excellent long-term performance of this distal fitting implant. The transgluteal approach shows consistant, good results.

FM 5

Cannulated hip screws for the prophylactical fixation of femoral neck fractures Garden type I or II. An adequate treatment for patients 65+?

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Question: The treatment of femoral neck fractures Garden type I and II in aged patients is discussed controversially. Raaymakers observed in these patients after conservative treatment a secondary dislocation rate of up to 40%. Cannulated hip screws are meant to avoid this complication. In addition a low revision rate in the treatment of aged patients is crucial. At our hospital cannulated hip screws were the standard treatment for femoral neck fractures Garden type I and II until 2007, thus allowing a survey of a bigger patient population. Do the cannulated hip screws meet the above mentioned requirements?
Method: From 2004 to 2007 44 patients with femoral neck fractures Garden type I or II were treated with cannulated hip screws. 4 patients were lost to follow up, 6 patients died within the first postoperative year. 34 patients were included into this study. Of these 19 patients were older than 65 years at the time of trauma. All patients were retrospectively reviewed for the need of a revision operation using medical history, x-ray findings and interview. In addition the type of revision operation was documented.
Results: 13 of 19 patients (68%) older than 65 years required a revision operation. In 10 of 19 cases (53%) a revision osteosynthesis or secondary prosthetic treatment was necessary, in 4 cases respectively concerning a femoral head necrosis and secondary dislocation and in 1 case respectively concerning secondary shortening and refracturing due to a second trauma. In comparison only 2 of 15 patients (13,3%) younger than 65 years required a revision operation.
Conclusion: The cannulated hip screws are no adequate treatment for patients older than 65 years with femoral neck fracture Garden type I and II. The rate of secondary dislocation can be reduced, but is still too high with a rate of 20%. The operative treatment implicates new risks for the soft tissue in particular. Furthermore the known high rate of femoral head necrosis leading to secondary prosthetic treatment is impressive. In our opinion prosthetic joint replacement is the treatment of choice if conservative treatment with full mobilisation is not possible.

FM 6

5-Year Follow-Up of Surgical Dislocation of the Hip for the Treatment of Femoroacetabular Impingement

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Femoroacetabular impingement (FAI) is a pathologic condition of the hip joint that leads to hip pain and osteoarthrosis. The goal of the surgical dislocation of the hip is to prevent this by correcting the osseous malformations. We investigated the clinical and radiographic outcome, the survivorship, and the factors predicting poor outcome at 5-year followup. We retrospectively evaluated 101 hips (78 patients) that underwent surgical dislocation at a mean age of 32 ± 8.4 (range, 15–52) years. The mean followup was 5.7 ± 1.0 (0.9–7.1) years. Failure was defined as a conversion to a total hip arthroplasty (THA), a MdA score of less than 15 or a progression of osteoarthrosis with a Tönnis score ≥2 at last followup. Predictive factors were calculated using the Cox regression. The cumulative survivor ship at 5 years was 97.0 ± 3.3% (95%-confidence interval, 93.6–100%). Failures (13 hips, 13%) included 6 hips (6%) with a progression of osteoarthrosis, 5 hips (5%) hips that converted to a THA, and 2 (2%) hips presenting with a MdA score of less than 15. At last followup the mean MdA score was 17.2 ± 1.2 (12–18) and the mean Tönnis score was 0.19 ± 0.47 (0–2). Factors predicting poor outcome were a preoperative Tönnis score of 1, a cartilage tear in the MR, and increased age or BMI at operation. Surgical hip dislocation has the potential to prevent the progression of osteoarthrosis and to decrease hip pain in patients with FAI.

FM 7

Femoral neck fracture: a complication after arthroscopic osteochondroplasty for femoroacetabular impingement

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Background: Biomechanical cadaver studies showed a low risk of femoral neck fractures after osteochondroplasty of the femoral head-neck-junction. Similarly the literature on complications after this procedure does not report this type of complication. The purpose of the present study was to assess the incidence and risk factors of femoral neck fractures after arthroscopic osteochondroplasties and their impact on outcome.
Methods: Our prospectively recorded computerized database of 410 consecutive hip arthroscopies was retrospectively analysed in for this complication. Age, gender, body height and weight of patients with and without fracture were compared as well as the extent of performed bony resection, which was determined whether on MRI or CT. In addition, preoperative Harris Hip Score (HHS) and WOMAC scored and WOMAC scores at follow-up were compared between both groups.
Results: 8 (1.9%) non displaced femoral neck fractures were identified. Six were treated conservatively and 2 by in situ screw fixation. Fractures occurred after a mean of 5 (range 2–12) weeks. None of them had adequate trauma. All patients were male (control group 42% male), their mean age was 43 years (control group 36, p = 0.06), body height averaged 180cm (control group 172, p = 0.01), body weight 83 kg (control group 73, p = 0.07) and BMI 25 kg/m^2 (comparative group 24, p = 0.45). The extent of bony resection did not differ between the groups. A comparison of preoperative and last follow-up HHS and WOMAC scores between the fracture and control group revealed no significant difference (p = 0.18–0.59).
Conclusions: Fracture of the femoral neck may occur after osteochondroplasty. Despite a small number of cases, our data suggests that male gender, higher body height, old age and high body weight are associated with an increased risk for this complication. Nevertheless, this complication does not negatively influence outcome once the fracture has healed.

FM 8

Revision total hip arthroplasty in patients 80 years or older

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Introduction: Orthopaedic surgeons are frequently asked to perform a revision total hip arthroplasty (THA) in patients over 80 years of age. Our objective was to evaluate the outcomes after revision THA in patients 80 years or older and compare them to a cohort of patients less than 80 years of age.
Methods: We reviewed all revision THAs performed in our institution from 3/1996 to 12/2008. We compared intra- and post-operative complications (medical and orthopaedic), mortality, clinical outcomes and patient satisfaction between the two age groups. Peri-operative information and complications were collected prospectively, and clinical outcome data were obtained both pro- and retrospectively. The Merle d'Aubigné score, Harris Hip score, general health (SF-12) and patient satisfaction (visual analog scale) were assessed.
Results: Overall, 325 revision THAs were included, 84 (25.8%) in patients ≥80 years and 241 in patients <80 years. In both groups the reason for revision was aseptic loosening in 62% of the patients (mean interval primary THA - revision 142 vs. 97 months). The older group was more often revised for periprosthetic fractures and recurrent dislocation. Mean follow-up time was 4.3 years. Mortality (≥80 vs. <80 years) was 6% vs. 0% 3 months postoperative, 9.5% vs. 1.2% 1 year postoperative, and 31% vs. 8.3% 5 years postoperative. 3 (3.6%) re-revisions were performed in patients ≥80 years compared to 24 (10%) in the younger group. Postoperative medical complications developed in 22.6% compared to 6.6% in the younger group. There were one infection and 13 dislocations in patients ≥80 years vs. 12 infections and 22 dislocations in the other group. The Merle d'Aubigné score improved from 9.6 to 13.7 (p = 0.001) in patients 80 years or older vs. 10.3 to 14.3 (p <0.001), and the Harris Hip score at last follow-up was 74.2 vs. 78.5. Patient satisfaction was significantly higher in the older group (8.4 vs. 7.5, mean difference 0.9, 95% CI 0.2;1.8)
Conclusion: Revision THA in patients over 80 years was associated with substantial clinical improvement, and patient satisfaction was higher than among the younger group. The medical complication rate and the 3-months-mortality were higher.

FM 9

Femoral revision with impaction grafting with the uncemented MRP-TITAN revision stem: Results of a prospective controlled study of 243 patients

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Introduction: We present the results of a prospective controlled study of the uncemented modular revision prostheses "MRP-TITAN" with a distal diaphyseal anchorage with and without metaphyseal bone stock augmentation.
Materials and methods: In the context of a prospective multicenter study 243 cementless stem revisions in matched patients using the MRP Titan Revision Stem with an average follow-up time of 4.38 ± 1.79 years (2.10–9.62 years) were examined. 70 patients (28.8%) received a metaphyseal bone augmentation, 173 patients (71.2%) without metaphyseal bone augmentation served as controls. Postoperatively, the clinical outcome was evaluated by the Harris Hip Score (HHS). Additionally x-rays were performed focusing on stability, periprosthetic bone remodeling, defect regeneration and the presence of radiolucent lines. Results: Preoperatively, no significant differences were seen concerning age, body mass index, score of the "American Society of Anaesthesiologists", femoral bone defects as differentiated by Paprosky I – III and the HHS ($p > 0.05$). Postoperatively no significant differences concerning the HHS and the intra- and postoperative complication rate occurred ($p > 0.05$) while plain radiographs showed increasing axial subsidence for controls in contrast to patients after metaphyseal augmentation (6.9% vs. 2.9%; $p = 0.16$). Secondary, a significant reduction of the proximal femoral bone atrophy due to femoral stress-shielding (5.71% vs. 17.9%); $p \leq 0.05$) could be detected after augmentation. Good integration of bone grafts with subsequent defect regeneration was seen in 65 (92.85%) patients after augmentation. For stem diameters ≥17 mm and femoral bone defects ≥Paprosky II C better clinical and radiological findings were detected in patients with augmentation. The revision rate after augmentation was clearly reduced (2.86% vs. 6.36%).
Conclusion: The encouraging results we found for the MRP Titan Revision Stem accentuate the need of metaphyseal bone defect augmentation for femoral bone defects lager than Paprosky II C and stem diameters lager than 17 mm. Subsequent better bone regeneration after metaphyseal bone augmentation indicates increasing physiological load transmission minimizing femoral stress-shielding as a requirement of a prolonged prostheses life time.

FM 10

Clinical and radiological outcome 40 years after Pemberton osteotomy – a case series

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Objectives: The Pemberton pericapsular pelvic osteotomy was first described in 1965 for treatment of developmental dislocation of the hip. In this pelvic osteotomy the anterior and lateral aspect of the acetabulum is reshaped to centre and better contain the femoral head. The Pemberton osteotomy and its success have been described to depend on the flexibility of the triradiate cartilage and its remaining remodeling capacity.
Methods: A single surgeon performed 18 Pemberton osteotomies between 1965 and 1970. We were able to recruit 12 patients (13 hips) for this study in 2008. A detailed history was taken and various disease specific questionnaires (WOMAC score, Merle d'Aubigné, Harris hip score) were completed. Two examiners did a full physical examination on each patient and functional assessment was performed by a senior physiotherapist. Conventional radiographs were taken to assess osteoarthritis and acetabular orientation.
Results: Data of 12 patients were collected (11 female, 1 male). 11 patients had a developmental dislocation of the hip (Toennis grade IV). One patient was diagnosed with Legg-Calvé-Perthes disease. Mean age at the time of intervention was 6 ± 4.6y. At follow-up the mean patient age was 47 ± 4.6 years. One patient with bilateral Pemberton osteotomies presented with a unilateral hip arthroplasty done at the age of 41. Patients who were operated under the age of 5 showed significantly better WOMAC results in the subscales pain ($p = 0.05$) and stiffness ($p = 0.02$). The WOMAC function score and the WOMAC total score showed no significant difference between the two age groups but a statistical trend in favour of the younger patient group ($p = 0.06$). 5 out of 12 hips had radiological signs of moderate osteoarthritis (Kellgren-Lawrence score >2 points). 9 out of 12 patients had no problems practising sport regularly. In the Tegner activity score 2 patients scored 5 points and 5 patients scored 4 points.
Conclusions: The overall results 40 years after Pemberton osteotomy were very good. 9 out of 12 patients reported no problems in ADLs or sports. The data of this small patient sample suggest that a younger age at the time of Pemberton osteotomy has a positive effect on clinical and radiological long term outcome.

FM 11

20-year Survivorship of the Hip After Fixation of Displaced Acetabular Fractures

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Introduction: Acetabular fractures are life-altering injuries which commonly occur in young, active and productive members of the society. The ultimate goal of surgery for acetabular fractures is hip joint preservation for the rest of the patient's life. However, long term survivorship in this predominantly young patient group has never been analyzed in a very large series.
Materials and methods (SPION): S: Case control study. P: Inclusion criteria: Surgically treated displaced acetabular fractures (n = 1,218 consecutive hips); minimum follow-up of two years or failure at any time. Exclusion criteria: Primary total hip arthroplasty (THA), periprosthetic fractures, insufficient follow-up of less than two years, refusal of information by the patient. This left 816 fractures with a mean follow up of 10.3 years (range 2–29 years) for analysis. I: Surgical treatment of displaced acetabular fractures by a single surgeon in accordance to an established treatment protocol based on Letournel's principles. O: Failure was defined as conversion to THA of hip arthrodesis. A Cox-regression analysis identified significant risk factors predicting the need for THA. Analyzed parameters comprised data on patient history, preoperative clinical examination, associated injuries, fracture pattern, radiographic and intraoperative features, and the accuracy of reduction. N: Identification of factors predicting the need for THA in the long term follow-up for the individual patient.
Results: The cumulative 20-years survivorship of the hip was 79%. Statistically significant factors influencing the need for artificial hip replacement/arthrodesis were identified. A best-/worst-case scenario for all patients lost-to-follow-up was carried out.
Discussion: In summary, the hip joint can be successfully preserved and prosthetic replacement avoided in the vast majority of displaced acetabular fractures at 20 years. The identified negative predictors are of outmost importance for development of novel surgical techniques and approaches to improve the clinical management for these patients. This worldwide largest series on acetabular fractures provides benchmark data for any type of comparative evaluation studies dealing with surgical treatment of acetabular fractures in future. Also, the study with its precedent character represents a valuable basis for any other long term analysis of articular fractures.

FM 12

Leg-Length control after Total Hip Arthroplasty. A comparison between conventional surgery technique and Navigation

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Introduction: Palpating the malleoli to ensure equal leg length during surgery is a doubtful undertaking. Every ab- or adduction of 5° leads to an error rate of 8 mm (Sarin et.al J Arthroplasty, 2005). One of the reasons surgeons tend to lean towards leg lengthening is to avoid dislocation. A postoperative leg-length within –5 mm to +5 mm in comparison to the opposite side is ideal. A difference up to 10 mm is still tolerated, a lengthening of over 10 mm is bothersome and often painful. The latter becomes more and more of a legal malpractice problem.
Methods: In a prospective study from 2007 to 2009, 200 hip arthroplasties have been navigated (Group A). On the a-p x-ray of the pelvis 3 months postoperative, the distance between the trochanter minor and the horizontal under the tear-sign have been measured. A series of 200 conventionally operated hip arthroplasties from 2004 to 2006 (Group B) – before navigation became daily routine – served in comparison. Both groups show the same age as well as the same distribution between genders. All patients have undergone cementless hip-prosthesis surgery in dorsal position with a distal fitting stem.
Results: 180 (90%) leg-lengths of group A, and 127 (63.5%) of group B, range within the ideal zone of –5 mm to + 5 mm. 19 (9.5%) of group A, and 52 (26 %) of group B, show discrepancies from 6mm to 10 mm or -6 to -10 mm. 19 (9.5%) of group B show a lengthening of over 10 mm, within group A there was none. 2 (1%) of the conventional

group show a postoperative shortening of more then 10 mm. One female patient in the navigation group with a dysplastic hip and a one sided preoperative length deficit of 30 mm could be corrected down to a shortening of only 10 mm. Within group B we had 3 (1.5%) dislocations, within group A there was none.
Conclusion: The navigation system supports intraoperative leg-length control at all times during hip replacement. Leg-length discrepancies of more than 10 mm and dislocations could be avoided.

FM 13

Does failed hip arthroscopy (HAS) negatively influence outcome after total hip replacement (THR)?

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Background: The risk that previous conservative hip surgery could negatively influence outcome of THR remains a concern. HAS gained wide popularity and due to its relatively small invasiveness, palliative indications may become more frequent. The aim of the present study was to test the hypothesis that previous HAS would negatively influence outcome after THR.
Methods: Our prospectively recorded computerized database of 489 primary THR was retro-spectively analysed for THR after failed HAS. Preoperative and follow-up WOMAC scores were compared between the study group and the whole collective. In addition comparison was performed with a paired gender, age, BMI, Charnley classification matched control group. Patient with previous ipsilateral hip surgery were excluded from the matched control group. X-ray evaluation of groups included preoperative and follow-up antero-posterior and cross table views.
Results: 22 patients (7 males, 15 females, mean age 43y) underwent THR after failed HAS. The mean interval between HAS and THR was 28 months (range 3–24). The mean WOMAC score improved significantly from 5.3 ± 1.4 preoperative to 1.2 ± 1.8 at follow-up ($p < 0.001$). There was no significant difference in terms of preoperative and follow-up WOMAC scores between the study group and the matched control group ($p = 0.403$; $p = 0.932$). Follow-up radiographs showed no implant related complications in both groups. Heterotopic ossifications Brooker class 1 once was seen in the study group ($n = 1$) as well as in the mactched control group ($n = 8$). Minor intra- and postoperative complications occurred two times in the study and three times in the matched group.
Conclusions: Prior HAS does not seem to negatively influence outcome of THR.

FM 14

Early failure of a spherical pressfit cup

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Introduction: In a prospective study we wanted to evaluate the clinical and radiological performance of a new ceramic-ceramic bearing. Between January 2008 and September 2009 a total of 151 Total Hip Arthroplasties (THA) have been done either via a standard lateral (117) or minimal invasive anterior (34) approach. Due to early failures the study was stopped, the analysis of the failures will be presented.
Material/Methods: The study was approved by the institutional ethical committee. The implant was a modular spherical pressfit cup (seleXys TH+™) without additional screws and a ceramic-ceramic (Ceramys™) bearing, combined with an uncemented stem (96 CBC™, 55 TwinSys ™, Mathys, Switzerland). All operations were performed in our routine setting (preoperative planning, use of image intensifier, no navigation). Patients were scheduled for clinical controls after 1 and 6 weeks and for clinical and radiological controls after 3 months and yearly afterwards.
Results: All patients had a complete clinical and radiological follow-up. Between 10/09-12/09 we detected seven cup failures with obvious tilt during the regular follow-up and stopped the use of the implant. The mean time interval between the operation and symptoms was 7.4 (2 to 20) months. All postoperative radiological parameters were within a normal range. Two of the cups were operated in MIS technique. None of the seven patients remembered an obvious trauma. Four cups have already been revised, three cups are not revised yet because of acceptable symptoms. The mean change of inclination was 25.1 (4 to 39)° and the mean change of anteversion was 9.4 (2 to 19)°, respectively. None of the revised cups showed signs of rim-impingement in microscopical analysis.
Conclusion: We found no technical error as explanation for the early failure. There might have been a lack of initial stability not realised by the operating surgeon and/or a poor later osseointegration. Soft tissue impingement might have caused peak forces not tolerated by a weak interface and leading to desintegration. As a consequence of our experience we have discontinued to use the seleXys TH+™ cup in combination with a hard-hard bearing.

FM 15

The refixation of the hip abductors after avulsion from the greater trochanter with temporary implant removal or femoral head resection

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Introduction: Rupture of the hip abductors after hip arthroplasty or spontaneously is a serious problem for which no satisfactory treatment is available. The patients are suffering from persistent pain and often are limping. We present the above mentioned technique and our results.
Method: Until now we operated 38 patients with this method (21 female, 17 male patients). In 27 patients the origin was a lateral approach to the hip with secondary avulsion of the reinserted abductor muscle. In 7 patients avulsion occured spontaneously. 3 patients suffered from a trochanteric non-union which resisted earlier attempts to fixation. In 1 patient the abductors were damaged after fracture treatment with a gamma-nail. In all patients the abductor muscle was reattached with non-resorbable sutures to the greater trochanter after the femoral stem of a hip implant or the femoral head had been removed.
Results: Reoperation with implantation of a new hip implant was done 8 weeks later. In 30 patients the abductor muscle had completely healed to the greater trochanter. In 4 patients only a partial healing was visible, 4 further patients await surgery. Complications in the implant free interval, peri-or postoperatively were seen in 7 patients (dislocations, fractures). 17 patients are satisfied or very satisfied with the results. In 10 patients follow-up is too short and in 4 patients the expectations could not be fulfilled.
Conclusion: The removal of a hip implant or the resection of the femoral head after avulsion of the hip abductors leads to a reliable refixation of the abductor muscle to the greater trochanter. In many cases the muscle can regain enough strength in order to lead to a painfree gait without limping. Our method is effective in addressing this serious problem, unfortunately it is demanding for the surgeon and the patient.

FM 16

The plain radiological Beta Angle in the Assessment of Femoroacetabular Impingement

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Introduction: Femoroacetabular Impingement may result from two forms of anatomical deformities. The cam type is caused by an overgrowth of the femoral head-neck junction whereas the pincer type is related to acetabular overcoverage. Most patients have mixed forms of these two deformities. This demonstrates the need for a unique imaging technique that takes into consideration the interaction of both femoral head-neck-junction and acetabular pathology. We developed a method to measure the angle between pathological head neck junction, head centre, and acetabular rim with the hip in 90° of flexion on the basis of plain x-rays. The purpose of this study was to measure this plain radiological beta angle in a collective of FAI patients against a group of healthy control persons, to determine correlations of the beta angle with clinical range of motion and to assess its reproducibility.
Methods: 50 symptomatic FAI patients and 50 asymptomatic control subjects had beta view x-rays for measurement of the beta angle and clinical evaluation of range of hip motion. A correlation analysis was performed to evaluate correlation between range of hip motion and the corresponding beta angle. The beta angle was measured digitally twice by three observers to evaluate inter- and intra-observer reliability.
Results: FAI patients showed a significantly smaller mean beta angle (15.6°; range: 1°– 29°) compared to the asymptomatic control group (38.7°; range: 30°–57°). Correlation between internal-rotation and beta angle was high in the FAI group and moderate in the asymptomatic control group. The plain radiological beta angle showed excellent inter-and intra-observer reliabilities in both, the FAI groups and the asymptomatic control group.
Conclusion: The data of this study suggests that the native radiological beta angle may represent a valid, reproducible, and cost-effective alternative to open MR-arthrography in the assessment of the pathological bony anatomy in patients with femoroacetabular cam, pincer, and mixed impingement.

FM 17

Percutaneous Iliosacral Screw Fixation for fractures and disruptions of the posterior pelvic ring – technique and perioperative complications

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Introduction: Percutaneous iliosacral screw placement allows minimally invasive early definitive fixation of fractures and disruptions of the posterior pelvic ring. The objective of this study is to describe the technique using conventional C-arm, evaluate the perioperative complications, and to point at possible pitfalls.
Methods: Thirty-two consecutive patients undergoing percutaneous pelvic ring fixation using cannulated screws between 10/2008 and 11/2009 were enrolled and analysed. The screws (7.3 mm) were inserted in the supine position using conventional C-arm fluoroscopy (inlet, outlet, and lateral view). Reduction and accuracy of screw placement was evaluated postoperatively by CT scans and conventional X-rays. Fracture healing and outcome were assessed during regular follow up examinations.
Results: Fifteen patients underwent unilateral, 17 patients bilateral screw fixation. In total 74 screws were placed. Mean age of the patients was 51 ± 18 years. Mean operation time including positioning of both patient and C-arm, and wound closure was 18 ± 8 min per screw. Two patients died during their stay at hospital from unrelated causes. Mean follow up of the remaining 30 patients was 5 ± 3 months. Time to full weight bearing in 24 patients was 9 ± 4 weeks. Six patients were still not able to put full weight on the operated extremity at last follow up (mean 3 ± 3 months), partially due to concomitant injuries. Patients without concomitant injuries that affected walking were able to bear full weight after 8 ± 4 weeks (n = 17). Three patients had persistent postoperative hypaesthesia in the L5/S1 dermatoma. No motor weakness was apparent in any of the patients, and no postoperative bleeding due to the insertion of an iliosacral screw was observed. Secondary surgery due to screw malpositioning or loosening had to be performed in 3 patients.
Conclusion: Percutaneous iliosacral screw fixation is a rapid and definitive treatment for posterior pelvic ring injuries with a low risk of secondary bleeding during posterior pelvic stabilisation. The procedure using standard C-arm fluoroscopy was found to be safe in the hands of surgeons acquainted with knowledge of the pelvic anatomy and its fluoroscopic correlations.

FM 18

Do intra-operative fractures of the greater trochanter or simple metaphyseal fractures negatively affect outcome after total hip replacement?

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Introduction: Intra-operative fractures of the greater trochanter and simple metaphyseal fissures may occur during total hip replacement (THR). Using the direct anterior approach for THR, it is our practice to treat GT fractures conservatively without soft tissue stripping and to secure simple metaphyseal fractures by wiring. The purpose of this study was to determine the impact of such intra-operative complications on outcome.
Methods: A retrospective review of our prospective database of 489 consecutive minimally invasive uncemented THR revealed 14 (2.9%, 5 male, 60 ± 8.5 yrs) patients with intra-operative fractures of the GT (8, 1.6%) or the shaft (6, 1.2%). Secondary fracture displacement or subsidence of the stem was evaluated by serial radiographs until consolidation. Outcome in terms of a one year WOMAC score was compared with an age, gender and body mass index (BMI) matched control group.
Results: All but one GT fractures consolidated after a 6 weeks period of partial weight bearing without cranial displacement. The remaining showed no bony consolidation but did not require surgical revision because of no secondary displacement and good patient satisfaction. WOMAC scores did not differ significantly when compared to the matched control group ($p = 0.45$). All 6 metaphyseal fractures healed uneventfully and without stem subsidence at one year. WOMAC scores at 1 year did not differ significantly between these patients and the matched controls ($p = 0.62$).
Conclusion: Using the direct anterior approach, intra-operative complications such as greater trochanter and simple metaphyseal fractures can be treated conservatively and by simple wiring, respectively. Such fractures did not have any negative impact on outcome in our series.

FM 19

Total femur replacement after implant loosening/femoral pseudarthrosis – a solution in special cases?

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Introduction: Implant loosening/femoral pseudarthrosis after total hip/knee replacement (THR/TKR) with insufficient bone stock/bone defects is associated with pain and wheelchair immobilization. In these cases, total femur replacement (combined total replacement of hip and knee, connected with an intramedullary rod), as known from tumor surgery, is a potential therapeutic procedure. We describe this technique and the results of a series of patients.
Study Type: Monocentric prospective case series.
Patients and methods: Patients included had complex pathological femoral fracture with implant loosening (Vancouver Type-B3) and inability to walk. Follow-up was scheduled at 3 and 6 months, 1, 3 and 5 years post-surgery, including clinical examination, x-rays and questionnaires.
Results: Included were 6 cases of total femur replacement in 5 patients (4 women and 1 man, 54 to 71 years old). All patients were polymorbid, unable to walk, and had 2-5 previous interventions in the affected joint/leg. 5 cases had stem loosening/pseudarthrosis after THR, 1 case after TKR.
Outcome: Follow-up duration ranged from 3 to 10 years (mean 5.5 years). Pain medication was reduced substantially. All patients gained mobility and could walk with crutches. 2 cases needed to be reoperated in the follow-up period (knee mobilisation, resection of periarticular calcifications of the hip). 1 patient lost his ability to walk after 8 years due to poor general condition and mental disorder. 2 patients reported some knee pain; radiologically there was bone loss in the metaphyseal area.
Conclusion: Total femur replacement can be used in special cases with pseudarthrosis of the femur and implant loosening. Most of these patients profited from this surgery with less pain and better mobility.

FM 20

The German Hip Outcome Score (HOS): Validation in patients undergoing hip joint preserving surgery

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Introduction: The scientific interest in hip joint preserving surgery is growing continuously. The Hip Outcome Score (HOS) is the first self-administered questionnaire specifically developed to address patients undergoing this type of surgery. This study therefore aimed to cross-culturally adapt and validate the HOS for use in German-speaking patients suffering from femoroacetabular impingement (FAI) or hip dysplasia and undergoing hip joint preserving surgery.
Methods: After cross-cultural adaptation (HOS-D), the following metric properties of the questionnaire were assessed in 93 consecutive patients (mean age 33 years, 44 women) undergoing hip joint preserving surgery (ie, arthroscopy, surgical dislocation, periacetabular osteotomy): feasibility, reliability, internal consistency, and construct validity (correlation with the WOMAC, Oxford Hip Score (OHS), SF-12, and the UCLA activity scale). Floor and ceiling effects were calculated taking the minimal detectable change into account.
Results: The Activities of Daily Living (ADL) subscale of the HOS-D could be scored in all cases, and the Sport subscale in all but one. The HOS-D scores were highly reproducible with ICCs of 0.94 for the ADL subscale and 0.89 for the Sport subscale. Internal consistency was confirmed by Cronbach's alpha values of >0.85 for both subscales. Correlation coefficients with the other measures ranged from -0.04 (SF-12 Mental Component Scale) to -0.89 (WOMAC function subscale).
Conclusion: The Hip Outcome Score (HOS-D) is a reliable and valid self-assessment questionnaire for patients suffering from FAI or hip dysplasia. Using the HOS, comparisons between studies and treatment regimens involving either German- or English-speaking patients are now possible.

FM 21

Socioeconomic aspects of total hip arthroplasty. A comparison between anterior minimally invasive surgery and standard lateral approach

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Introduction: Minimally invasive total hip arthroplasty (THA) has become a big trend in orthopedic surgery with results advocating shorter hospital stay and diminished costs per case.
Methods: The aim of our study was to compare retrospectively THA performed by an anterior minimally invasive approach (AMIS) to THA performed by a standard lateral approach on the following criteria: number of hospitalization days, average cost per case, operative time, destination of patients, and number of hospital physiotherapy sessions.
Results: Between February 2008 and February 2009A, 54 patients with coxarthrosis were treated by THA through an AMIS approach and 280 through a lateral approach (group control).
AMIS group: the mean age was 64.7 years and the average BMI was 25.7. The mean operative time was 98 minutes. Patients had a mean number of 3 intra-hospital physiotherapy sessions. The mean hospital stay was 7.1 days and the average cost per case was 13.554 CHF. Almost 80% of the patients returned directly to home.
Lateral group: the mean age was 68.7 years and the mean BMI 26.7. The average operating time was 117 minutes. The mean number of intra-hospital physiotherapy sessions of was 6. The average hospital stay was 11 days with an average cost per case was 21.000 CHF. Half of the patients needed further care in rehabilitation centers with additional cost. The preoperative data of the 2 groups were similar according to age and BMI. All the above-mentioned postoperative data were statistically different between the 2 groups.
Conclusion: It seems that AMIS approach could be an option to reduce the number of intra-hospital physiotherapy sessions, hospitalization days, hospital costs, and may results in fewer patients in rehabilitation centers.

FM 22

Developmental dysplasia of the hip should be followed through Puberty

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Introduction: Developmental dysplasia of the hip is usually treated conservatively with e.g. a Pavlik vest. We retrospectively analyzed patients with developmental dyplasia but otherwise healthy newborn children. The patients were all documented clinically and radiological until after walking age.
Methods: More then 500 children were treated for developmental dysplasia of the hip before the year 2000 at our clinic. The diagnosis was made during the first 3 months by ultrasound of the hip using GRAF's method (at least of type IIc). Out of this collective we analyzed about 180 patient charts randomly. Out of the 180 patients 150 had clinical and radiographic documentation until the ages of 8 years or older.
Results: All children had normally appearing pelvic X-rays at an age of about 4 years. In 5 patients (only girls) however we found dysplastic hips when they were 8 years and older. These patients had no other medical conditions, especially no neurologic disease.
Conclusion: Of the infants treated dysplasia of the hip some appeared to have normal hips at the age of 4. About 3% of our patient collective became "again" dysplastic. It remains uncertain if a developmental dysplastic hip can be treated and later on adequately diagnosed until the age of 4 or whether this patients should be clinically followed until puberty.

FM 23

Radiographic assessment of the femoral tunnel entrance area prior to anterior cruciate ligament revision surgery

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Introduction: Failure of ACL reconstruction has been reported as high as in 25%. Prior to revision surgery plain x-ray and 2D-CT are performed to assess the femoral tunnel. To our present knowledge, no study has aimed at depicting potential conflict between the pre-existing and the planned femoral tunnel entrance area (FTEA) with radiographic measurements. The purpose of the study was to evaluate existing measurement methods and to establish a new method of radiologic measurement to avoid intra-operative complications (i.e. tunnel fusion, wall breakage) prior to revision surgery.
Methods: The FTEA of ten patients after primary ACL reconstruction (single-bundle, two-incision, outside-in technique) and good overall result was assessed using measurements on plain x-ray. Additional measurements were performed using our new technique on 3D-CT based on operative landmarks. Three axes were defined: X: horizontal line along the posterior aspect of the intercondylar roof (PAIR), Y: line parallel to the axis of the femoral shaft (pFS) through the changing point of the medial aspect of the lateral femur condyle and the notch roof, and Z: sagittal line along the inner margin of the lateral condyle crossing X. The expenditure of the FTEA was measured according these lines. Mean value with standard deviation was defined as our desired FTEA for revision surgery. Identical measurements were performed on ten patients with failed ACL reconstruction prior to revision surgery. Measurement results were compared.
Results (preliminary): The desired FTEA can be depicted unequivocally in our patients. The FTEA on 3D-CT is 0.3 mm (±0.7 SD) to 10.4 mm (±0.9) shallow to PAIR, 2.9 mm (±1.3) lateral and 1.3mm (±2.0) medial to pFS, and 2.3 mm (±0.7) superior and 4.1 mm (±0.5) inferior to pFS. FTEA on sagittal conventional radiographs is 70% (±10) posterior along the Blumensaat's line and 42° (±5.7) inclined. The FTEA of 2 out of 10 of the patients with failed ACL reconstruction shows a conflict with the desired FTEAs on 3D-CT, which was verified in the intra-operative setting. In plain x-ray nearly half of the patient showed identical measurement to our planned FTEA.
Conclusions: Measurement techniques on conventional radiographs are inferior to 3D-CT measurements. Therefore, 3D-CT reconstruction is strongly recommended prior to ACL revision surgery to depict patients with potential conflict between former and planned femoral tunnel to avoid intra-operative problems.

FM 24

Antero-posterior measurements of normal and dysplastic knee trochleae with axial magnetic resonance imaging

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Introduction: Different surgical techniques have been described to correct trochlear dysplasia. When defining trochlear dysplasia, there exists no clear criteria to distinguish between decreased trochlear depth and flattened lateral and /or medial condylar height. This study describes the results of axial MRI measurements of normal and abnormal trochlear anatomy and we aim to describe parameters to guide the selection of the necessary surgical procedure to produce normal trochlear anatomy.
Material and methods: We prospectively evaluated the MRI scans of 152 subjects: 30 patients with patellar instability due to trochlear dysplasia and 122 subjects without any symptoms or objective findings related to the patellofemoral joint. The height of the medial and lateral condyle and the centre of the trochlea were measured on axial MR images. The height of these different locations was compared to the total width of the femoral condyle and expressed as a percentage. The statistical analysis was performed with the Student's t test using SPSS software. For intraobserver reliability 20 randomly selected MRIs were evaluated twice.
Results: In normal subjects, the height of the lateral condyle was 81% of the width of the femoral condyle, the trochlear central height was 73%, and the medial condylar height was 76%. In patients with patellar instability, the lateral condylar height was 82% and showed no significant difference compared to the normal group. ($P = 0.082$). The trochlear central (77%) and medial condylar height (79%) were significantly different ($P < 0.001$) to the normal subjects. There was also a significant difference ($P < 0.001$) between males and females in the anatomical measurements taken. The resultant percentages of all three measurements were greater in males than in females. The intraobserver reliability was excellent for all the parameters recorded.
Conclusion: In conclusion (1) the MRI anatomical evaluation method presented is reliable for calculation of the height of the trochlea in different locations, (2) a more objective assessment of trochlear anatomical pathology is possible, and (3) in our series of patellofemoral instability patients, most would benefit from a deepening trochleaplasty as the surgical procedures of choice to correct the dysplasia.

FM 25

Lateral release versus lateral retinacular lengthening for hypercompression syndrome of the patella. A prospective randomized double-blinded study

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Introduction: The lateral release (RR) is an established treatment for hypercompresionsyndrome of the patellar (HSP) but there is still a varying rate (up to 30%) of postoperative complications, such as recurrence of the HSP or medial patellar instability. An alternative technique is the lateral retinacular z-lengthening (RL). We present a prospective study designed to compare the complication rate and the functional improvement after RR to the outcome after RL.
Methods: 28 patients (average age 42,5 yrs) with HSP received RR or RL over the same lateral parapatellar skin incision. Surgeon and rehabilitation program were the same. Preoperatively, 3, 6, 12 and 24 months postoperatively the following standardized outcome documentation was used: Kujala score (0-100 points); passive patellar tilt (PPT, positive/negative) and medial glide (MG, 0-4 quadrants) (Kolowich); medial patellar stability with the gravitation-subluxation-test (GST) (Nonweiler & DeLee); and thigh diameter in cm measured at 10 cm proximal to the patella. All examinations were done by two orthopedic surgeons without knowledge about the performed technique.
Results: The Kujala score improved significantly for RR from 52.2 to 77.2 and for RL from 51.8 to 88.4 points, with a significant difference between the two groups ($p < 0.5$). PPT improved from positive in 14(RR)/14(RL) to positive in 2(RR)/1(RL) cases without a significant difference. The average of the MG changed from 0.4(RR)/0.4(RL) to 2.5(RR)/1.6(RL) quadrants which equates to a significant difference between the groups. There was also a significant difference in the GST which increased from 0 to 4 positive cases after RR while there were no positive cases seen 24 months after RL. The thigh diameter changed from 0.4 cm(RR)/0.4 cm(RL) to 1.8 cm(RR)/0.2 cm(RL) with a significant difference between the groups.
Conclusion: RR and RL increase patellofemoral outcome score for patients with HSP. However, RL showed a more durable improvement and controlled MG (lower range) and no medial instability compared to RR which is explained by the preserved continuity of the lateral patellar retinaculum.

FM 26

Clinical outcome and morphological MRI changes after trochleoplasty for patellar instability due trochlear dysplasia

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Introduction: Patellar dislocation can occur in patients with trochlear dysplasia. Trochleoplasty is a surgical procedure which strives to deepen the trochlear groove to allow the patella to engage properly. Aim of this study was to evaluate the clinical outcome and MRI changes after sulcus-deepening trochleoplasty according to the technique by Bereiter, and to find predictive factors for successful results.
Material and methods: The study group consisted of 38 patients (44 knees) with a mean follow-up of 4.2 years (range, 2 to 7.8). Clinical assessment included a structured interview and standardized physical examination including the Kujala score. At follow-up, pain, stability, subjective knee score and patient satisfaction were focussed. The imaging assessment consisted of pre- and postoperative X-rays and MRI.
Results: The mean Kujala score increased from 65 to 85 points ($p < 0.001$). Pain decreased less significantly ($p = 0.027$) than instability ($p < 0.001$). The subjective knee score increased from 39% to 74% ($p < 0.001$). Twenty-seven knees were ranked as excellent, 10 as good, 2 as fair, and 5 as poor. Trochlear cartilage showed increased changes in the MRI without any significant correlations. No chondrolysis or necrosis of cartilage was found. Predictive factor for better subjective knee score was dysplasia type B and D.
Discussion: Trochleoplasty is a valuable and reliable surgical technique for patients suffering from patellofemoral instability with underlying trochlear dysplasia. While stability is predictable, pain is less predictable. Preoperative predictor for a better postoperative subjective knee score is a pronounced trochlear dysplasia with a spur (type B and D).

FM 27

Changes in knee joint load during forefoot running with different step frequencies

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Introduction: A good running technique has two important tasks to fulfil. First to run economically and second to run with a physiological technique that reduces the risk of injury. While many studies have shown that trained runners reach the best running economy at or near the self selected step frequency (SF) or step length, it is not clear if the SF is also the technique with the lowest mechanical load. Therefore the aim of this study is to examine the changes in knee joint load at a constant running speed and modified SF.
Methods: Ten trained female forefoot runners ran at different SFs (2.25, 2.50, 2.75, 3.00, 3.25 Hz, self selected) at a constant velocity of 3m/s. During the measurement the step rhythm was determined by a metronome. Kinematic and kinetic data was collected, using a 12 camera Vicon-system and two kistler forceplates. Joint kinetics were calculated using the PIG-Model and normalized with respect to body mass.
Results: Knee joint moments in the sagital plane and the mechanical power are more influenced by changes in SF than Knee joint moments in the frontal plane. A higher SF has often statistically lower values than a lower SF.

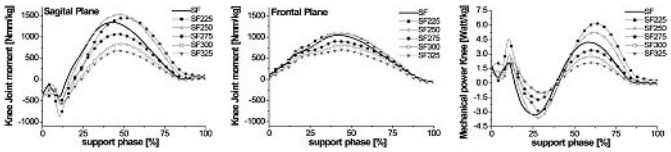

Fig. 1: Changes in Knee joint moments in the sagital plane (left), in the frontal plane (middle) and mechanical power (right) at the knee joint due to different SF at a constant running speed of 3m/s.

Conclusion: The study shows that a variation of SFs can have an influence on the mechanical load at the knee joint. Especially in the sagital plane, the load can be reduced with a higher SF. For a bigger reduction of the moments in the frontal plane the runners should also strengthen their hip abductor muscles and try to vary their foot progression angle.

FM 28

ACL injury and the posterior tibial and meniscal slope on MRI

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The risk for anterior cuciate ligament (ACL) injury is supposed to increase with a greater posterior tibial slope (PTS) but reports are contradictious. Imprecise measurement, variability between the medial and lateral tibial plateaus, the meniscal slope (MS) and gender differences are known to confound data. For injury risk analysis these factors need to be respected. Therefore, we compared both plateaus PTS, the MS and the relative difference between them on MRI in 55 matched pairs with isolated non-contact ACL injury and a control group with symptoms of patello-femoral pain. The PTS did not differ between the groups and the relative difference between the two plateaus was not associated to injury. Although in ACL injured males a greater PTS (1.3°) was found results were not significant ($p = 0.08$). In contrast, the lateral MS was greater in all patients with ACL injury (males: +4.7°; females +2.6°; $p < 0.01$). Females had a greater PTS than males which was only significant in the control group (medial +1.8°/ lateral +1.7°, $p < 0.02$/ $p = 0.05$). In conclusion, there was no obvious association between a greater PTS or the relative plateau difference and ACL injury. However, a greater lateral MS may be indicative for a greater injury risk. Females can have a greater medial PTS and MS than males.

FM 29

Introduction of a new fixation method for free tendon fixation in ACL-Reconstruction – A biomechanical study

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Introduction: Different initial fixation strength for BTB and Hamstring grafts is described in the literature. Free tendon fixation to the femoral bone tunnel is thought to be less stable and thereby may limit an early postoperative rehabilitation protocol. A new fixation method with a bioabsorbable mesh augmentation of the tendon graft to increase primary stability is presented.
Methods: 29 fresh porcine femora were divided into 3 groups: 9 BTB, 10 hamstrings, 10 hamstrings with mesh. BTB-grafts were prepared of the present porcine knees, the hamstrings were simulated by porcine tendons. The tendons were prepared as described at Rigid Fix© Surgical Technique (DePuy Mitek, Inc.). At the mesh group a 1x6 cm biodegradable mesh usually used for repair of inguinal hernias (Ethicon Ultrapro©, Monocryl-Prolene-Composite) was additionally sutured in between the tendon transplant. Fixation was performed by biodegradable Rigid Fix© Pins. Cyclic tensile loading (1000 cycles, 150N) was performed. Then the ultimate pullout strength was measured. Data were collected by a 3-D image correlation system (Limess GmbH). A defined distance between cartilage and graft was used as variable for loosening.
Results: After 1000 cycles plastic deformation showed a significant difference between all three groups ($p \leq 0.001$). Load to failure was highest at the mesh group with a significant difference to the hamstrings group ($p = 0.009$).

	BTB	Hamstrings	Mesh
Plastic deformation 1st cycle	0.67±0.35mm	2.19±0.98mm	1.52±0.63mm
Plastic deformation 1000 cycles	1.06±0.32mm	4.62±1.07mm	2.82±0.99mm
Load to failure	522N ± 166N	394N ± 75N	554N ± 93N

Conclusion: The results of the present study suggest that mesh augmentation of free tendon grafts increases primary stability and reduces plastic deformation of femoral cross-pin fixation and thereby better protect the graft from secondary elongation in the postoperative rehabilitation. The ingrowth of the graft shouldn't be compromised because the mesh is surrounded by tendon. A reduction of biological quality is not expected.

FM 30

ACL rupture treated with the healing response technique – 4-year follow-up

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Introduction: The healing response technique is a non-reconstructive method to promote healing in patients with proximal ACL ruptures (Steadman et al, J Knee Surg., 2006, 19(1):8-13). The technique is based on microfractures next to the ACL femoral insertion to obtain a blood clot which can lead to reattachment of the ACL at its origin. This cohort study reviews the long-term results of 31 patients in comparison to data from the literature.
Methods: Between 2005 and 2007, 31 patients (age at injury 10–45 yrs, average 29.8 yrs, 20 male) with proximal complete (n = 24) and incomplete (n = 7) ACL ruptures were treated according to the healing response method. Additional injuries were meniscal lesions (n = 16) and injuries of the medial collateral ligament (n = 8). All patients were evaluated using Kneelax 3 testing, MRI, clinical examination and the Lysholm-, Tegner- and OAK-score with a mean follow-up of 4 yrs.
Results: Ten of the 31 patients (32%) needed definitive ACL-reconstruction because of persistent instability (n = 2) or re-injury (n = 8) after 19 months (range 6–41 months). Nine of the re-operated patients had initially complete proximal ACL ruptures. Two patients (6%) were lost to follow-up. The remaining 19 patients were evaluated after an average of 50 months (range 27–58 months). Of these, average satisfaction-rate was 8.5 (1 = very dissatisfied and 10 = very satisfied, range 4–10). The average Lysholm score was 91, the Tegner score was 5.6 (preop 6.6) and OAK score was 93. Kneelax 3 testing measured on average 2.7 mm more ap-translation in comparison to the healthy opposite site. Two patients were clinically unstable and an ACL-reconstruction is planned. MRI-findings showed 14 completely healed ACL with some posttraumatic alterations, two complete ruptures and three showed lambda-versions of the ACL (ACL repairs on PCL).
Conclusion: The healing response method showed good to excellent results in 17 of 31 patients (55%), of which 14 showed complete healing of the ACL. However, 12 needed definitive ACL-reconstruction or showed unsatisfactory clinical outcomes, which is not superior to functionally treated patients reported in the literature.

FM 31

Function and Flexion after TKA – does design matter?

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Introduction: Pain reduction, improvement of function and range of motion are the main targets of prosthetic replacement of the knee. The impact of the prosthetic design on range of motion, especially flexion, was mainly addressed by in-vivo studies. A clinical trial was carried out at our institute to compare three different types of total knee prostheses and their influence on maximum flexion. The present study demonstrates the results at six and twelve months.
Material and methods: Seventy-two patients (eighty three knees) were included in a prospective randomized single-blinded study. Three different designs of total knee prosthesis were implanted: the LCS, the LCS PS and the Journey Knee. All of the procedures were performed by two experienced orthopaedic surgeons (KM, BP). The standard technique involved tibia first procedure and the support of the Brainlab-Navigation system for positioning of the implants. Clinical and radiological assessment was performed preoperatively and at two, six, twelve and twenty four months postoperatively. We used the WOMAC Score, Forgotten Joint Score, Hospital for Special Surgery Score and Knee Society Score to rate the outcome.
Results: At six months postoperatively we found a mean value of maximum flexion of 115° for the LCS and the Journey Knee and 119° for the LCS PS, with the difference not being statistically significant. Patients with the LCS implant reached a mean WOMAC Global Score of 28,18 which was significant better than the LCS PS (33,57) and the Journey Knee (36,99). At one year postoperative (actual follow up 60 patients) with a mean value flexion of 121° for the LCS, 123° for the LCS PS and 117° for the Journey knee no statistical significant differences could be found concerning the flexion. There were no statistical significant differences in the scores equally.
Conclusion: Statistical significant differences concerning function between the three designs involved in this study could be found at six but not at twelve months follow up. We conclude that different designs do not have an impact on function and flexion.

FM 32

The shortage of orthopaedic surgeons 2020. What's wrong with the Swiss healthcare politics?

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Introduction: The osteoarthritis shows such an increase in the USA that one starts to talk about an epidemic. Among others, the chief cause is the demographics as well as certain social developments during the last 40 years, such as increasing late damages due to earlier sportive activities and the rapid increase of obesity. Within 16 years from now, in 2016, due to a shortage of orthopaedic surgeons, there will be 1.5 million knee-patients and probably 800000 hip-patients who will not be able get the necessary surgical treatment anymore. How does the situation present itself in Switzerland?
Methods: Official statistics, national healthcare reports, economic publications and newspapers of the last 5 years are analysed. The collected data show an overview. This permits a prognosis of the development of Swiss orthopaedic surgery for the next 10 to 15 years.
Results: The demographic developments of Switzerland will bee the same as in the USA, Germany or any other industrial country. The strong regulations for professional activities for specialists (Praxisstopp), the imminent changes in political health care such as the annulment of the present constraint contracts (Vertragszwang) or the implementation of DRG's stand in diametrical opposition to the epidemiologic developments of the osteoarthritis described as before. Several data are indicating now already that medical care for the population with diseases concerning the musculoskeletal system will dramatically deteriorate. In 2020 we will be short of 20% of the orthopaedic surgeons necessary. Particularly with regard to the surgeons to be trained in the disciplines of joint replacement, spinal surgery and revision-surgery, we shall face a severe shortage of highly qualified specialists.

Conclusion: In 2020 the medical care of diseases concerning the musculoskeletal system will dramatically deteriorate. Neither the politicians nor the media seem to pay attention to this phenomenon, something which leads to aggravating wrong decisions. The SGOT/SSOT as the professional association of all categories, such as professional- and further training, tariff policy, quality management, judicial subjects etc. is expected to comply with their members' requirements.

FM 33

Geneva Hip Arthroplasty Registry: The role of a hospital-based registry

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Introduction: In the field of joint replacement surgery, large registries exist at the regional, national and international level. They provide important information on long term effectiveness and quality of implants through direct surgeon feedback, publications and annual reports. In this context do we still need hospital-based registries?
Objective: The purpose of this work is to discuss strengths and limitations of hospital-based arthroplasty registries. Moreover, we present our own registry (patient, implant and technique-related characteristics, outcome instruments, areas of research), evaluate mortality and follow-up rates, response rates for questionnaires, and finally describe the effort necessary to maintain the registry.
Results: As opposed to hospital-based ones, national registries provide information on a very large number of patients, many different implants and techniques and from surgeons with all levels of experience within a short period of time. However, they are limited with respect to the number of variables that they can collect for each individual patient without compromising the quality of their data, and they usually focus on "revision" as their endpoint. The Geneva Hip Arthroplasty Registry has prospectively enrolled all primary and revision total hip arthroplasties (THA) since March 1996, and now includes 4,165 primary (mean age 69 y.) and 385 revision THAs. Patients have a clinical and radiological follow-up visit at 5-year intervals. The following outcome measures are used: Harris Hip, Merle d'Aubigné and UCLA scores, WOMAC and SF-12 questionnaires, and satisfaction evaluation. Radiological analysis, specifically looking at osteolysis and wear is performed by an independent orthopaedic surgeon. Follow-up rates are 84.7% at 5 years and 85.5% at 10 years among all those who have not died or left the area. Mortality is 13.5% at 5 years and 29.6% at 10 years. Questionnaire response rates are 71% preoperative, 77% at 5 years and 67 % at 10 years postoperative. Maintenance of the registry necessitates continuous data input from the operating surgeon, two medical secretaries, an informatics specialist and a physician trained in epidemiology and statistics.
Conclusion: There is an increasing need and demand to provide data on how an implant/technique works in the real world and under which circumstances. Large as well as smaller registries are important tools to achieve this goal.

FM 34

Economic impact of the german DRG system on surgical training regarding total knee arthroplasty

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Introduction: The implementation of the DRG – System in Germany provoked fundamental changes in hospital financing and – if introduced in 2012 – will probably influence the hospital structure in Switzerland substantially. These challenges and increasing economical needs interact and affect surgical training as well. While total knee arthroplasty (TKA) is one of the most common procedures in orthopedics surgery we investigated whether the DRG system influences the cost – proceed structure in surgical training for orthopedic residents.
Methods: Consecutive TKAs were performed by the chief of surgery (CS) (n = 30), an attending (A) (n = 31) and a resident (R) (n = 27). All patients were embedded in a standardized clinical pathway. By analyzing the costs and numbers of blood transfusions, the operating time and the length of stay in the hospital we investigated the health care related costs matched to the DRG based financial refunding. Data was analyzed undergoing a analysis of variance followed by a post-hoc scheffé procedure.
Results: On the one hand the resident generated additional costs of 41€ in comparison to the CS and 426 € to the attending. These costs are generated by the need of a longer operating time [CS 94 min ± 4.4 min (SEM); A 82.6 min ± 3.7 min; R 102.7 min ± 5.1 min] a higher number of transfusions per patient [CS 0,13 ± 0,09; A 0.2 ± 0.12; R 0.36 ± 0.16] and a longer stay in the hospital [CS 15.6d ± 0.79d; AA 13.7d ± 0.6d; R 15.14d ± 0.4d]. On the other hand there were higher proceeds of the R of 282 € in comparison to the attending and 447 € to the CS. This was generated both by a higher patient clinical level of complexity (PCCL) and increased complication rates resulting in a consecutive augmented profit by grouping these patients to a more lucrative DRG.
Conclusion: Surgical education of resident is associated with additional costs for the hospital. Nevertheless, the german DRG matrix results in higher profits accounted to the learning surgeon by increased PCCL relevant status and grouping the case to a more profitable DRG. Hereby, the additional costs are partly more than redeemed.

FM 35

Association of psychological status and patient-reported physical outcome in joint arthroplasty

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Introduction: Patient-reported outcome (PRO) measurement has become an important part of outcome assessment after joint arthroplasty. Questionnaires usually report on pain, stiffness, joint awareness or function in activities of daily living (ADL). However, there may be a significant interference between these parameters and psychological status.
Objective: To investigate associations between two orthopaedic PRO tools and psychological variables.
Methods: 356 patients were contacted in a mail survey. Inclusion criteria were primary, cemented, unilateral THA or TKA (no previous arthroplasty surgery). Patients were sent 4 questionnaires: the WOMAC score (measures pain, stiffness, function), the Forgotten Joint Score (FJS, measures joint awareness in ADLs) the Brief Symptom Inventory (BSI, measures psychological status and distress in 9 symptom scales and 3 global indices) and the Catastrophising-scale (from the Coping Strategies questionnaire).
Results: 243 (68.3%) patients completed and returned the questionnaires. Mean patient age was 70.6 (SD 11.3) and 120 patients (49.4%) were female. Mean time since surgery was 31.1 (SD 12.3) months. 157 (64.6%) patients had THA surgery and 86 (35.4%) had TKA surgery. High correlations with the Catastrophising-scale were found (FJS –0.60, WOMAC 0.79). In multiple linear regression models sex, education and implant location explained 6.3% of the FJS variance and 9.3% of the WOMAC-score variance. In addition to these predictors, psychological parameters (catastrophising, BSI-somatisation and BSI-global severity index) explained 30% of the FJS and 54.3% of the WOMAC-score variance.
Conclusion: The WOMAC score and the FJS are both strongly associated with psychological variables. This association was found to be around 5 times stronger than the association with sex, education and implant location together. This strong association reduces interpretability of these scores significantly as the scale names suggest to measure specific dimensions like pain, stiffness, function or joint awareness. In fact these scales largely include patients› psychological status. We suggest that future studies on orthopaedic outcome include assessment of psychological variables to obtain a more differentiated view on orthopaedic outcome.

FM 36

5 years of experience with the SWISSspine registry. Update and midterm results for Lumbar Total Disc Arthroplasty (TDA)

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Study design: Prospective multicenter observational case-series.
Background: SWISSspine is the first mandatory health technology assessment registry of its kind in the history of Swiss orthopaedic surgery and worldwide unique. The registries set-up and methodology, as well as short-term results of lumbar total disc arthroplasty (TDA) were recently published. This presentation now shows the mid-term results of the lumbar TDA in the registry.
Methods: Between March 2005 and January 2010, 638 interventions with implantation of 734 lumbar total disc replacements were documented. In a prospective, observational multicenter mode data are collected pre- and perioperatively, at three months and one year after surgery and then annually. Surgery, implant and follow-up forms are administered by surgeons. Co-morbidity questionnaires, NASS and EQ-5D forms are completed by patients.
Results: Significant and clinically relevant reduction of low back pain VAS (69.6 to 27 points, p <0.001), leg pain VAS (54 to 19.3 points, p <0.001), improvement of quality of life (EQ-5D, 0.34 to 0.79 points,

p <0.001) and reduction of analgesics consumption was observed at the 2-year follow up (FU). Rates for intraoperative complications for single-level and two-level surgeries were 4.2% and 7.3% respectively. Major complications at FU occurred in 7.9% and 8.3% respectively. Revision rates were 3.7% for single-level and 1% for two-level surgeries. Preoperative pain and quality of life levels, number of levels of surgery, patient age, surgical TDA volume of treating center and follow-up interval were covariates with a significant influence on pain alleviation or quality of life improvement.
Conclusion: The SWISSspine registry proves to be an excellent tool for quality control and outcomes research in spinal surgery by collecting observational data in a nationwide framework. The two years results of lumbar TDA show further low back and leg pain alleviation, consequent reduction of pain medication and improvement of quality of life as well as some important factors influencing these outcomes.

FM 37

A comprehensive and short assessment scale with population based reference values to be used for the outcome assessment in all orthopaedic surgeries

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Objective: The aim of this study was to develop and validate a short and easy patient administered questionnaire to assess all types of treatments focusing on the loco motor system. The questionnaire should be complemented by generating population based reference values in order to adjust the outcome for age and gender
Design: Based on a systematic literature review, often used, or relevant items were extracted from validated questionnaires, reviewed by an expert panel and assembled to an 18 page questionnaire. This questionnaire was distributed to a random selection of the Swiss German population. Using a predefined, stepwise item reduction process the most sensitive questions were identified for three different body regions (upper extremities, spine and lower extremities). The shortened questionnaire was validated in relation to its reliability, internal and external consistency and validity.
Results: Overall, 16634 of 23763 eligible individuals participated in the study (70%). The step wise item reduction process identified 203 of 240 questions to be either redundant, not sensitive or showing an insufficient test retest reliability. The remaining set of questions had a test-retest reliability ranging from 0.82 to 0.99 (median: 0.87) and an item-total coefficient ranging between moderate and good. Correlation coefficients between subscales and the three validated instruments (WOMAC, SPADI, Oswestry) ranged from 0.63 to 0.81. Age and gender related percentile curves of the scores were built as reference values using the population based data.
Conclusion: The new questionnaire is a reliable and valid multidimensional tool for the assessment of all treatments focusing on the loco motor system. It is short and easy to administer and it is the only questionnaire available in the field that provides reference values in order to adjust the outcome for age and gender.

FM 38

Variations in the preoperative status of patients coming to primary total hip replacement in 20 European orthopaedic centres (Eurohip Study Group)

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Introduction: Total hip replacement (THR) is a high volume, effective intervention for hip osteoarthritis. Indications and determinants of outcome remain unclear. The “Eurohip” study group has undertaken a cohort study to investigate these questions. This part of the study describes the variations in disease severity and the relationship between clinical and radiological severity and explores some of the determinants in variation.
Study Type: Prospective multicentric study.
Patients and methods: A minimum of 50 consecutive patients coming for THR for primary hip OA in each of the 20 participating centres (12 countries) entered the study. Pre-operative data included demographics, length of history, and involvement of other joints. Each subject completed the WOMAC. Other data collected were the type of prosthesis and the ASA score. Pre-operative radiographs were read by the same three readers for Kellgren-Lawrence grading.
Results: Data from 1327 subjects has been analysed. The mean age of the group was 65.7 years and there were more women (53.4%) than men. Most (79%) were ASA 1 or 2. Reported disease duration was 5 years or less in 69.2%. Disease in other joints was common (one hip only 31.4%, both hips only 12.6% and hip and other peripheral joints 52.8%). Radiographs were available in 1051 subjects and K&L grade was 3 or 4 in 95.8%. There was much more variation in WOMAC score. The radiographic severity showed no correlation with the WOMAC scores.
Conclusion: Clinical disease severity varies widely at the time of THR for OA. Clinical severity shows no correlation with radiographic severity. Simple scores of pain do not reflect the complexity of decision-making about who should have a THR.

FM 39

Significance of early postoperative MRI after lumbar spinal decompression: Prospective study of asymptomatic patients in comparison to patients requiring surgical revision

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Purpose: To evaluate prevalence, extent and significance of hematoma in the first postoperative week in asymptomatic patients and patients requiring surgical revision. To determine the amount of dura compression which is clinically significant.
Material and methods: MR was performed in 30 asymptomatic patients (47levels) in the first week after lumbar spine decompression for degenerative stenosis. Eleven patients requiring surgical revision (16 levels) for symptomatic early postoperative hematoma were used for comparison. In both groups the cross sectional area of the maximum dural compression (bony stenosis and dural sac expansion) was measured preoperatively and postoperatively by an experienced radiologist.
Results: Epidural hematoma was seen in 42.5% in asymptomatic patients (20 out of 47 levels) The median area of postoperative hematoma at the operated level was 176 mm^2 and 365 mm^2 in the asymptomatic patients and symptomatic patients respectively. The median cross sectional area of the dural tube at the operated level was 128.5 mm^2 (mean 134.0 mm^2) and 0 mm^2 (mean 51.0 mm^2) in asymptomatic and reoperated patients respectively. In the reoperated group 75% of the patients had a maximal postoperative dural sac area of 58.5 mm^2, whereas in the asymptomatic group 75% of patients had an area of 96.50 mm^2 or more (ratio 1.21).
Conclusion: Postoperative hematoma after lumbar spine decompression for stenosis was seen in 42.5% of the operated levels without clinical symptoms. The size of hematoma and the degree of dural sac compression were significantly larger in patients with symptoms needing surgical revision. Hematoma area more than 250 mm^2 and dural sac area less than 70–75 mm^2 in early postoperative MRI were found out to be the thresholds for clinical significance.

FM 41

Expectations of spinal surgery from the surgeon's and patient's perspectives

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Introduction: Patients' satisfaction after spinal surgery depends, in part, on whether their expectations of surgery are fulfilled; their expectations, in turn, are primarily based on the information received from their surgeon. However, it is difficult to know whether the patient has understood the key messages conveyed by the surgeon regarding the likely outcome. This study sought to evaluate the level of agreement in expectations declared pre-operatively by the patient and surgeon.
Methods: 50 consecutive, German-speaking patients (25 m, 25 f; mean ± SD (range) age 64.1 ± 15.3 (15–90) y) scheduled for spinal surgery, and their treating surgeons (N = 2), took part. Following the pre-operative informed consent consultation (where procedure, associated risks and likely outcome were discussed), the patient and surgeon independently completed a questionnaire enquiring about baseline status and realistic expectations regarding pain, pain medication usage, sensory and motor function, and the ability to work, do household activities and play sport, 3 mo after treatment. Concordance was given by %agreement and Kappa coefficients.
Results: Evaluation of the pre-operative status, regarding sensory/motor deficits in connection with the back problem, revealed agreement between patient and surgeon in just 62% (motor) and 76% (sensory) cases. The patient but not the surgeon reported a motor deficit in 32% cases and sensory deficit in 16% cases; for 6–8% cases, the doctor reported such a deficit that the patient was seemingly unaware of. The patients consistently expected better results than did the surgeons, especially for back pain, work ability and sport. Accordingly, the Kappa values for patient-surgeon agreement for these domains were extremely low (–0.059, 0.077 and 0.062 respectively). The best agreement was for expected pain-medication usage and improvement in sensory deficits, though agreement here was still only "fair" (weighted Kappa, each = 0.31).
Discussion: The findings demonstrate the wide range of possible misunderstandings between the patient and surgeon regarding the expected result of surgery, and highlight the need for clearer explanations of the association between the back problem and neurological deficits, and the improvements that can be expected after surgery. The systematic, routine evaluation of outcome will assist in deriving the information necessary to establish realistic expectations of surgery.

FM 42

Influence of low back pain on the outcome of discectomy for lumbar herniated disc

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Introduction: Discectomy is a common and generally successful treatment for lumbar disc herniation (LDH). However, clinical experience raises some concern that the presence of concomitant low back pain (LBP) may have a negative influence on the overall treatment outcome. This prospective observational study examined how the relative severity of LBP influences the outcome of decompression surgery for LDH.
Methods: The SSE Spine Tango system was used to acquire the data from 308 patients. Inclusion criteria were LDH, first-time surgery, maximum 1 affected level, and discectomy/sequestrectomy as sole procedure (no fusion/stabilisation). Before and 12mo after surgery, patients completed the multidimensional Core Outcome Measures Index (COMI; includes 0-10 leg/buttock pain (LP) and LBP scales); at 12 mo, global outcome was rated on a Likert-scale and dichotomised into "good" and "poor" groups.
Results: In the "good" outcome group, mean baseline LP was 2.8 (±3.1) points higher than LBP; in the "poor" group, the corresponding value was 1.1 (±2.9) ($p < 0.001$ between groups). There was a low but significant positive correlation between baseline LP-minus-LBP scores and improvement in the multidimensional COMI score after 12-months ($r = 0.20$, $p = 0.001$). Significantly fewer patients with back pain as their "main problem" had a good outcome (69% good) compared with those who reported leg/buttock pain (84% good) as the main problem ($p = 0.04$). In multivariate regression (controlling for age, gender, co-morbidity), baseline LBP intensity was a significant predictor of the 12-month COMI score, and of the global outcome (each $p < 0.05$) (higher LBP, worse outcome).
Conclusions: Overall, patients with more back pain showed significantly worse outcomes after discectomy for LDH. This finding fits with general clinical experience, but has rarely been quantified in the many outcome predictor studies conducted to date. Consideration of the severity of concomitant LBP in LDH may assist in clinical decision-making and in establishing realistic patient expectations before the operation.

FM 43

Sacral osteotomy and single-stage posterior reduction with pedicle screw fixation in high-grade spondylolisthesis

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Introduction: Several techniques have been advocated for surgical treatment of high-grade spondylolisthesis. In situ posterior fusion is associated with pseudarthrosis and deformity progression, while reduction places the L5 nerve roots at risk. We describe a technique of posterior sacral dome osteotomy and single-stage reduction with pedicle screw fixation for high grade dysplastic spondylolisthesis adolescents and yound adults.
Methods: Between 1996 and 2005 nine consecutive patients with high-grade spondylolisthesis L5 (>50%) were treated by sacral osteotomy, posterior reduction and pedicle screw fixation from L4-S1 as a single-stage procedure. Five out of nine patients were females, the average age at the time of surgery was 19.5 (12–28) y. The average follow-up is 7.1 (2.1 to 11.6) y. Intraoperative neuromonitoring was carried out. Follow-up comprises clinical examination and radiographic studies. Non-parametric testing was used to analyze changes in radiographic parameters during follow-up.
Results: Fusion was achieved in all patients after 1 year. The mean anterolisthesis of L5 was 99.6 ± 25.6% preoperatively and was corrected to 25.1 ± 17.7% after the procedure and to 28.9 ± 18.1% at the latest follow-up ($p = 0.263$). Lumbar lordosis changed from preoperative 70.4 ± 13.0° to 54.6 ± 7.2° at the last follow-up. The slip angle improved from preoperative to at the last follow up. All preoperative L5 sensomotory symptoms resolved. There were no permanent neurological complications.
Conclusion: This technique produces good deformity correction of spondylolisthesis and lumbosacral kyphosis.

FM 44

Robotic, fluoroscopic or EMG assisted pedicle screw insertion. A CT based comparative study

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Introduction: In order to improve safety of pedicle screw placement several techniques have been developed. More recently robotically assisted pedicle insertion has been introduced aiming at increasing accuracy. The aim of this study was to compare this new technique with the two main pedicle insertion techniques in our unit namely fluoroscopically assisted vs EMG aided insertion.
Material and methods: A total of 382 screws (78 thoracic, 304 lumbar) were introduced in 64 patients (m/f = 1.37, equally distributed between insertion technique groups) by a single experienced spinal surgeon. From those, 64 (10 thoracic, 54 lumbar) were introduced in 11 patients using a miniature robotic device based on pre operative CT images under fluoroscopic control. 142 (4 thoracic, 138 lumbar) screws were introduced using lateral fluoroscopy in 27 patients while 176 (64 thoracic, 112 lumbar) screws in 26 patients were inserted using both fluoroscopy and EMG monitoring. There was no difference in the distribution of scoliotic spines between the 3 groups (n = 13). Screw position was assessed by an independent observer on CTs in axial, sagittal and coronal planes using the Rampersaud A to D classification. Data of lumbar and thoracic screws were processed separately as well as data obtained from axial, sagittal and coronal CT planes.
Results: Intra- and interobserver reliability of the Rampersaud classification was moderate, (0.35 and 0.45 respectively) being the least good on axial plane. The total number of misplaced screws (C&D grades) was generally low (12 thoracic and 12 lumbar screws). Misplacement rates were same in straight and scoliotic spines. The only difference in misplacement rates was observed on axial and coronal images in the EMG assisted thoracic screw group with a higher proportion of C or D grades ($p < 0.05$) in that group. Recorded compound muscle action potentials (CMAP) values of the inserted screws were 30.4 mA for the robot and 24.9mA for the freehand technique with a CI of 3.8 of the mean difference of 5.5 mA.

Discussion: Robotic placement did improve the placement of thoracic screws but not that of lumbar screws possibly because our misplacement rates in general near that of published navigation series. Robotically assisted spine surgery might therefore enhance the safety of screw placement in particular in training settings were different users at various stages of their learning curve are involved in pedicle instrumentation.

FM 45

Complications following palmar plate fixation of distal radius fractures: A review of 674 cases

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Introduction: Palmar plate fixation of unstable distal radial fractures is becoming the standard treatment for this common injury. The literature on complications usually reports on particular cases or small series. We present our complications in a large series of this popular technique.
Methods: The complications following open reduction and palmar plate fixation of unstable extra- and intraarticular distal radius fractures were evaluated in a retrospective study. A multidirectional fixed angle implant was used in all cases. Patients were treated in our hospital or were referred to us.
Results: Between February 2004 and December 2009 a palmar plate fixation was performed in 674 cases. The overall complication rate, excluding hardware removal, was 13% (86 complications). Revision surgery was necessary in 11% (74 procedures). The most common reasons for revision surgery were secondary dislocation (15 patients), intraarticular screw placement (eight patients), and postoperative median nerve compression (20 patients). An ulna shortening osteotomy for ulnar impaction syndrome was necessary in eight cases. There were two flexor pollicis longus, one finger flexor, and four extensor pollicis longus tendon ruptures. Nine patients developed a complex regional pain syndrome. A fasciotomy for posttraumatic compartment syndrome of the forearm had to be performed in four cases. Hardware failure occurred in three cases. Infections were seen twice. Hardware removal was performed in 232 (34%) cases. For many patients this procedure was beneficial.
Conclusion: Palmar plate fixation of distal radius fractures is a safe and successful procedure. Nevertheless, complications making a second intervention necessary are relatively common. Some complications can be avoided by improving the surgical technique. Hardware removal is often beneficial for the patients.

FM 46

Trapeziometacarpal prosthesis versus trapezium excision and tendon suspension-interposition: Consequences on thumb metacarpophalangeal joint

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Introduction: Adduction contracture of TM joint can lead to hyperextension of metacarpophalangeal (MP) joint of the thumb, which can result in a longitudinal collapse of the thumb during pinch. Status of MP is of critical importance to the long-term stability of the more proximal basal joint reconstruction. The goal of the study is to determine the consequences of 2 different basal joint reconstruction procedures on stability, mobility and strength of MP joint.
Methods: 31 patients were operated with TM prosthesis from Apr 2007 to Dec 2008(TMP group) and 18 patients with trapezium excision, tendon suspension and interposition (APL) from Jan 2007 to Sep 2008(TETSI group). All the procedures were performed by the same surgeon using the same anterior approach (Gedda-Moberg). Mobility and stability of the thumb MP joint and strength (key pinch and grasp) were measured at a mean follow-up of 13 months.
Results: Hyperextension of MP joint decrease of 14° in the TMP group ($p < 0.05$) and of 6° in the TETSI group. Among a subgroup a TMP patients presenting a preoperative hyperextension ≥10 ° ($n = 14$), the mean correction was even greater (21°, $p < 0.05$). The grasp strength improved significantly in the TMP group compared to the TETSI group, while there was no significant change of key pinching in both groups. There was no statistical change between pre- and postoperative ulnar and radial MP joint stability. Residual postoperative pain was 2/10 on a visual analog scale for both groups.
Conclusion: In our study, trapeziometacarpal (TM) prosthesis provides better correction of MP joint hyperextension and better improvement in grasp strength. This could result from greater TM stability and with restoration / preservation of the length of 1st column of the thumb. There was no need of supplementary procedure on a hyperextensile MP joint.

FM 47

Value of sonography to detect occult fracture of the scaphoid: a comparison with CT

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Purpose: to evaluate sonography performed by an emergency radiologist in patients with clinical suspicion of scaphoid fracture and normal radiographs.
Material and methods: From 2004 to 2008, 67 patients with normal radiographs and clinical suspicion of scaphoid fracture were included in the study, within 3 days following wrist trauma. Informed consent was obtained from each patient. Sonography was performed by a board certified emergency radiologist, without preliminary training in wrist sonography, using the linear probe (5–13 MHz) of the standard sonography equipment in the emergency department (Aloka ProSound SSD 5000SV). The radiologist did evaluate the presence of a cortical interruption of the scaphoid along with a radio-carpal or scapho-trapezium-trapezoid effusion. These findings have been reported the most suggestive signs of scaphoid fractures in the literature. A wrist CT (reference standard) was performed in every patient, immediately after sonography. Fractures were classified into 2 groups, according to their potential for complication: group 1 (high potential, proximal or waist), group 2 (low-potential, distal or tubercle).
Results: A scaphoid fracture was demonstrated by CT in 13 (19%) patients: 8 (62%) of them (3 in the proximal pole, 5 in the waist) belonged to group 1, 5 (38%) to group 2 (2 in the distal part, 3 in the tubercle). Sonography was 92% sensitive (12/13) to detect a scaphoid fracture. It was 100% sensitive (8/8) to detect a fracture with a high potential of complication (group 1).
Conclusion: Our data show that sonography could be used for the triage to CT in patients with clinical suspicion of scaphoid fracture and normal radiographs.

FM 48

Incidence of neurologic lesions after total shoulder arthroplasty

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Introduction: Clinically evident neurological injury on the operated limb after total shoulder arthroplasty is not uncommon. Subclinical incidence is unknown. The purpose of this prospective study was to determine the incidence of neurological lesions after reverse shoulder arthroplasty (RSA) and anatomic shoulder arthroplasty (ASA) (group control), and to correlate its occurrence to postoperative lengthening of the arm and to position of the glenosphere in the vertical plane (inferior overhanging of the glenosphere related to the scapula).
Materials and methods: We included all patients undergoing either a primary RSA or an ASA. Each patient underwent pre- and postoperative electromyography (EMG). This study focused on the clinical, radiological and EMG evaluation, with a measure of the lengthening of the arm in case of RSA according to a protocol previously validated.
Results: Between November 2007 and February 2009, 41 patients (42 prostheses) were included, 19 RSA and 23 ASA. Control EMG realized at an average of 3.6 weeks postoperatively in RSA group showed nerve lesions in 9 patients (47% of cases) involving mainly the axillary nerve; 8 were regressive in less than 6 months. In ASA group, we noticed one plexus lesion. The incidence of acute intra-operative nerve injury was significantly more frequent in the reverse group ($p = 0.002$) with a risk 10.9 times higher (95% CI 1.5, 78.5). Mean lengthening of the arm after RSA was 2.7 ± 1.8 cm (range 0 to 5.9) compared to the normal contra-lateral side. Comparing only the RSA group with arm lengthening ≥4 cm to the group with <4 cm the relative risk was 1.9 (95% CI 0.8; 4.3; $p = 0.303$). The amount of inferior overhanging of the glenosphere was not related to the development of a neurologic lesion ($p = 0.650$).

Discussion: The occurrence of peripheral neurological lesions following RSA is frequent but usually transient. Lengthening of the arm is considered, due to non-anatomic design of the prosthesis or to maneuver of reduction, as one major factor responsible for this neurologic damage. Indeed, surgical dissection, compression phenomena by use of retractors or presence of hematoma, vascular injury, mobilization of the upper limb and possibly interscalene block may occur during both ASA and RSA procedures.

FM 49

A new technique of biologic augmentation in repair of chronic rotator cuff tears using autologous platelet rich fibrin (PRF): Vacularization response and tendon healing in a prospective randomized trial

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Introduction: Platelet derived growth factors enhance tenocyte proliferation of chronic rotator cuff tendon tears and also promotes ECM synthesis of a physiologic rotator cuff tendon-bone insertion. Platelet rich fibrin (PRF) can store and deliver locally specific healing growth factors up to 28 days. We hypothesized that arthroscopic rotator cuff repair with PRF is technically feasible and results in higher vascularisation response and watertight healing rate at early follow up than without PRF.
Methods: Twenty prospective randomized patients underwent arthroscopic rotator cuff repair for the treatment of chronic posterosuperior rotator cuff tears. In ten patients, platelet rich fibrin (PRF) was added in between the tendon and the bone. All patients were prospectively followed. Vascularization was measured with Power Doppler ultrasonography at 6 weeks and 3 months and healing using MR arthrography.
Results: There were no complications regarding the surgical procedure. PRF was added in 9 of 10 cases in between the tendon and the bone. In 1 patient, which had a loss of tendon substance laterally, the PRF was added lateral to the tendon end. The mean score of SSV, SST and relative Constant increased in both groups significantly from pre- to postoperatively. The vascularization of the operated tendon-bone insertions were always significantly higher in the PRF group than the contralateral healthy shoulders. Whereas the PRF group showed a higher vascularization compared to the control group at 6 weeks, it was not different after 3 months follow up. Watertight healing was obtained in 86% of the repaired cuffs with PRF.
Discussion/Conclusions: Arthroscopic rotator cuff repair with application of platelet rich fibrin (PRF) is technically feasible and yields higher early vascularization response. Increased vascualrization may potentially predipose to an increased and earlier cellular response and an increased healing rate.

FM 50

Arthroscopic isolated supraspinatus tendon repair in patients under 50 years of age. Restoration of abduction strength?

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Introduction: Rotator cuff tears in people below 50 years of age are frequently traumatic and involve the supraspinatus. Arthroscopic repair yields good overall results. However, no data are available in terms of restoration of abduction strength compared to the intact opposite shoulder in young patients with isolated supraspinatus tears.
Material and methods: We retrospectively reviewed a consecutive series of 19 patients younger than 50 years of age with a MRI documented, isolated full-thickness supraspinatus tear who had undergone arthroscopic repair. After a minimum follow-up of 2 years all patients were evaluated clinically with the Constant score including abduction strength measurements of both shoulders. Standard MRI of the operated shoulder and ultrasound of both shoulders were performed to assess tendon integrity and fatty infiltration.
Results: Structural results showed a retear rate of 16%. Fatty infiltration of the supraspinatus increased significantly from preoperatively to follow-up ($p = 0.031$) with a maximum Goutallier grade of 2. The subjective result was excellent or good in 89% of the patients. SSV increased significantly from 54% to 87%. The Constant score of the affected side showed a significant amelioration (65 (41-94) to 79 (26-93) points). Pain scoring improved from 7.2 (SD 3.9) to 13.9 (SD 2.2) ($p = 0.001$). A significant preoperative difference of Constant scores between both shoulders disappeared at follow-up. Abduction strength was not significantly improved by the operation. Mean strength changed from 4.3 kg (SD 2.7) preoperatively to 4.9 kg (SD 2.5) postoperatively. Though it was highly significantly inferior to the intact controlateral side preoperatively, there was no significant difference between both sides at follow up. Results remained similar if we excluded patients with rerupture.
Conclusion: Arthroscopic repair of isolated supraspinatus tears in people younger than fifty years yields good functional and subjective results restoring the Constant score to the level of the opposite healthy shoulder after a minimum follow-up of two years. The effect on abduction strength is limited. Pain relief, rather than restoration of trength, is the main factor leading to Constant score amelioration.

FM 51

Factors affecting long-term survival of GSB III elbow prostheses

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Introduction: Data about the long-term survival of elbow prostheses are rare due to the small number of cohorts that are available for long-term follow-up. We performed a long-term analysis of our patient cohort in order to quantify 10 and 20 year survival rate and to identify risk factors for implant revision.
Materials and methods: We included all patients that received a GSB III total elbow prosthesis between 1978 and 1998, gathered information about the condition of their elbow prosthesis, possible risk factors and computed Kaplan-Meier survival curves. Additionally we stratified the cohort for known risk factors such as diagnosis, and included further risk factors in a cox regression analysis.
Results: 253 patients (mean age at operation 57y) with 293 GSB III prostheses were included. Whereas 81 did not experience a revision during the observation period, 61 were revised, 76 deceased without revision and 75 had no revision until the last known follow-up. This corresponds to a 10-year survival rate of 0.8 (95% CI 0.74–0.85) and a 20-year rate of 0.67 (95% CI 0.57–0.76). Prostheses in patients with posttraumatic conditions survive significantly shorter compared to patients with rheumatoid arthritis; previous operations lead to an 2.8 fold increased risk for revision ($p = 0.004$). Neither age at implantation, nor gender revealed a significant influence on prosthesis survival.
Conclusions: The results indicate a good long-term prognosis for this implant design when implanted in comparably young patients. The prognosis has to be adjusted for the underlying disease. Previous operations like joint reconstruction significantly increase the risk for revision.

FM 52

Effect of the Scapulo-Humeral Rhythm on Anatomical and Reverse Shoulder Prostheses

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Introduction: Several studies have reported significant alteration of the scapula-humeral rythm after total shoulder arthroplasty. However, the biomechanical and clinical effects, particularly on implants lifespan, are still unknown. The goal of this study was to evaluate the biomechanical consequences of an altered scapula-humeral rhythm.
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. The reverse and anatomic Aequalis prostheses (Tornier Inc) were inserted. Two scapula-humeral rhythms were considered for each prosthesis: a normal 2:1 rhythm, and an altered 1:2 rhythm. For the 4 configurations, a movement of abduction in the scapular plane was simulated. The gleno-humeral force and contact pattern, but also the stress in the polyethylene and cement were evaluated.
Results: With the anatomical prosthesis, the gleno-humeral force increased of 23% for the altered rhythm, with a more eccentric (posterior and superior) contact. The contact pressure, polyethylene stress, and cement stress increased respectively by 20%, 48% and 64%. With the reverse prosthesis, the gleno-humeral force increased of 11% for an altered rhythm. There was nearly no effect on the contact pattern on the polyethylene component surface.
Conclusion: The present study showed that alteration oft the scapula-humeral rythm induced biomechanical consequences which could preclude the long term survival of the glenoid implant of anatomic prostheses. However, an altered scapula-humeral rhythm, even severe, should not be a contra indication for the use of a reverse prosthesis.

FM 53

Outcome after surgical treatment of symptomatic delayed unions and nonunions of midshaft clavicle fractures

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Introduction: Nonoperative treatment of displaced midshaft clavicle fractures is associated with higher nonunion rate than previously reported. Moreover, its occurrence can compromise shoulder function. The aim of this study was to evaluate the outcome of surgical treatment of symptomatic clavicle midshaft delayed and nonunion.
Methods: Between 1999 and 2008, 19 clavicle delayed unions and nonunions were treated by open reduction and reconstructive plate fixation with augmentation by autologous bone graft. Iliac bone graft was used in 15 atrophic cases, and graft from the callus was used in 4 hypertrophic nonunions. There were 14 men and 5 women, with an average age of 41 years (range, 19 to 59 years) at time of surgery. No patient had undergone a previous surgery and all complained of shoulder pain. Delayed unions and nonunions were defined as non-healing after 3 and 6 months respectively. The mean time to surgery was 8 months (range, 4 to 23 months). All patients were pre and postoperatively clinically evaluated and imaged with standard radiographs until complete healing.
Results: After a mean time of 3 months (range, 2 to 7 months) all fractures were completely healed. All patients reported full range of motion at time of last follow-up. Nine patients (47%) reported slight shoulder pain but all returned to their previous professional activities after a mean time of 3 months (range, 1 to 8 months). We reported 12 (63%) minor complications. There were 6 (32%) plate-related discomforts which resolved after hardware removal, two (11%) scar numbness, two (11%) adhesive capsulitis with spontaneous complete recovery, and two (11%) AC-joint pain treated successfully with local corticosteroids injection.
Conclusion: Surgical treatment of delayed unions and nonunions of midshaft clavicle fractures yields satisfactory results and a high union rate. However, 50% of the patients may still complain of slight residual shoulder pain.

FM 54

Radiographic analysis of humeral stress shielding after total shoulder arthroplasty with non-cemented stem

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Objective: To describe the characteristics of cortical bone resorption at the humerus after non-cemented shoulder arthroplasty with a rectangular stem. The aim was to analyze the influence of this radiographic phenomenon on functional outcome and pain.
Methods: Between 06/2003 and 09/2006 180 consecutive shoulder arthroplasties with non-cemented stems were performed on 163 patients and included in a prospective controlled cohort study. Follow-up controls were performed at 6, 12, 24 and 36 months postoperatively and included a clinical assessment using the Constant Score and radiographic controls in 3 standardized views. Patients were classified into two groups with and without signs of stress shielding with complete resorption of part of the cortical humeral bone. The osteolytic zones were analyzed with respect to their extent and to their location at the radiographic view and the humeral zone (Sperling classification). Both groups were compared regarding their functional outcome (abduction strength and activities of daily living (ADL)) and pain symptoms.
Results: 148 cases were available for the radiographic and clinic assessment (82%). In 33 cases (22%) a complete cortical bone resorption was identified within the first 3 years. All cortical resorptions were found on the ap view with the arm internally rotated and all were in zone 2. In 4 cases of posttraumatic osteoarthritis the osteolysis was located in both zone 1 and 2. The mean extent of complete osteolysis was 22.7 mm ± 12.2 mm (range: 3 mm–47 mm). A significant difference was found between both groups concerning the coefficient between stem size and humeral shaft ($p = 0.001$), and in the postoperative abduction strength at the last follow-up ($p < 0.01$). However, no significant difference existed between both groups regarding pain and ADL ($p > 0.05$).
Conclusion: Humeral stress shielding is a radiographic phenomenon, which can appear at the supero-posterior diaphysis after shoulder arthroplasty with a non-cemented, rectangular stem. In the postoperative short- to mid-term follow-up no influences on ADL and pain symptoms seem to exist, as long as the greater tuberosity is not affected. However, this development has to be followed over a long-term period.

FM 55

Arthroscopic Repair of Isolated Subscapularis Tears: Clinical Outcome and Structural Integrity

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Background: Subscapularis tears may significantly impair shoulder function. Studies have shown favorable results after open repair of isolated subscapularis tears. Only few studies exist analyzing the outcome after arthroscopic reconstruction. The goal of this study was to evaluate the clinical and structural outcome after arthroscopic repair of isolated subscapularis tears.
Method: We retrospectively analyzed all patients following arthroscopic repair of an isolated subscapularis tear from August 2003 till August 2007. Exclusion criteria were a concomitant supra- or infraspinatus tear, bony avulsion of the subscapularis, fatty muscle infiltration of more than stage 2 according to Goutallier, a cuff tear arthropathy or prior shoulder surgery. The pre- and postoperative clinical evaluation included the subjective shoulder value (SSV) and the Constant score (CS). Furthermore, strength for internal rotation of both shoulders was measured. Radiological assessment included pre- and postoperative MRI.
Results: Of a total of 33 patients 7 were not available for the follow-up. The remaining 26 patients (male 18, female 8) were reexamined and analyzed. The mean follow-up was 45 months. The SSV significantly improved from 40% (SD ± 15%) preoperatively to 70% (SD ± 38%) at follow-up ($p = 0.01$), the CS from 66% (SD ± 17%) to 85% (SD ± 27%) ($p = 0.01$) and pain (VAS 0-15 points) from 4.9 points (SD ± 2.7) to 12.4 points (SD ± 4.1) ($p = 0.003$). There was no significant change in flexion (143° before surgery to 144° at follow-up; $p = 0.72$), internal rotation (5.5 points and 7.1 points; $p = 0.1$) and external rotation (57° to 50°; $p = 0.08$). At follow-up, the average strength of internal rotation was 4.4 kg compared to 5.6 kg on the contra-lateral side. The rerupture rate was 7%. Fatty infiltration of the subscapularis did not deteriorate over time.
Conclusions: Arthroscopic repair of isolated subscapularis tears yields very satisfying clinical and structural results with significant improvement of pain and shoulder function and a low rerupture rate.

FM 56

The Unstable Painful Shoulder (UPS). As a Cause of Pain from Unrecognized Instability in the Young Athlete

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Background: Exact etiology of shoulder pain in the overhead athlete is often difficult to determine. There is a subset of patients with exclusively painful shoulders from unapparent instability episodes ("unstable painful shoulder" – UPS). We hypothesized that (1) Instability of the shoulder can be present in a purely painful form, without any apparent history of dislocations or subluxations, but with true anatomical (soft tissue or bony) 'roll-over' lesions; (2) arthroscopic shoulder stabilization is effective to relieve the pain and allows return to sports. Methods: Twenty patients (mean age 22 ± 8 years) were identified with a UPS, and operated under arthroscopy. Inclusion criteria: persistent painful shoulder with "roll-over" (instability) lesions on imaging or at surgery. All patients were clinically and radiographically evaluated at an average of 38 months postoperatively (range, 24–69 months) by an independent examiner.
Results: Preoperatively, all patients only complained of deep, anterior pain and denied any feeling of instability. The mean time from the onset of symptoms to diagnosis and surgical treatment was 25 ± 23 months. On clinical examination, 85% had anterior hyperlaxity (ER >85°). Pain could be reproduced with the anterior apprehension test while it could be relieved by the relocation test. Imaging studies with injection of dye and/or arthroscopy confirmed that at least one unapparent shoulder subluxation occurred by finding true instability ('roll-over') lesions. The Rowe, Walch-Duplay and UCLA scores improved significantly ($p < 0.05$); 19 patients (95%) were satisfied and 15 (75%) returned to their previous level of sports.
Conclusions: Instability of the shoulder can be present in a purely painful form, without any apparent history of dislocations or subluxations. The diagnosis of "UPS" is often unrecognized and patients at risk are young hyperlax athlètes. Arthroscopic stabilization is effective to relieve pain and allows the return to sports.

FM 57

Implantation of Xenogenic Chondrocytes Demonstrates No Adverse Effect on Adjacent Nerve Tissue

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This is a follow up to prior pre-clinical efficacy studies where it has been shown that transplanted chondrocytes may initiate regeneration and repair of disc tissue subsequent to nucleus removal. The objective of this study was to evaluate the effect of transplanted chondrocytes on neural tissue structure and function in a xenogenic rat model. A rat lumbar laminectomy model was developed in which 24 Sprauge Dawley rats were assigned, 6 per group, according to treatment: fibrin carrier alone; human juvenile chondrocytes plus fibrin carrier; sham control; and a nerve root ligation (positive control). A right-sided hemi-laminectomy was performed and the study material was placed on and around the exposed L4 nerve root and spinal cord. Pre- and post-operative mechanical allodynia was measured for the ipsilateral hind paw using the von Frey up-down technique. The lumbar spines were harvested after 6 and 12 weeks for histomorphologic characterization and immunohistochemical staining of TNF-α as a marker for nerve root injury.
Results: There was no measurable loss of function (allodynia) with the exception of the ligation group, which produced significant and lasting allodynia. The ligation group also demonstrated marked reduction of myelinated fibers observed histologically. On the contrary, none of the animals comprising either of the fibrin carrier alone, juvenile chondrocyte plus fibrin, or the sham control groups showed histological evidence of nerve injury as measured by osmium staining of demyelization. H&E stained sections revealed no evidence of aberrant cartilage formation or the appearance of inflammatory cells.
Conclusion: No chronic adverse effects were observed following placement of chondrocytes in fibrin carrier on the spinal nerve tissue of immune competent rats as assessed by the von Frey technique, histological, and immunohistologic analyses. The results of our study suggests that transplantation of chondrocytes into the disc space may be a safe therapeutic strategy for disc nucleus regeneration that has minimal potential to produce negative side effects on adjacent neural tissue. should the investigative material extrude from the treated disc to remain in direct contact with the spinal cord, the nerve root or the dorsal root ganglia.

FM 58

Prevention of Heterotopic Ossification – New approaches

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Introduction: Heterotopic ossification of soft tissue is a significantly disabling problem in orthopaedic surgery possibly leading to severe joint contracture, ankylosis, spasticity. Therapeutical options mainly include NSAID›s and local radiation, both inherently carrying major disadvantages such as delayed fracture healing and impairing ossification. Hypoxia reportedly stimulates the secretion of HIF-1α. This leads to an increased VEGF production, which acts as a main stimulus for angiogenesis and formation of heterotopic ossification. The inhibition of this pathway could be an essential therapeutical approach. Echinomycin as an antibiotic agent allegedly inhibits the production of VEGF. Therefore we used an established animal model to examine the heterotopic ossification after treatment with Echinomycin.
Methods: Male CD-1 mice (n = 20) were used in this study as approved by the relevant Swiss authorities. All mice underwent bilateral Achilles tenotomy and were divided into groups: Control (n = 10), Echinomycin (n = 10). The control group underwent Achilles tenotomy only. The Echinomycin group received 10 mcg Echinomycin subcutaneously for 4 weeks, followed by 6 weeks of rest and cage activity only. After 10 weeks the limbs were harvested and Micro CT was performed. Heterotopic bone volume was then identified in 3d images. Statistical analysis was performed using the Wilcoxon rank sum test.
Results: In 12% of the samples no heterotopic ossifications were found. In all other samples, heterotopic ossifications with a bone volume ranging from 0.001–1.649 mm^3 were found. The mean bone volume in the control group was 0.976 mm^3 whereas the mean bone volume in the Echinomycin group was 0.092 mm^3. Range: 0.01–0.488 mm^3 (p 0.003).
Discussion: A significant reduction in bone volume (roughly 90%) could be observed in the group treated with Echinomycin (p = 0.003).
Conclusion: Echinomycin may be a promising therapeutical agent in the prevention of Heterotopic ossification.

FM 59

Tendon-lengthening in continuity: A new method of helical cutting

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Introduction: Additional tendon length is occasionally needed for the surgical reattachment of retracted tendons and for lengthening of intact but contracted tendons. To achieve additional length with the known techniques such as the z-plasty, the tendon needs to be cut through entirely and loses its continuity. The purpose of this study was to develop a new method for tendon lengthening, where continuity is preserved and a high amount of additional length is achievable.
Methods: Calf Achilles tendons (n = 35) were harvested immediately after slaughter and 5 tendons were assigned to groups I to VII. Angles of 60° (group I and IV), 45° (group II and V) and 30° (group III and VI) were cut. In group IV to VI mattress suture stitches were made along the cutting lines. The mean length increase of the helical cuts was used to define the intended length of group VII, where a z-plasty was performed. Maximal tensile strength (Fmax) and the achieved lengthening at Fmax (LFmax) were determined for each tendon.
Results: Helically cut tendon could achieve higher amount of length and tensile strength than tendons lengthened using z-plasty; Other than in groups III and IV, where the cut angle was 30°, resulting in 279 ± 80% and 213% ± 10% LFmax, respectively, high tensile strength (from a minimum of 80N ± 54N in group II to maximally 222N ± 62N in group IV) was achieved, whereas with z-plasty (group VII), a LFmax of 172% ± 10% was achieved by a Fmax of 70N ± 15N. The length and tensile strength could be controlled by choice of the angle of the helical cut.
Conclusion: Helical cutting of tendons allows lengthening tendons to an amount not possible with conventional methods. The lengthened coil-shaped tendon remains in continuity and has the potential to withstand considerable loads also without additional suture reinforcement. The behavior of the helical cut tendon in vivo is not known. However, the preservation of continuity might be favorable not only in regard to high tensile forces but also to healing.

FM 60

The structure of retracted tendons after direct repair or repair following continuous traction

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Introduction: Repair of the retracted musculotendinous unit after rotator cuff tendon tear is limited by musculotendinous retraction and is not always possible. Continuous musculotendinous traction can restore original muscle architecture. The changes in chronically retracted tendons undergoing single stage repair or repair after continuous traction are unknown.
Methods: The infraspinatus tendon was released in 17 sheep and allowed to retract for 10 months (group I, n = 5) and 4 months (group II, n = 12). In group I direct repair was performed after 10 months, whereas in group II repair was performed after the retracted musculotendinous unit had been lengthened progressively to its original length. Those tendons (group III, n = 4), in which continuous traction was not successful, retracted without any repair. Tendons were assessed macroscopically, by MRI, histology and TEM.
Results: Compared to normal controls, tendon thickness decreased in group I to 65% ($p < 0.05$) and increased in group II to 116% (p = 0.118). Tendons in group III showed increased thickness of 129% ($p < 0.05$), but substantial shortness. Thickness was positively correlated with the muscular pennation angle in all groups. Increased collagen fiber crimping and disorganization was found in groups I and III, whereas in group II the changes were partially restored.
Conclusion: Single stage repair of a retracted musculotendinous unit results in deterioration of the tendon, characterized by collagen fiber crimping, fibril atrophy and disorganization. Continuous traction arrests and partially restores the changes of the retracted tendon.

FM 61

Early serum procalcitonin level after primary total hip replacement – preliminary results

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Introduction: Procalcitonin (PCT) has been shown to be a specific marker for bacterial infections. CRP, ESR or WBC elevation in the early postoperative phase after total hip arthroplasty could either be the manifestations of an early bacterial infection or signs of an unspecific

postoperative inflammatory reaction. Therefore a specific marker for early postoperative infection would be very useful to prevent harmful and expensive sequelae. Current literature describes PCT to be useful in determination of postoperative infectious and non-infectious fever after orthopaedic surgery. The early postoperative serum-level of PCT has been shown to be very useful in detection of early infections after cardiac surgery compared to CRP or WBC levels. The aim of this prospective study was to measure the early PCT serum level before and during 5 days after primary total hip replacement surgery in comparison with the course of CRP, WBC and IL-6 levels. The so determined serum PCT baseline of uneventful primary total hip replacement would then serve as basis to compare early postoperative infections with.
Methods: Blood samples of 26 consecutive patients (17 male 9 female, age 52–81, mean 66) were analysed regarding PCT, WBC, CRP and IL-6 serum levels the day before and during 5 days after surgery. Included were patients older than fifty years scheduled for primary unilateral total hip replacement. Exclusion criteria were acute or chronic infection, increased preoperative serum levels of the investigated parameters, known coagulopathy and malign neoplastic diseases.
Results: The normal postoperative PCT serum levels could reproducibly be determined and compared to other laboratory values.
Conclusion: Serum PCT has a specific postoperative low-level course with only minimal rise and a peak postoperatively compared to WBC, CRP and IL-6 levels which remain on high levels in the early postoperative phase and therefore can not help to determine infectious versus non-infectious origin. A short 'rise and fall' instead of persistently high PCT levels will help to differentiate between infection and harmless unspecific postoperative inflammatory reaction.
Key words: Procalcitonin, Total hip replacement

FM 62

Clinical value of Tc-99m-DPD-SPECT/CT for evaluation of patients with pain following total knee arthroplasty – a new dimension of diagnostics

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Introduction: Although TKA is a very successful surgical procedure in patients with osteoarthritis of the knee. However, failure does occur in a considerable number of patients resulting in persistent or recurrent knee pain. One of the most common causes are patellofemoral disorders. To date no optimal "single-stage" sensitive and specific diagnostic imaging modality for this group of patients has been reported. The purpose of our study was to evaluate the clinical value of SPECT/CT for the assessment of patients with painful total knee arthroplasty (TKA).
Materials and methods: 23 painful knees in patients following primary TKA were assessed using Tc-99m-DPD-SPECT/CT. The rotational (internal-external rotation), sagittal (flexion-extension, anterior-posterior slope) and coronal (varus-valgus) alignment of the prostheses were assessed on 3D reconstructed SPECT/CT images using a customized software. The level of the SPECT-tracer uptake (0-10) and its anatomical distribution was mapped using a validated localization scheme. The highest activity grading for each area of the localization scheme was noted. Univariate analysis (Wilcoxon-Mann-Whitney, Spearmean`s-rho test, $p < 0.05$) was performed to identify any correlations between component position, tracer uptake and diagnosis.
Results: Progression of patellofemoral osteoarthritis (n = 11), loosening of the tibial (n=3) and loosening of the femoral component (n = 2) were identified as the leading causes of pain after TKA. Six patients with symptomatic patellofemoral osteoarthritis showed tibial component malposition (n = 3 each with external rotation of tibia > 10° and with a tibial slope <3°). Patients with externally rotated tibial trays showed significantly higher tracer uptake in the medial patellar facet ($p = 0.049$) and in the femur ($p = 0.051$). Patients with patellofemoral osteoarthritis as leading cause for their knee pain showed significantly ($p = 0.000$) higher tracer uptake in the patella than others.
Conclusion: SPECT/CT proved to be particularly helpful in identifying patellofemoral osteoarthritis, which was responsible for knee pain in nearly half of our patients. The importance of its ability to accurately localize the pathological tracer uptake within a small area of interest might be mostmost pronounced in complicated anatomical sites, consisting of several different articular compartments (e.g. patellofemoral, medial and lateral tibiofemoral) where localization of the cause of pain could be difficult.

FM 63

Accurate and Reliable Navigation of a Surgical Reaming Device for Femoral Head-Neck Offset Improvement – A Cadaveric Investigation

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During arthroscopic treatment of femoroacetabular impingement (FAI), overresection or insufficient resection are a frequent complication. For increased accuracy, we hypothesized that it would be feasible to navigate a surgical reaming device for offset improvement. At first experiments in open surgical dislocation procedures in cadaveric specimens were performed. Five cadaver hips were examined. Preoperatively, CT scans were obtained and 3D models of the hip joint were reconstructed. Using a preoperative planning application, the examiner performed a virtual head-neck osteochondroplasty. The planned model was stored and then transferred to the navigation application. An open surgical dislocation procedure was absolved, dynamic reference bases (DRB) were attached to femur and pelvis and a restricted surface matching was performed. Using a navigated Electric Pen Drive (Synthes AG, Switzerland) equipped with a DRB the surgeon performed the operation guided by the navigation system. At the end of the procedure, the femoral head-neck junction was digitized with a tracked pointer and a postoperative CT was performed. Finally, the postoperative reamed model, the postoperative model as visualized by the navigation system and the planned model were compared for differences in surface distances and three-dimensional alpha-angles. A Bland Altman Analysis was performed. The mean surface distances from measurement between all models ranged from 0.33 mm to 1.55 mm. The Bland Altman plot showed even and random spread of the means above and below the zero line within the confidence interval. Navigation of the Pen Drive in the in vitro setting allowed for accurate and reliable registration and conduction of the procedure. For application in arthroscopy, alternative registration methods due to limited surgical exposure, and also calibration and use of a different line of arthroscopy-specific tools will have to be evaluated.

FM 64

Dynamic loss of pressure on ACL hamstring grafts – an explanation for poor biomechanical performance with interference screw fixation

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Introduction: For the fixation of ACL hamstring grafts with interference screws, the mechanical hold mostly relies on pressing the graft with the screw, resulting in graft friction against the bone canal and screw. The pressure on the graft, which occurs while and after insertion of the screw respectively, are not known but are of central importance for mechanical hold and biological healing.
Methods: We analyzed the pressure created on 8mm human hamstring autografts in an 8 mm sawbone tunnel in vitro, using pressure indicating Fuji-films and a force sensor. There were 2 screw sizes (8 and 9mm), with and without a bone wedge between graft and screw. In a subgroup, the magnitude of the expansive contact force was continuously recorded during forty minutes and the tendon weight measured before and after test.
Results: During screw insertion, the local pressure (>40 MPa) exceeded the breaking strength of metaphyseal bone by a factor 10, but dropped unexpectedly quickly by 75% over 40 minutes. Accordingly, the tendon graft was seen to lose between 20 and 30% of water content. At the interface between graft and screw or bone, the peak pressures were 42 ± 4 MPa and 9.2 ± 4 MPa for the 8 mm screw and 44 ± 5 MPa and 33 ± 6 MPa for the 9mm screw for direct fixation and bone wedge technique, respectively ($p < 0.01$).
Conclusion: This is the first report assessing the peak contact pressure, and maintenance contact force of on a tendon transplant fixed by an interference screw within a bone tunnel. Using the bone wedge fixation technique and a small screw, the peak pressure on the tendon transplant can be reduced from a maximal value of 42 MPa by a factor of 5. The viscoelastic adaptation of the tendon, being both severe and continuous, reduces effective contact pressure within minutes and can be reasonably attributed for the poor biomechanical performance of the interference screw fixation method.

FM 65

Effect of the Glenosphere Position and Size on Reverse Shoulder Prostheses Mobility

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Introduction: Several methods have already been proposed to improve the mobility of reversed prostheses (lateral or inferior displacement, increase of the glenosphere size). However, the effect of these design changes have only been evaluated on the maximal range of motion and were not related to activities of daily living (ADL). Our aim was thus to measure the effect of these design changes and to relate it to 4 typical ADL.
Methods: CT data were used to reconstruct a accurate geometric model of the scapula and humerus. The Aequalis reversed prosthesis (Tornier) was used. The mobility of a healthy shoulder was compared to the mobility of 4 different reversed designs: 36 and 42 mm glenospheres diameters, inferior (4 mm) and lateral (3.2 mm) glenospheres displacements. The complete mobility map of the prosthesis was compared to kinematics measurement on healthy subjects for 4 ADL: 1) hand to contra lateral shoulder, 2) hand to mouth, 3) combing hair, 4) hand to back pocket. The results are presented as percentage of the allowed movement of the prosthestic shouder relative to the healthy shoulder, considered as the control group.
Results: None of the tested designs allowed to recover a full mobility. The differences of allowed range of motion among each prosthetic designs appeared mainly in two of the 4 movements: hand to back pocket and hand to contra lateral shoulder. For the hand to back pocket, the 36 had the lowest mobility range, particularly for the last third of the movement. The 42 appeared to be a good compromise for all ADL activities.
Conclusion: Reverse shoulder prostheses does not allow to recover a full range of motion compared to healthy shoulders, even for ADL. The present study allowed to obtain a complete 3D mobility map for several glenosphere positions and sizes, and to relate it to typical ADL. We mainly observed an improved mobility with inferior displacement and increased glenosphere size. We would suggest to use larger glenosphere, whenever it is possible.

FM 66

A new radiation free targeting guide for intramedullary nails: Preliminary results of cadaver study

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One of the most demanding steps of intramedullary nailing is the distal locking. The aim of this study is to evaluate a new radiation free targeting guide on cadavers.
Material and method: The study was conducted on fixed cadavers. 24 femurs were available. The method consists of the following steps: determining the zero position of the device; opening the tip of the great trochanter; introducing the nail (Sirus nail® 12X400 (Zimmer Inc.)); introducing an emitter inside the nail to be positioned in the distal holes; adaptation of the guide on the standard handle with a receptor; moving the receptor to be aligned to the emitter; changing the receptor for the sleeve and performing the drilling and the locking. For the second or even third screw, the targeting device needs a little adjustment.
Results: On the 25 distal locking procedures, we observed only one failure due to the breakage of the prototype. This translates as a 98% success rate for two screws with a mean time of 7.4 minutes.
Conclusion: This new device has the advantage to be fully mechanical, to be solidly linked to the patient and to be totally radiation free. It can be used in any hospital, by any surgeon. The procedure is easy to learn and reproducible. It could be adapted to any nail system and does not need external power supply.

FM 67

Can plate osteosynthesis of stable femoral periprosthethic fractures cause early cement mantle failure around the hip stem? A biomechanical evaluation

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Introduction: Periprosthetic femur fractures are a serious complication after hip replacement surgery. In an aging population these fractures are becoming more and more common. Open reduction and plate osteosynthesis is one of the available treatment options.
Objective: To investigate hip stem stability and cement mantle integrity under cyclic loading conditions after plate fixation with screws perforating the cement in the proximal fragment.
Methods: Polished tapered hip stems were implanted in 16 biomechanical testing femora with Palacos cement (3rd generation technique) according to the manufacturer's recommendations. 8 testing bones were osteotomised distal to the stem representing the fracture group (Vancouver Type C). The osteotomy was fixed with a polyaxial locking plate, the other 8 specimens served as a control group. The specimens were tested in a biaxial material testing machine under axial compression (including adduction and torsion moments) for 100.000 cycles at physiological loads. Stem subsidence was measured in 3 planes with a stereoscopic image correlation system during the tests. Subsequently the sliced and crack dyed specimens were investigated microscopically for cement cracks.
Results: In the control group no specimen failed during testing. There were no statistically significant differences in stem subsidence along the longitudinal axis (control group mean ± SD –15.4 ± 12.2 µm, fracture group –14.1 ± 13.1 µm). In the fracture group two specimens fractured through the most proximal screw hole after 74.000 and 80.000 cycles. Overall 15 out of 36 screws in the proximal fragment had direct stem contact. No cement cracks were detected in the sliced specimens in both groups.
Conclusion: Drilling the cement mantle and placing screws in the cement did not increase stem subsidence under cyclic loading. No cracks or cement mantle failure were observed. Large screw diameters proximally weaken the lateral cortex resulting in tension failure of the bone. Plate fixation of a periprosthetic femoral fracture with a stable, cemented prosthesis does not lead to early cement mantle failure.

FM 68

Correlations between subjective score measurements and objective force and gait parameters after total knee arthroplasty

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Introduction: The survival rate of TKA is the way quality is usually expressed. In our opinion objective parameters such as force and gait measurements are important to verify subjective patient satisfaction. The aim of this prospective study was to evaluate correlations between subjective score measurements and objective force and gait parameters after TKA.
Material and methods: 42 TKA (37 patients) with 3 different types of TKA (LCS-PS©, LCS© DePuy and Journey© Smith & Nephew, Inc.) were included in this study. For subjective score measurements FJS (Forgotten Joint Score©), WOMAC (Western Ontario and McMaster Universities Osteoarthritis Index©), KS (Knee Society Score©) and FS (Function Score©) were used. Objective data were obtained by measuring maximal isometric quadriceps force in 30°, 60° and 90° of knee flexion (Monitored Rehab Systems©), Quadriceps/Hamstrings Ratio (Q/H Ratio) (HHD, FB50K©) and gait analysis on a force plate (Zebris FDM 1,5 Mtr©). The subjective and objective data were evaluated preoperatively and 1 year after surgery. SPSS was used for statistical analysis.
Results: There was no significant correlation between FJS and WOMAC and absolute quadriceps force. Only FS correlated significantly with objectively measured quadriceps force in 30° of knee flexion ($p = 0.026$). Additionally there could be found a significant correlation between WOMAC and Q/H Ratio ($p = 0.028$). Furthermore significant correlations between FJS and push off force at gait analysis ($p = 0.008$) and WOMAC and push off force at gait analysis ($p = 0.008$) could be found.
Conclusion: It is difficult to make subjective outcome measurement highly reproducible with objective parameters after TKA. The absolute quadriceps force did not correlate with patient satisfaction neither in 90° nor in 60° or 30° of knee flexion. But Q/H Ratio correlated significantly with WOMAC and might be more important for patient satisfaction than absolute quadriceps force. Furthermore a significant correlation could be seen between WOMAC and FJS and push off force at gait analysis. Therefore gait analysis seems to be the best objective parameter. Wether additional information could be obtained by a complete gait analysis is subject of further studies.

FM 69

The impact of complications in total ankle replacement and ankle fusion analyzed by prospective validated outcome at intermediate follow-up

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Background: Major modifications in the design and techniques of total ankle replacement (TAR) designs have challenged the perception that ankle fusion is the treatment of choice for end-stage ankle arthritis. High complication rates of more than 50% in some series have been reported for both procedures at intermediate and long-term follow-up.
Methods: 114 TAR (61 Agility, 22 Hintegra, 16 STAR, 15 Mobility) and 47 ankle fusions (22 open, 25 arthroscopic) were prospectively evaluated including clinical and radiographic assessment at a mean intermediate follow-up of 39 and 37 months, respectively. Mean age in the TAR group was 64 years (51 female, 63 male patients) and 59 years in the fusion group (15 female, 32 male patients). The number of recorded complications and their impact on the Ankle Osteoarthritis Scale (AOS) were analyzed.
Results: The complication rate was 54.4% in the TAR study group and 25.5% in the ankle fusion study group. Both groups had a significant improvement in the mean AOS score (P <0.001). There was no significant difference of the mean gain in the AOS scores between the groups (P >0.05). Significantly more major complications in TAR group than in the ankle fusion group were recorded (P = 0.003). The impact of major complications on the AOS outcome was not significant in the TAR group (P = 0.201) but in the ankle fusion group (P = 0.035).
Conclusions: The outcome after TAR and ankle fusion at intermediate follow-up with regard to pain relief and function is comparable. While the number of complication is significantly higher in TAR than in ankle fusion, the impact on the outcome is significant only in ankle fusions.

FM 70

Static and dynamic hindfoot alignment in ankle and TTC arthrodesis

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Background: The Saltzman hindfoot alignment view (HAV) is considered the gold standard for assessing the axis from hindfoot to tibia. However, it is unclear how static alignment influences dynamic alignment during gait. This study aimed at evaluating the static and dynamic hindfoot alignment in ankle (AA) and tibiotalocalcaneal (TTC) arthrodesis.
Methods: 98 patients (AA = 56, TTC = 42) with an average follow-up of 4.1 ± 1.3 years were assessed clinically with AOFAS- and SF-36 scores, visual hindfoot alignment, HAV, dynamic pedobarography using a 5-step method and a mask with 11 divisions (novel emed m/e). For comparison, 70 normal feet were evaluated.
Results: The HAV-angle was –0.75 ± 7.83 degrees for ankle, –1.19 ± 6.92° for TTC arthrodesis. Visual alignment only predicted the corresponding HAV-angle in 48%. The HAV-angle had significant correlations to several final pedobarographic load parameters (r = 0.35–0.53, p = 0.02 to <0.0001). Static alignment did not influence subjective outcome. To reproduce the dynamic load pattern of normal subjects, an HAV-angle of 0 to >10° of valgus was needed.
Conclusions: Intra-operative positioning of the hindfoot by visual means resulted in a relatively large standard deviation of ±7–8° and a slight varus position. Visual judgment was not accurate enough as it only corresponded to the HAV-angle in 48%. The static alignment had a strong correlation to the dynamic load pattern; however, it did not influence subjective outcome. To reproduce the dynamic load pattern of normal subjects, a neutral to >10° of valgus position was needed in the HAV.

FM 71

Risk factors for post-traumatic ankle osteoarthritis: A 12-22 year follow-up study

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Introduction: Among patients with ankle osteoarthritis (OA) a post-traumatic origin is much more frequent (65–80%) than among patients with knee or hip OA (<10%). However, long-term cohort studies evaluating risk factors for the development of advanced radiologic OA after ankle fractures are lacking.
Methods: We conducted a retrospective cohort study including consecutive patients operated at our institution between 1/1988 and 12/1997 for malleolar fractures treated with open-reduction and internal fixation (ORIF). Peri-operative information was obtained retrospectively, and clinical and radiological follow-up was determined prospectively. Patients were seen at 12–22 years postoperative. Ankle OA was independently assessed by two reviewers on standardized radiographs with use of the revised Kellgren and Lawrence (K&L) scale. Bivariate analyses and multivariate logistic regression analyses were performed to determine predictors for advanced radiologic OA.
Results: 374 patients (56% men) underwent ankle surgery during the defined period. 9% of the patients had a Weber A fracture, 58% a Weber B and 33% a Weber C fracture. Mean age at the time of operation was 42.9 years (±17.1; range 16-86 years). 12–22 years after surgery, 47 patients had died, 126 were lost to follow-up, and 99 did not respond or refused to participate. 102 patients were available at follow-up. These patients did not differ in terms of age, gender distribution, BMI and type of fracture from those who were not seen. Mean duration of follow up was 17.3 years (±3.3). Advanced OA (K&L grade 3–4) was present in 37 patients (36.3 %). Significant risk factors for developing OA were: fracture type (53% advanced OA after Weber C vs. 31% after Weber B vs. 0% after Weber A, p = 0.006), presence of a medial malleolus fracture (Weber B: 52% vs. 21%; Weber C: 68% vs. 31%), fracture-dislocation, increasing BMI, older age, and longer time to follow-up.
Conclusion: Advanced radiologic OA is frequent (36.3%) 12–22-years after post-traumatic ankle fracture treated with ORIF, especially in patients with Weber C fractures, in the presence of a medial malleolus fracture and after fracture-dislocation. Overweight and obese patients as well as older patients are at increased risk.

FM 72

Metatarsal length does not correlate with maximal peak pressure and maximal force in metatarsalgia patients and healthy controls

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Introduction: Primary metatarsalgia of the lesser metatarsals is a common problem in clinical routine. It is caused by mechanical overload or repetitive pressure loading under the metatarsal head, which exceeds the focal tissue tolerance. This leads to pain and formation of plantar calluses. According to a widely accepted theory increased metatarsal length is an important factor for the development of metatarsalgia. Up to now there is no biomechanical evidence which supports this theory. It is unclear if increased metatarsal length has any influence on biomechanic parameters of the plantar forfoot.
Methods: We perfomed a prospective study on 102 forefeet of metatarsalgia patients and symptom free subjects. Each foot was physically examined and underwent standardized full-weight bearing x-rays and dynamic pedobarography.
Results: Relative length of the first and third metatarsal did not correlate with maximal peak pressure and maximal force under the first and third metatarsal head. There was no difference in maximal peak pressure or maximal force in the metatarsal group compared to the symptom free control group.
Conclusion: Relative metatarsal length has no influence on plantar loading parameters. There is no biomechanical rationale supporting the theory that increased metatarsal length increases plantar pressure under the metatarsal head and predisposes for the development of primary metatarsalgia.

FM 73

Midterm results of the Scarf Osteotomy in hallux valgus treatment (a review of 159 cases) and indication of the additional Akin osteotomy as a routine-procedure even if there is no interphalangeal valgus

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Introduction: Since 1995 in our institution the Scarf Osteotomy has been the standard procedure in the treatment of moderate to severe hallux valgus deformity. Since 2003 under the clinical impression of a better postoperative result the Scarf Osteotomy has been routinely combined with basal closing wedge osteotomy of the first phalanx (Akin Osteotomy). This study reviews the subjective, clinical and radiological outcome of 65 patients that underwent a Scarf Osteotomy and 93 patients that underwent a combined Scarf and Akin Osteotomy. The two groups were then compared.
Methods: The study includes 159 patients with hallux valgus deformity operated from 1997 to 2007. From 1997 to 2002, 65 were treated with a Scarf Osteotomy alone (1st group) and from 2003 to 2007, 93 were treated with a combined Scarf and Akin Osteotomy (2nd group). Mean follow-up was 91 months in the 1st group and 40 months in the 2nd group. Each patient was reviewed clinically and radiographically.

Results: There was a significant decrease of the intermetatarsal angle M1-M2 (16 degrees to 10 degrees in the 1st group and 16 degrees to 9 degrees in the 2nd group). The hallux angle M1-P1 (30 degrees to 17 degrees in the 1st group and 32 degreees to 10 degrees in the 2nd group) and the total-hallux-angle M1-P2 (37 degrees to 26 degrees in the 1st group and 38 degrees to 17 degrees in the 2nd group) also decreased significantly in both groups. The decrease of the hallux angle and total-hallux-angle was significantly greater in the Scarf and Akin group. The AOFAS score increased significantly from 32 to 94 in the 1st group and from 31 to 94 in the 2nd group.
Conclusion: The scarf osteotomy is a very efficient method treating hallux valgus and provides good midterm results. The additional Akin Osteotomy leads to a greater decrease of the total hallux angle (M1-P2). We found better radiological and cosmetic results in the Scarf and Akin group but we could not find a significant difference with respect to pain or function. Thus we do not recommend performing the additional Akin Osteotomy as a routine procedure however it should always be performed, if there is an additional interphalangeal valgus or insufficient correction with Scarf Osteotomy alone.

FM 74

A new prosthesis design for the metatarsophalangeal joint of the hallux – preliminary results

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Background: Severe hallux rigidus is a challenging condition for the foot surgeon. The current gold standard in the treatment of this condition is arthrodesis of MTP-I joint, thus accepting the permanent and complete loss of mobility in this biomechanically important joint. In the past many attemps have been made in total replacement of MTP I joint. Most of them failed due to early loosening and wear. The aim of this study is to evaluate the preliminary results of a new cementless, anatomically shaped, three component prosthesis design with minimal bone resection. The hypothesis were a) the procedure warrants for a good pain relief and increase in clinical scores. b) the prosthesis results in a good MTP-I mobility, c) the prosthesis allows stable pressfit fixation and osteointegration of both components.
Methods: From 2008 to 2009 we included 20 cases in the study. 11 cases (10 patients; 5 male, 5 females) have reached a minimum follow-up of 6 months (average 10 months, range 6–15). The average age of the patients was 62.3 years (range, 49–87). Pre- and postoperatively at latest follow-up the patients were evaluated clinically and radiologically.
Results: The AOFAS forefoot score improved from 52.6 (range, 39–65) to 80.0 (range, 52-95; p <0.001) and the VAS for pain decreased from 6.5 (range, 0–9) to 1.5 (range, 0–4; p <0.001). 7 patients were able to wear normal comfortable shoes. Postoperative ROM of the MTP-I was 17.3 (range, 10–40) for plantarflexion and 19.1 (range, 0–30) for dorsal extension. This was not significantly different from the preoperative values. Pre- and postoperatively, all but one patient had a physiological radiological alignment concerning hallux valgus angle, intermetatarsal angle and distal metatarsal articular angulation angle. One patient had an increased preoperative hallux valgus angle, which was corrected at the time of surgery. At latest follow-up, all prosthesis showed stable osteointegration and no migration. So far, no complications arose and there were no prosthesis-related reoperations.
Conclusion: The new metatarsophalangeal joint prothesis (METIS) shows to be a good solution in the treatment of hallux rigidus in short term follow-up. The prosthesis achieved excellent pain releave and a significant increase in the clinical outcome score. The range of motion could not be increased at short term follow-up, but did not decline and allowed wear of normal shoewear in the majority of the patients. The uncemented three component prosthesis prooved good osteo-integration and minimal bone loss, particularly on the metatarsal side. It warrants a good pain relieve with preserved mobility in the MTP I joint. MTP-I joint replacement might therefore begin to play a more important role in the treatment of hallux rigidus. Long-term follow-up will have to proove this promising short time results.

FM 75

Ankle joint pressure in pes cavovarus after lateralizing calcaneal osteotomies

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Background: Tendon transfers and calcaneal osteotomies are commonly used to treat symptoms related to medial ankle arthrosis in cavovarus foot deformity. However, the power of the different osteotomies in terms of lateralizing the ground contact point of the hindfoot and redistributing ankle joint contact stresses are unknown.
Methods: A static cavovarus foot deformity was simulated in eight cadaver specimens. The effect of three types of calcaneal osteotomies on the migration of the center of force (COF) and tibiotalar peak pressure at 300 N axial load (half-body weight) were recorded using pressure sensors.
Results: A significant lateral shift of the COF was observed: 4.94 mm for the laterally closing Z-shaped osteotomy with additional lateralization of the tuberosity, 3.43 mm for the lateral sliding osteotomy of the calcaneal tuberosity, and 2.7 mm for the laterally closing Z-shaped osteotomy (all P <0.001). A significant peak pressure reduction was recorded: –0.53 MPa for the Z-shaped osteotomy with lateralization, –0.58 MPa for the lateral sliding osteotomy of the calcaneal tuberosity, and -0.41 MPa for the Z-shaped osteotomy (all P <0.01).
Conclusion: Lateralizing calcaneal osteotomies substantially contribute to normalize ankle contact stresses in pes cavovarus.
Clinical relevance: Realignment of the varus heel in pes cavovarus for anteromedial ankle arthrosis is an important and efficient part of joint preserving reconstruction. It may help to prevent the onset or progression of ankle arthrosis.

FM 76

Characteristics and outcome of knee prosthetic joint infections (PJI): A 10-year cohort study (2000–2009)

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Background: Prosthetic joint infections (PJI) lead to significant long-term morbidity with high cost of healthcare. We evaluated characteristics of infections and the infection and functional outcome of knee PJI over a 10-year period.
Methods: All patients hospitalized at our institution from 1/2000 through 12/2009 with knee PJI (defined as growth of the same microorganism in ≥2 tissue or synovial fluid cultures, visible purulence, sinus tract or acute inflammation on tissue histopathology) were included. Patients, their relatives and/or treating physicians were contacted to determine the outcome.
Results: During the study period, 61 patients with knee PJI were identified. The median age at the time of diagnosis of infection was 73 y (range, 53–94 y); 52% were men. Median hospital stay was 37 d (range, 1–145 d). Most reasons for primary arthroplasty was osteoarthritis (n = 48), trauma (n = 9) and rheumatoid arthritis (n = 4). 23 primary surgeries (40%) were performed at CHUV, 34 (60%) elsewhere. After surgery, 8 PJI were early (<3 months), 16 delayed (3-24 months) and 33 late (>24 months). PJI were treated with (i) open or arthroscopic debridement with prosthesis retention in 26 (46%), (ii) one-stage exchange in 1, (iii) two-stage exchange in 22 (39%) and (iv) prosthesis removal in 8 (14%). Isolated pathogens were *S. aureus* (13), coagulase-negative staphylococci (10), streptococci (5), enterococci (3), gram-negative rods (3) and anaerobes (3). Patients were followed for a median of 3.1 years, 2 patients died (unrelated to PJI). The outcome of infection was favorable in 50 patients (88%), whereas the functional outcome was favorable in 33 patients (58%).
Conclusions: With the current treatment concept, the high cure rate of infection (88%) is associated with a less favorable functional outcome o 58%. Earlier surgical intervention and more rapid and improved diagnosis of infection may improve the functional outcome of PJI.

FM 77

Can implant retention be recommended for treatment of infected TKA?

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Introduction: Treatment results for deep periprosthetic infection after total knee arthroplasty (TKA) vary. Most reports have focused primarily on the final cure rate of infection and little is known about the success rate of initial surgical treatment.
Methods: We compared the results of initial surgical treatment (index surgery) with its follow-up cure rate and tried to identify factors that might allow implant-retaining treatment. Sixty-four knees (60 patients) treated for infected TKA at our institute from 2002 to 2007 were analyzed. Mean age at index surgery was 65 ± 10 years (range 38–85) and median follow-up was 36 months (range 12–84). Thirty-two knees underwent debridement with the retention of the component (retention group), and 32 knees were treated with component removal and staged revision surgery (removal group).

Results: The success rate of infection control after index surgery was 31%, 59%, and 45 % for retention, removal and the overall group, respectively. Final cure rates improved to 66%, 69%, and 67% after additional operative procedures. Multivariate analysis indicated two significant independent predictors of failure: Staphylococcus aureus infection and infection of revision TKA. For the retention subgroup analysis, S. aureus and polyethylene non-exchange were associated with index treatment failure.
Conclusions: Our results clearly indicate that staged removal treatment gives the most reproducible results. However, in patients with primary TKA infection and without *S. aureus*, debridement with implant retention might result in a final cure rate comparable to removal treatment. When retention treatment is chosen, polyethylene exchange is strongly recommended.

FM 78

Outcome of single event multilevel surgery in 121 children with cerebral palsy using the Movement Analysis Profile and the Gait Profile Score

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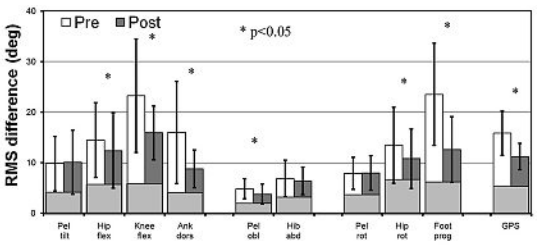
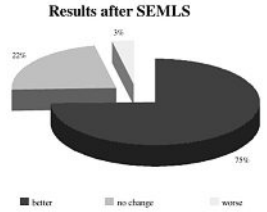
Introduction: The natural history of gait in children with bilateral spastic cerebral palsy (CP) is one of deterioration. Single Event Multilevel Surgery (SEMLS) is performed in order to prevent deterioration and to improve gait in patients with bilateral involvement of the lower extremities. The aim of this study is to investigate the short-term outcomes using the Movement Analysis Profile (MAP) [1] and the Gait Profile Score (GPS) [1].
Methods: All 121 diplegic patients with GMFCS level II or III (48 girls/73 boys; mean age 10.7 ± 2.7 years at time of the surgical intervention) who had SEMLS at our hospital between 1995 and 2008 were included in this study. A change of one standard deviation (1.31°) in the overall GPS compared preoperative to postoperative was defined as clinical significant changing.
Results: The mean follow-up was 1.3 ± 1.0 year. The mean overall GPS preoperative was 15.5° ± 3.9° and the mean overall GPS postoperative was 11.2° ± 2.5°. The change in GPS was 4.3° ± 3.7°. The figures show the MAP for all patients compared preoperative to postoperative and the operative results after SEMLS:





Conclusion: Gait problems in children with bilateral spastic CP can be corrected successfully in one major operative session with the SEMLS approach in this large cohort of 121 children. 75% of the patients showed a clinical significant improvement, 22% of the patients showed no change, and only 3% of the patients deteriorated at short-term follow-up reflected by the overall GPS.
References: [1] Baker et al., *Gait Posture 2009;30-3:265-9.*

FM 79

What duration for antibiotic treatment for native septic arthritis? A retrospective single-centre study

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Objectives: The ideal duration of antibiotic treatment in the therapy of septic native joint arthritis is unknown. To assess the epidemiology of septic arthritis at Geneva University Hospitals. To assess risk factors for recurrence with emphasis on surgical and medical treatment parameters.
Methods: Case-control study.
Results: A total of 169 episodes in 157 patients (median age 63 years, 65 females) were retrieved. The infected joints were: knee (n = 51), hip (n = 21), shoulder (n = 32), ankle (n = 9), sterno-clavicular (n = 2), elbow (n = 2), sacroiliac (n = 1), and interdigital (n = 43). In 21 episodes (21/169, 12%), arthritis recurred after the end of antibiotic treatment. In multivariate analysis, lack of surgical intervention (odds ratio 11.3, 95% confidence interval 2.7–46.2), Gram-negative infection (OR 5.9, 1.4–25.3), and immunosuppression (OR 5.3, 1.3–22) were significantly associated with recurrence, while open arthrotomy vs. arthroscopic drainage (OR 0.5, 0.2–1.8), total duration of antibiotic therapy (OR 1.0, 1.0–1.0), or duration of intravenous antibiotic therapy (OR 1.0, 1.0–1.0) were not. Seven days of intravenous therapy had the same effect than 8 to 15 days (OR 0.4, 0.1–1.7) or <21 days of intravenous treatment (OR 1.1, 0.4–3.1). 2 weeks of total antibiotic treatment had the same outcome as a therapy of 2 to 4 weeks (OR 0.4, 0.1–2.3) or >4 weeks (OR 0.4, 0.1–1.6).
Conclusions: Among modifiable parameters, at least one surgical intervention is of utmost importance in the treatment of septic native joint arthritis. The modalities of concomitant antibiotic therapy are secondary. Selected antibiotics might be administered orally after few days of parenteral regimen for a total duration of two weeks.

FM 80

Two-stage surgical treatment of chronic osteomyelitis of the tibia

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Introduction: Chronic osteomyelitis (CO) of the tibia in adults is most often secondary to open fractures. Its treatment is known to be difficult and requires a multidisciplinary approach that includes orthopaedics, plastic surgery, infectious disease and general medicine. Various treatment protocols have been advocated. Surgical management should include radical debridement, fistulectomy, sequestrectomy, obliteration of dead space, stabilisation any non-healed fracture, soft tissues coverage, and antibiotic therapy. At our institution, we systematically apply a two-stage protocol. The first step consists of soft tissue and bone débridement, obliteration of dead space with antibiotic-impregnated beads or cement and external fixation if required. A VAC dressing is applied, and 2 weeks later the second step is performed which includes bone grafting, internal fixation (if required) and free flap.
Method: Cohort of 14 consecutive patients treated for CO of the tibia between 2004 and 2010 with a two-stage treatment protocol. Classification System: Cierny-Mader. Recorded parameters: aetiology of CO, type of bacteria, CRP, type of free flap, time to bone healing, infection relapse, need for revision. Follow-up: annually for check up once there were clinical and radiographic evidences of healing.
Results: Ten patients had had an open fracture, 3 a closed fracture, and 1 a valgus osteotomy of the distal tibia. Ten patients had Cierny-Mader type 3 and 4 patients a type 4. One free flap failed and required repeat free flap. One patient at 1 year has still not fully healed the non-union treatment but has no obvious signs of CO recurrence. At an average follow-up of 3.5 years (5 M – 6 Y), no patient had recurrence of osteomyelitis.
Conclusion: Chronic osteomyelitis of the tibia is difficult to manage and there is no consensus on the best method. In the literature, multiple stage treatment has been associated to a higher success rate as compared to a single stage. Our study confirms that a 2-stage protocol is a sound treatment strategy for treating chronic osteomyelitis of the tibia.

FM 81

The use of the vac in complex wounds – does it work and how?

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Background: Complex wounds pose a major challenge in reconstructive and trauma surgery. Several approaches to increase the healing process have been proposed in the last decades. In this study we study the mechanism of action of the Vacuum Assisted Closure device in diabetic wounds.
Methods: Full-thickness wounds were excised in diabetic mice and treated with the VAC device or its isolated components: an occlusive dressing (OD) alone, subathmospheric pressure at 125 mm Hg

(Suction), and a polyurethane foam without (Foam) and with ($Foam_c$) downward compression of approximately 125 mm Hg. The last goups were treated with either the complete VAC device (VAC) or with a silicne interface that alows fluid removel (Mepithel-VAC). The effects of the treatment modes on the wound surface were quantified by a two-dimensional immunohistochemical staging system based on vasculature, as defined by blood vessel density (CD31) and cell proliferation (defined by ki67 positivity), 7 days post wounding. Finite element modelling was used to predict wound surface deformation under dressing modes and cross sections of in situ fixed tissues were used to measure actual microstrain.
Results: The foam-wound interface of the Vacuum Assisted Closure device causes significant wound stains (60%) causing a deformation of the single cell level leading to a profound upregulation of cell proliferation (4-fold) and angiogenisis (2.2-fold) compared to OD treated wounds. Polyurethane foam exposure itself causes a frather unspecific angiogenic response ($Foam_c$, 2 – fold, Foam, 2.2 – fold) without changes of the cell proliferation rate of the wound bed. Suction alone without a specific interface does not have an effect on meassured parameters, showing similar results to untreated wounds. A perforated silicone interface caused a significant lower microdeforamtion of the wound bed correlating to changes of the wound tissues.
Conclusion: The Vacuum Assisted Closure device induce significant tissue growth in diabetic wounds. The wound foam interface under suction causes profound macrodeformation that stimulates tissue growth by angiogenesis and cell proliferation. It needs to be taken in consideration that in the clinical setting different wound types may profit from different elements of this suction device.

FM 82

Is there a relation between leg pain in children and vitamin D level?

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Introduction: Leg pain in children, the so called growing pain (Incidence in literature up to 49%), occurs frequently and leads pretty often to a doctor's visit. Pain usually appears in the evening or during the night. The clinical examination is normal, the reason for pain unknown and up to date the there is no effective therapy. Vitamin D deficiency may cause musculoskeletal pain and weakness of the limbs which will disappear with vitamin D substitution, so called hypovitamin D – induced pain – not only in children. For multiple reasons (restricted sun exposition, sun protection, clothing habitudes, nutrition) vitamin D deficiency has again become a major health problem for both children and adults of all ages and races. An association between growing pain and unrecognized vitamin D deficiency seems possible. This idea is further supported by the fact that some studies found a reduced bone density in children with growing pain as measured by quantitative ultrasound.
Patients and methods: In this prospective study there are 50 patients in the pain group, aged 2–10 years with compromising pain.The patients are clinically examined and blood samples with 25-hydroxyvitamin D, Ca, P, parathyroid hormone and alkaline phosphatase levels are tested. In case of deficiency, the patients are treated with 1000IE of vitamin D/ d. After 3 months the blood and clinical examination will be repeated. Control group: 50 healthy patients, aged 2–10 without leg pain. Blood samples with 25-hydroxyvitamin D, Ca, P, parathyroid hormone and alkaline phosphatase are tested.
Preliminary results: Out of the pain group 45 patients were examined until end of January 10. All of them exept 5 had a vitamin D deficiency (<20 µg/l) or a suboptimal vitamin D level (20–30 µg/l). The patients were suffering from legpain since 3.3 y (0.5-7 y). Pain occurred in the evening or at night (100%) in some cases during activity at daytime. In 7 cases pain occurred monthly, in 20 cases weekly and in 8 cases daily. Until now 10 are reexamined and 8 showed an improvement of vitamin D level and pain. 2 showed an equal vitamin D level than before and still suffered from legpain. 3 out of 21 control patients had a sufficient vitamin D level.
Discussion: The reexamined children with leg pain showed after 3 months an improvement of pain if the vitamin D blood level improved, too. We conclude, that growing pain is caused by vitamin D deficiency and easily treated with vitamin D. The vitamin D level in Swiss children with or without growing pain is lower than assumed. Further investigation is necessary and vitamin D prophylaxis in children should be discussed.

FM 83

Retrospective analysis on the use of structural and non structural bone grafts and substitutes in hindfoot arthrodesis

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Introduction: Hindfoot fusions implicate the decision whether to use an autologous bone graft or an osteoconductive or- inductive substitute material in order to promote bony union and/or to support the correction of an additional hindfoot deformity. Evidence directing this decision is missing. The goal of this study was to retrospectively review the use of structural and non structural bone grafts and substitute materials used for hindfoot fusions at the foot and ankle clinic of University Hospital of Basel and thereby comparing average time to union achieved with specific grafts in specific hindfoot fusions.
Methods: We retrospectively identified all patients who underwent hindfoot fusions at the foot and ankle clinic of the University Hospital of Basel over a one year period. Patients were then allocated to three treatment groups including 1) ankle and tibiocalcaneal, 2) triple/ subtalar and 3) talonavicular arthrodesis. Within these major treatment categories, patients who received the same or no bone graft were further pooled in subgroups. These subgroups were then compared in respect to average time to union and presence of non- and delayed union.
Results: We identified 67 patients (32M, 35F, mean age 57 ± 15 years) undergoing 70 (48 primary, 22 secondary) hindfoot arthrodeses in which 56 grafts (20 structural, 15 non structural, 21 combined structural/non structural) were used.11 grafts were autologous, 45 consisted of substitute materials. Acellular allografts (Tutoplast®) and demineralised bone matrix (DBM) were the most often used structural and non structural bone graft respectively. Given the limited number of patients receiving the same graft in a specific procedure, comparison of time to union could only performed for structural and non structural bone grafts bone grafts in triple/subtalar arthrodesis. In this category, acellular allograft in combination with DBM and DBM alone showed shortest time to union.
Conclusion: Structural and non structural bone graft and substitute materials have become an important part in hindfoot arthrodesis. Their true efficacy must further be evaluated in prospective randomized studies.

FM 84

Comparison of Hindfoot Alignment Measurements on MR Images and Hindfoot Alignment Plain Films

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Background: More recently a new radiographic view on conventional x-rays has been introduced. Although it helps to evaluate the alignment of the hindfoot it has some limitations regarding evaluation of surrounding soft-tissues associated with deformity. It would be of interest whether MRI could also be used to asses hindfoot alignment in a similar fashion as the reported hindfoot alignment view on conventional x-rays. The present study was done to compare the hindfoot alignment (HA) measurements on MR images and plain films.
Materials and methods: Fifty-one patients (mean age: 43 years; range: 17–72 years) participated in the prospective study. A pilot study using an ankle phantom and HA plain films was performed to identify possible variations among measurement structures. The tibio-calcaneal angles using the medial (TCAm) and lateral (TCAl) calcaneal contour were found to be reliable concerning rotational malpositioning during imaging. TCAm and TCAl were measured on HA plain films and coronal T1-weighted MR images by two independent and blinded musculoskeletal radiologists. Additionally, tibio-calcaneal angles using the calcaneal axis (TCAc) and sustentaculum-tuber line (TCAs), minimal fibulo-calcaneal distance (FCD), and talo-calcaneal overlap (TCO) at the anterior talo-calcaneal facet were measured on MR images. Measurements were compared using intraclass correlation coefficient (ICC) and Bland-Altman plot.
Results: On the plain films, mean TCAm/TCAl averaged 12.2°/8.8° (range 0.2–25.4°/0.6-23.5°; SD 6.7/5.9). On MR images mean values were: TCAm 9.3° (range 0.4-25.6°; SD 6.7), TCAl 5.9° (range 0.2–27.0°; SD 8.6), TCAc 8.2° (range 0.2–24.7°; SD 6.5), TCAs 17.4° (range 0.6–38.2°; SD 9.4), FCD 8.5 mm (range 2.0–15.7 mm; SD 2.6 mm), and TCO 6.8 mm (range –3.2–15; SD 4.5). TCAm was hard to measure on plain films due to marked variability of the calcaneal contour. Significant, weak to moderate, correlations were found between TCAl on plain films and TCAm/TCAc/TCAs (PCC 0.391/0.413/0.337, p = 0.005/0.003/0.018) on MR images. Measurements on plain films and MR images differed less than two standard deviations (less than 12°) on Bland-Altman plots.

Conclusion: Hindfoot measurements on MR images using TCAm are feasible and correlate moderately with TCAl on plain films. The methods are interchangeable within the limits of two standard deviations.

FM 85

Tibialis anterior tendon shortening in combination with Achilles tendon lengthening in spastic equinus in cerebral palsy

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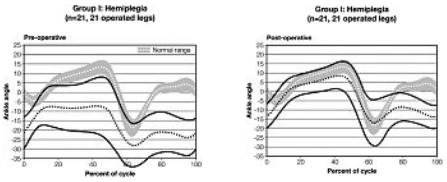
Introduction: Equinus is the most common deformity in cerebral palsy (CP). As in longstanding equinus deformities the antagonist (Tibialis anterior muscle) becomes stretched and hence is weak. Tendo Achilles lengthening (TAL) in combination with tendon shortening of the antagonist was introduced to rebalance muscle strength.
Methods: All CP patients having had tibialis anterior tendon shortening (TATS) and TAL in combination were included in this study. A total of 29 patients had 30 surgical interventions. We found: 21 hemiplegic patients (11 right / 10 left affected, 14 boys / 7 girls, age: 9–22; mean 15.8 years) and 8 di- or quadriplegic patients (5 diplegics, 3 quadriplegics; just one bilateral affected, 5 boys / 3 girls, age 8–38; mean 16.1 years). 13 patients had additional surgery (soft tissue or bony procedures). The Movement Analysis Profile (MAP) [1], the Gait Profile Score (GPS) [1], the Gait Deviation Index (GDI), and the Gillette Gait Index (GGI) was calculated for all patients pre- and postoperatively.
Results: MAP for ankle dorsi-/plantarflexion, GPS, GDI, and GGI improved significantly for all patients compared pre- to postoperatively. In 93.3% (n = 27) of the patients active dorsiflexion of the ankle was possible postoperatively.

Changes in ankle kinematics pre,- and postoperatively for all hemiplegic patients:



Conclusions: For the treatment of spastic equinus in CP we recommend shortening of the elongated antagonist (TATS) in combination with lengthening of the short agonist (TAL) to achieve optimal postoperative function in stance and swing phase.
References: [1] Baker et al. (2009). *Gait Posture 30:265-269*

FM 86

The clinical relevance of Saltzman's hindfoot alignment view in Total Ankle Replacement

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Background: Alignment is instrumental for success and long-term survival of Total Ankle Replacement (TAR). To this point in TAR, only coronal alignment in the region of the tibiotalar joint or above has been assessed because inframalleolar deformity is difficult to visualize radiographically. The Hindfoot Alignment View according to Saltzman (HAV) is the only radiograph which enables to correlate the hindfoot position to the tibia. The purpose of this study was to evaluate the clinical relevance of this view in assessing patients with TAR.
Methods: From 06-09/2008 28 consecutive patients with a Hintegra-TAR with an average followup of 4.1 ± 1.5 years were followed with (1) AOFAS and SF-36 score, (2) visual judgment of the hindfoot position, (3) HAV and AP/lateral radiographs, (4) dynamic pedobarography (novel emed m/e).
Results: The HAV position correlated well with different load parameters on heel strike (r = 0.44 to 0.62) but not with the varus-valgus load pattern of the rest of the foot. Visual judgment and TAR joint line did not correlate to radiological hindfoot alignment or to pedobarographic load distribution. The hindfoot alignment of HAV correlated significantly to the Physical Function and Role Physical of SF36. No correlation was found to other SF36-qualities or AOFAS-score.
Conclusion: Inframalleolar alignment, as assessed by the HAV, influences the dynamic pedobarographic load patterns and clinical outcome. Visual judgment and TAR joint line are not accurate enough to envisage the hindfoot alignment or dynamic load patterns. Adjusting the hindfoot correctly with HAV might eventually improve long-term outcome and survival of TAR.

FM 87

Flexible versus rigid orthosis in postoperative Hallux valgus rehabilitation

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Introduction: Operative correction of Hallux Valgus deformity is one of the most frequent performed orthopaedic procedures, but little information is found in literature concerning the postoperative management. At our clinic treatment after surgical correction of bunions with a retention brace is considered to be of great importance. We compared a flexible versus a rigid orthosis in our study.
Material and methods: Between 12/08 and 07/09 26 patients (30 feet) with symptomatic hallux valgus deformity were treated with soft tissue release and osteotomy of the first metatarsus. We performed a prospective randomized study. Postoperatively patients were randomized in two groups. Group A (n = 16) was treated with the rigid orthosis (Uriel®) and a stiff shoe. The patients of group B (n = 14) received a flexible orthosis (Hallufix®) which allowed dorsoplantar movement of the first tarsometatarsal joint. Clinical and radiological follow-up was performed at six weeks, three and six months. Clinical outcome was assessed by the AOFAS clinical rating system and the VAS.
Results: Preoperatively both groups were comparable in demographic data (age (42 ± 15 vs. 45 ± 15), AOFAS and degree of the Hallux valgus deformity. Overall the postoperative AOFAS score showed a significant improvement in both groups during the study period (group A: 62 ± 18 vs.88 ± 13; p = 0.003 / group B: 55 ± 11 vs. 87 ± 12; p = 0.002). However at 6 weeks follow up the group with the flexible splint showed a better active range of motion (27° ± 19 group A vs. 35° ± 24 group B). At six months postoperatively this difference was levelled out (53° ± 20 group A vs. 52° ± 13 group B). No significant difference in loss of correction was observed radiologically. A deep wound infection occurred in one patient in group B.
Conclusion: Within the first six weeks of rehabilitation after a surgically corrected Hallux valgus deformity the flexible orthosis (Hallufix®) seems to be in favour regarding active range of motion. We concluded that the flexible orthosis (Hallufix®) is a safe and promising option in postoperative treatment of a surgically corrected Hallux valgus deformity.

FM 88

A new approach: Osteosynthesis of talus body shear fracture assisted by hindfoot and subtalar arthroscopy

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Introduction: Fractures of the talar body are rare injuries with a certain incidence of arthrosis and talar necrosis resulting in severe sequelae. The aim was to invent a safe minimal invasive approach for osteosynthesis under direct visualisation of fracture reduction.
Methods: So far two patients with talar body shear fractures were stabilised by osteosynthesis. Reduction of the fracture was carried out under visualisation of subtalar and hindfoot arthroscopy. Partial threaded cannulated screws were used for fracture compression. Screws were inserted from posterior under endoscopic and fluoroscopic control. Postoperative management included immobilisation in a walker combined with early physiotherapy out of the walker and partial weight bearing for 6 weeks. Plain radiographs were taken on every follow up 6 weeks, 3 and 6 month postoperatively and the AOFAS Ankle score was assessed. The one year follow up is still to come. One patient received a CT scan to prove fracture healing after 6 month.
Results: None of the patients had postoperative complications. Full weight bearing without support was achieved after 10 weeks. The AOFAS Ankle score improved to 84 and 95 respectively after 6 month. Joint and Fracture alignment was rated as anatomic in both cases. Fracture healing occurred between 3 to 6 month.
Conclusion: Subtalar and hindfoot arthroscopy is a safe and auxiliary approach to control fracture reduction and osteosynthesis of talar body shear fracture. The technique can help to diminish postoperative complications and might be able to reduce some of the severe sequelae of this injury.

FM 89

Inlay thickness: risk factor for osteolysis after ankle arthroplasty

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Objectives: Ankle replacement causes a high rate of severe periprosthetic lesions, for which various reasons might be due. This study suggests, that one reason of loosening could be the Inlay thickness. The purpose of this study is to measure the outcome of ankle prosthesis at our hospital and to identify the risk factors in Ti-HA coated implants, especially the PE-Inlay thickness.
Methods: Between 2003 and 2007 we performed 58 ankle arthroplasties with the Salto® Prosthesis (Fa. Tornier). In a retrospective case control study, 58 patients (20 female and 38 male patients) with an average age of 63 years (ranging from 34–88), have been selected. In total, 25 arthroplasties have been performed on the left and 33 on the right side. At an average final follow-up of 39,4 months (4–80 months) 1 patient had died from causes unrelated to surgery. 2 patients are lost to follow up. One patient with low grade infection was excluded. Patients with missing data (x-rays, missing data of component sizes) were excluded. All other patients with complete data were included (45 patients). All patients were examined periodically at our hospital and x-Rays of the ankle were performed. The last examination / xray set the end of the follow up period. Additional CT scans were done in suspicious ankles to evaluate the size of osteolytic changes. The patients have been divided in 5 groups according to the presentation of osteolysis. 1. no osteolysis, 2. small periprosthetic changes, 3. some small lytic zones, 4. two ore more greater lytic zones diameter <1 cm, 5. osteolysis >1 cm diameter (one ore more).
Results: Severe periprosthetic lesions were identified in ankles with an inlay of 4 mm thickness. Revision because of osteolysis had to be performed in 6/21 (29%) cases of 4 mm inlay thickness, 1/8 (12,5%) in cases with 5 mm inlay and (1/16) 6% in inlays with 6mm height. The diameter or numbers of the osteolytic changes does not correlate with the revisions, although there are five revisions performed in groups four and five of 4-mm inserts.
Conclusions: These data suggest, that a small inlay thickness in ankle implants creates a risk factor for revision of osteolytic changes.

FM 90

Epiphyseal fracture of distal humerus in children, treated with bio-absorbable materials: one year follow-up

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Introduction: The use of bioabsorbable materials for orthopaedic use and traumatic fracture fixation in children has been poorly investigated in the litterature and the effects on growing bones seem contradictory. The aim of the study is to compare the clinical and radiological results and evolution between bioabsorbable and traditional K-Wires for the treatment of elbow epiphyseal fractures in children.
Method: From jan. 2008 to Dec. 2009 21 children with similar fractures and age were separated in two groups according to the way of fracture fixation: bioabsorbable K-Wire group and traditional K-Wire group. Follow-up was done at 3, 6 and 12 month post-operatively. Range of motion and elbow stability were measured for all patients. The radiological evolution of the two groups were compared in term of consolidation, ossous resorption and radiolucencies. The clinical results were compared according to the *Mayo Elbow Peformance score*. Controlateral elbow is compared with injured elbow in the two groups.
Results: In the bioabsorbable K-wire group, there were 10 children, including 5 girles and 5 boys with an average age of 9.5 years, ranging from 5 to 14 years. They were 7 external condylar fractures and 3 epitrochlear fractures. In the traditional K-Wire group there were 11 children, 2 girls and 9 boys with an average age of 7.6 years, ranging from 4 to 14 years. There were 10 external condylar fractures and 1 epitrochlear fracture. At first follow up. The Mayo Elbow Performance score was 93.8 (85-100)for the bioabsorbable K-Wire group and 95.5 (85-100) for the traditional K-Wire group. In two children from the bioabsorbable K-Wire group there were transitory radiolucencies along the wire tract on the x-ray, without clinical manifestation of it.We didn't see any premature closure of growing cartilage
Discussion: There is no significant differencies in term of clinical and radiological outcome between the two groups. The use of bioabsorbable pins seems to be a good alternative to removable traditional materials, avoiding a second operation.

FM 91

Treatement of septic bursitis in a retrospective study

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Context: No evidence-based recommendations exist for the management of infectious bursitis.
Objective: To characterize the epidemiology and treatment of infectious olecranon and patellar bursitis.
Design, setting and patients: Case-control study of 343 episodes of infectious bursitis requiring hospitalization at the Geneva University Hospitals January 1996–March 2009.
Main outcome measures: Risk factors for recurrence, including surgical interventions, length of antibiotic therapy, and patient immune status.
Results: We identified 343 episodes of infectious bursitis (237 olecranon, 106 patellar). *Staphylococcus aureus* predominated among the 256 cases with an identifiable pathogen (85%). 312 cases (91%) were treated surgically, 142 (46%) with bursectomy and closure in one-stage, 146 in two-stage. All received antibiotics for a median duration of 13 days with a median intravenous component of 3 days. Cure was achieved in 293 (85%) episodes. Recurrences occurred often multiple times in the same individuals. In multivariate analysis, only immunosuppression was linked to recurrence (odds ratio 5.6, 95%CI 1.9–18.4). Total duration of antibiotic treatment (OR 0.9, 0.8–1.1) showed no association. Compared to ≤7 days, 8 to 14 days (OR 0.6, 0.1–2.9) or >14 days of treatment (OR 0.9, 0.1–10.7) were equivalent as was the intravenous component (OR 1.1, 1.0–1.3). In a subgroup analysis of only immunocompromised patients, no surgical and medical parameter influenced cure. Patients with one-stage bursectomy received a shorter antibiotic therapy than patients with multi-stage bursectomy (11 vs. 15 days) and were hospitalized shorter (6 vs. 10 days, Wilcoxon ranksum tests, p <0.001).
Conclusions: In severe infectious bursitis requiring hospitalization, bursectomy and closure can be performed in one intervention. Adjuvant antibiotic therapy might be limited to seven days; saving antibiotics and hospitalization time. Immunosuppression is a risk for recurrence and difficult to compensate by surgical and medical parameters. The accumulation of recurrence in few patients suggests unknown endogenous risk factors.

FM 92

Biomechanical Analysis of Proximal Tibial Epiphysiolysis in teenage basketball players: A case series

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Introduction: The proximal tibial epiphysiolysis is an uncommon injury in teenagers. There are only a few case reports in the medical literature and none of them have described the mechanism or the predisposing factors for this lesion. The purpose of this study was to find, through a retrospective analysis of a case series and through a systematic review of scientific literature, a common denominator as well as the biomechanical explanation for the proximal tibial epiphysiolysis.
Methods: Medical charts were analysed of six adolescent males who sustained seven Salter-Harris I and II fractures of proximal tibia.
Results: Landing from a jump during basketball activities was the mechanism of injury for all the patients. The range of radiological bone age was between 15 and 15½ years. All the patients underwent physiologic epiphysiodesis in the following weeks to the accident without any complication.
Conclusions: This study affirms that landing poorly from a jump with a decreased knee and hip flexion movement may generate enough tensile forces on the proximal tibia epiphysis for growth plate failure. Neuromuscular fatigue appears as another important risk factor for this lesion; in fact, it may alter the coordination and the proprioceptive acuity during landing from a vertical jump. To our opinion, basketball trainers should be sensitized with the fact that improved physical preparation and specific training to attenuate tensile forces in landing from a vertical jump are required for teenage basketball players.

FM 93

Treatment of periprosthetic infection after total hip arthroplasty: is implant retention a viable option?

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Introduction: While most outcome studies of infected total hip arthroplasty (THA) focus on the final cure rate, little is known about the results of initial surgical treatment (index surgery).
Methods: We compared the index surgery results with the final cure rate for different treatment algorithms using logistic regression analysis to identify predictors for initial and final treatment outcome. Using the Harris Registry at Massachusetts General Hospital, we reviewed 93 hips (92 patients) that were surgically treated for infected THA at our institution between 1999 and 2007. Mean age at index surgery was 66 years (range 39–88) and the median follow-up was 58 months (range 13–110). Twenty-eight hips underwent debridement with implant retention (retention group), and 65 hips were treated with component removal and staged revision surgery (removal group).
Results: The overall success rate of infection control was 70% after index surgery and 66% at final follow-up. The success rates after index surgery for retention and removal groups were 50% and 78% respectively. Final cure rates after additional operative procedures were 61% and 68% respectively. Independent risk factors after index surgery included revision THA, less than 28 days of symptom duration at index surgery, and polymicrobial infection. Staphylococcus aureus infection was the only independent risk factor for final clearance of infection. Although the initial success rate of the retention group was lower than the removal group, additional procedures resulted in a comparable final cure rate.
Conclusions: S. aureus was the only significant independent risk factor for final failure of treatment in infected THA. Aggressive efforts should be made to control infection caused by this organism.

FM 94

Evaluation of a two-stage revision procedure treating periprosthetic joint infections

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Introduction: We present the results of a modified two-stage revision procedure for the treatment of periprosthetic joint infections according to the "Liestaler treatment algorithm".
Material and methods: 70 consecutive patients [64.9 ± 11.9 years] with a follow-up period of 15 ± 3 month [12–19 month] were included in the clinical study. We evaluated the duration of the infection, systemic and local wound-compromising factors, the stability of the implant and the type of the micro-organism. The establishment of an interdisciplinary infectiological conference at the beginning of the treatment and a weekly infectiological-surgical ward round served to determinate an individualised treatment concept.
Results: 57.1% periprosthetic infections (40 cases) were either caused by staphylococcus aureus or coagulase-negative staphylococci, 13 cases (18.6%) by difficult-to-treat micro-organism. No micro-organism could be cultured in 4 cases (5.7%). The probability of survival without prosthesis failure was 84.3% after 1 year. 54 patients (77.1%) had a successful outcome and required no additional surgical or medical treatment during the follow-up period. The antimicrobial treatment according to the published treatment recommendations had to be individualized to the patient's requirements within the infectiological-surgical ward round in 29 cases (41.4%). 60 patients (85.7%) had an adequate antimicrobial therapy, 10 patients (14.3%) had an at least partially adequate antimicrobial therapy. Patients with an adequate antimicrobial therapy had a higher success rate than those with an at least partially adequate antimicrobial therapy (89% vs. 56.1%). In septic patients (n = 6) as well as in periprosthetic joint infections caused by difficult-to-treat micro-organism (n = 13) the outcome was reduced (50% and 61.5%).
Conclusion: The therapy of periprosthetic joint infections requires an individualised treatment procedure according to the patient's sate of health and the characteristics of periprosthetic joint infections. The establishment of an infectiological-surgical ward round by the week should be an integral part of the treatment.

FM 95

Single event multilevel surgery in children with Cerebral Palsy – Five years follow up using the Movement Analysis Profile and the Gait Profile Score

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Introduction: Without treatment, mobility in children with bilateral spastic cerebral palsy (CP) deteriorates with time. Single event multilevel surgery (SEMLS) is performed in order to prevent deterioration and to improve gait in patients with bilateral involvement of the lower extremities. The aim of this study is to evaluate the short- and mid-term outcomes of SEMLS for gait correction in children with spastic CP using the Movement Analysis Profile (MAP) [1] and the Gait Profile Score (GPS) [1].
Methods: A total of 14 diplegic patients (4 girls/10 boys; mean age 12.8 ± 3.3 years, median 12.5y, range 7–18y at time of preoperative gait analysis) had 90 surgical interventions. All participants had pre- and postoperative 3D gait analysis including a thorough clinical assessment and collection of 3D gait data. From the 3D gait data temporal parameters (cadence, stride length, and walking speed), the Gillette Gait Index (GGI), the Gait Deviation Index (GDI) [2], the MAP and GPS were calculated.
Results: At short-term follow-up (mean 1.85 yrs postoperative) MAP for knee flexion, ankle dorsiflexion, and foot progression, and the GPS, GGI, and GDI improved statistically significantly. Between the short and mid term follow-up 9 patients (= 64.3%) had additional minor surgical procedures (soft tissue or bony interventions). For this period no statistical significance was found for all of the investigated gait parameters. The favourable results from short-term were maintained to the mid-term follow-up (mean 5.0 yrs postoperatively) and MAP for hip flexion, walking speed and stride length even improved statistically significantly.
Conclusion: Gait problems in children with bilateral spastic CP can be corrected successfully in one major operative session with the SEMLS approach consisting of correction of bony deformities and surgery of tendons including agonist lengthening and antagonist shortening. The favourable short-term results were preserved till mid-term follow-up (5 years).
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FM 96

Modified Dunn Procedure for slipped capital femoral epiphysis (SCFE). Complications and mid-term outcome

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Introduction: In situ stabilization of moderate to severe SCFE results in a hip deformity which may cause early degenerative arthritis. In 1964, Dunn introduced a technique for open reduction and fixation without compromising the blood supply of the femoral epiphysis. This technique was modified and improved in the past decades. At our institution this technique was used since 2001and the purpose was to review this consecutive series in terms of complications and outcome at mid-term.
Methods: Between June 2001 and July 2008, 30 moderate and severe SCFE underwent open reduction and fixation in 28 patients by 5 different surgeons. Surgical records were retrospectively analyzed for cartilage damage and epiphyseal perfusion, which was intraoperatively assessed by scanning bleeding from an epiphyseal drill hole or laser doppler flowmetry (27/30 hips). Hospitalisation and follow-up records were analyzed for complications and all patients underwent clinical and radiological examination with a follow up time of 1.0–8.5 years (median 2.9y) after surgery including a WOMAC-score.
Results: Correct alignment of the epiphysis after reposition was achieved in all cases. In one case the epiphysis was rated avascular during the index procedure. This patient developed avascular necrosis of the femoral head. In 4 patients follow-up was complicated by screw breakage and loss of reduction making revision surgery necessary. In two of them partial osteonecrosis of the femoral head occurred later on. Both were treated by intertrochanteric reorientation osteotomy. The mean WOMAC-Score (100 rated as no restrictions) of all patients at last follow-up averaged 96 (range 65–100) for pain, 93 (range 50–100) for stiffness and 96 (range 59–100) for function.
Conclusion: Open reduction of SCFE can restore normal anatomy of the proximal femur and near normal hip function. Avascular necrosis occurs as a result of an initially non perfused epiphysis or in cases of surgical revisions due to loss of reduction. Therefore, very careful postoperative rehabilitation is mandatory. Longer-term follow-up is necessary to show, if open reduction can reduce the risk of early degenerative arthritis.

P 1

Influence of surgical approaches in reverse shoulder arthroplasty surgery

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Introduction: Reverse shoulder arthroplasty can be performed using different surgical approaches. The purpose of this retrospective multicentric study is to compare the results concerning arm and humeral length as well as overall shoulder function using either the deltopectoral (DP) or the trans-deltoid (TD) approach.
Materials and methods: Between 2003 and 2008, 183 prostheses (180 patients) were enrolled in this clinical and radiological study with a minimum follow-up of 1 year. Lengthening of the arm (distance elbow-acromion) and the humerus (distance elbow-top of the head) was calculated on plain x-rays using a previously validated protocol. Postoperative function was evaluated by determining anterior active elevation.
Results: 146 reverse shoulder arthroplasty were implanted by a DP approach and 37 through a TD approach. The average lengthening of the humerus compared to the contro-lateral side was 0.4 cm ± 1.4 for DP group compared to a shortening of –0.5 cm ± 1 for TD group ($p < 0.001$). The average lengthening of the arm compared to the contra-lateral side was 1.7 cm ± 1.8 in DP group and 1.2 cm ± 1.2 in TD group. This difference is not statistically significant ($p = 0.107$). Anterior active elevation for group a was 141° ± 26° compared to 137° ± 29° for group b ($p = 0.396$).
Discussion: Reverse shoulder arthroplasty can improve anterior active elevation through the restoration of deltoid muscle tension and by increasing the humeral lever arm. The evaluation of deltoid tensioning to date was based on subjective intraoperative elements. By using objective pre-and postoperative measures of lengthening of the arm and overall humeral length, we could highlight a difference between the DP and TD approaches. The humeral bone cut in the TD approach is statistically more important. There is however no difference in term of function between the two approaches.

P 2

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

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Background: In elderly patients with complex proximal humerus fractures, reconstruction is not always possible. Hemiarthroplasty with an anatomic reattachment of the tuberosity remains to be the reference treatment. Non-union or tuberosity migration can lead to inferior functional results. In selected cases of highly complex fractures in elderly people, in which a stable fixation of the tuberosity can not be guaranteed the implantation of the Reverse Total Shoulder Arthroplasty (RTSA) seems to be an excellent alternative. In the present study we retrospectively analyzed the short-term results of RTSA in complex proximal humerus fractures.
Methods: From 11.04.2008 to 02.11.2009 RTSA was performed in 14 patients (average age 82 years [69;90], 13 women, 1 man) with proximal humerus fractures as a primary treatment. All procedures were performed by a single surgeon (UR) using the Anatomical Inverse Shoulder (Zimmer) with fracture stem. Mean follow-up was 8 months (6 weeks to 18 months). One patient was lost to follow up past due to death unrelated to surgery. Implant positioning and signs of loosening were analyzed on standard x-rays. Pain, range of motion, subjected shoulder value (SSV) as well as Constant-Score, the DASH-Score, Simple Shoulder Rating Scale (SSRS) were used to evaluate shoulder function.
Results: A high satisfaction with an average SSV of 72% [40;90], excellent pain relive and adequate ROM was documented. All patients reached the same activity as before surgery and could return to independent living. Postoperative in-hospital rehabilitation was necessary in 9, 4 patients were discharged directly at home. 2 reoperations due to hematoma were performed. No radiological signs of loosening were detected. Mean surgery time was 124 min. [105;150]. Average hospitalization stay was 11 days [5;17].
Conclusions: Our results indicate that RTSA seems to be a save procedure in elderly people with comminuted humerus fractures in which a stable fixation of the tuberosities can not be achieved. Our short terms results show promising results in regard of function, pain and activity, with satisfactory radiological outcomes and a low complication rate. RTSA seems to have the potential to restores adequate ROM and has the potential to allow patients to go back to independent living. As our collective is very small and the follow up is short further studies are needed to confirm our results.

P 3

Toward intraoperative functional imaging of the rotator cuff tendons

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Introduction: Injured and healing rotator cuff tendons have altered tissue load distribution and mechanical strains. We present work toward a clinical tool to quantify these changes, and thus provide an objective, intra-operative, functional assessment that may help guide the clinician in managing partial rotator cuff tears.
Methods: We employed a sheep infraspinatus model of partial rotator cuff tendon tear. The tendon surface displacements were recorded with an endoscopic video camera while external load was applied to the tendon. The relative displacement of the tendon surface markers, and the corresponding tissue strains were calculated using digital image correlation.
Results: Increased tendon midsubstance strains were observed along the tendon functional axis, indicating compromised tendon mechanics. Functional endoscopic imaging indicated that a full thickness, partial width tear of the rotator cuff tendon could be reliably discerned (intact: 0.6 ± 0.6%, vs. torn 1.5 ± 0.8%, $p < 0.05$).
Conclusion: These in vitro pilot experiments indicate the potential of functional clinical endoscopy to sensitively discern partial thickness tears in rotator cuff tendons under load, as well as for sensitively tracking healing in repaired tendons. Sensitivity of the method to operator/patient movement artifacts will necessitate further technical development to overcome this critical issue.

P 4

The predictive value of contra lateral rotator cuff disease for structural outcome of rotator cuff repair

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Introduction: Rerupture rate after rotator cuff reconstruction ranges from 11 to 68% [1–4]. A rerupture may affect the outcome in terms of function and strength, pain and structural long term prognosis. Although a significant improvement of the preoperative status can be achieved[5], the outcome is less favorable than with healed repairs [3, 4, 6]. In cadaver studies, bilateral rotator cuff tears have been found to be present in up to 38%[7]. In this study we analyzed the integrity of the contra lateral rotator cuff as a predictive factor for the occurrence of rerupture.
Methods: 64 consecutive patients with a mean age of 56 (40–72) years underwent an arthroscopic rotator cuff repair for a single tendon tear (32 patients) and for a two-tendon or a three-tendon tear (32 patients). Preoperative ultrasound was used to determine the integrity of the contra lateral rotator cuff. One year postoperatively the patients were examined clinically (Constant score[8]) and radiographically (standard MRI of the operated side to determine the integrity after reconstruction).
Results: 20 of the 64 patients had a pathologic contra lateral rotator cuff (9 tendinopathies, 5 partial and 6 full-thickness tears) preoperatively. At one year follow-up, an intact rotator cuff was found in 37, a partial rerupture in 13 and a full-thickness rerupture in 14 shoulders. There was a tendency that patients with contra-lateral rotator cuff pathology had more reruptures (25% vs. 18% for partial and 25% vs. 21% for full-thickness reruptures) but this was not statistically significant ($p > 0.05$). By trend, the Constant score showed better results for patient with intact contra lateral rotator cuff, but again the difference was not statistically significant ($p > 0.05$). Multiple tendon tears, preoperative supraspinatus muscle atrophy and a preoperative Constant score below 70% were predictive factors for a full-thickness rerupture at one year follow-up ($p < 0.05$).
Conclusion: Our study failed to prove that the integrity of the contra lateral rotator cuff is a significant predictive factor for the occurrence of a rerupture after arthroscopic rotator cuff repair. Rather, the rerupture rate correlates with the preoperative rupture size, muscle atrophy of the supraspinatus and Constant Score.
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P 5

Reversed shoulder arthroplasty baseplate fixed according to the three major columns principle

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Introduction: Glenoid bone volume and bone quality can render the fixation of a reversed shoulder arthroplasty (RSA) basis plate hazardous. Cadaveric study at our institution has demonstrated that optimal baseplate fixation could be achieved with screws in three major columns. Our aim is to review our early rate of aseptic glenoid loosening in a series of baseplates fixed according to this principle.
Methods: Between 2005 and 2008, 48 consecutive RSA (Reversed Aequalis) were implanted in 48 patients with an average age of 74.4 years (range, 56 to 86 years). There were 37 women and 11 men. Twenty-seven primary RSAs were performed for cuff tear arthropathy, 3 after failed rotator cuff surgery, 6 for failed arthroplasties, 7 for acute fractures and 5 after failed ORIF. All baseplate fixations were done using a nonlocking posterior screw in the scapular spine, a nonlocking anterior screw in the glenoid body, a locking superior screw in the coracoid and a locking inferior screw in the pillar. All patients were reviewed with standardized radiographs. We reported the positions of the screws in relation to the scapular spine and the coracoid process in two different views. We defined screw positions as totally, partially or out of the target. Finally, we reported aseptic glenoid loosening which was defined as implant subsidence.
Results: Four patients were lost to follow-up. Thus 44 shoulders could be reviewed after a mean follow-up of 16 months (range, 9 to 32 months). Thirty-seven (84%) screws were either partially or totally in the spine. Thus, 7 (16%) scapular spine screws were out of the target. No coracoid screw was out of the target. At final follow-up control, we reported no glenoid loosening.
Conclusion: Early glenoid loosening occurred before the two years follow-up and is most of time related to technical problems and/or insufficient glenoid bone stock and bone quality. Our study demonstrate that baseplate fixation of a RSA according to the three columns principle is a reproducible technique and a valuable way to prevent early glenoid loosening.

P 6

Congenital proximal humerus varus – a vascular problem?

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Introduction: Proximal humerus varus is a rarely discussed clinical entity and only few cases are described in the literature. The upper extremity analogue of coxa vara is assumed to be a consequence of haematologic, infectious, metabolic, genetic or neurologic disorders. We report about two patients with humerus varus without any apparent aetiologic factors.
Case report: One girl (9 yrs) and one boy (14 yrs) presented with length discrepancy of the upper extremity and significantly reduced arm elevation. X-Ray showed a shortening of the humerus with a proximal varus deformity of 90°. The medial region of the proximal humerus epiphysis failed to develop. Angiographic documentation suggests a interruption of the vascular supply in the region of the maximum deformity. No other aetiological factors as trauma, infections or haematologic disorders could be evalulated. Due to the impaired function surgical treatment was performed with a valgus osteotomy of the proximal humerus. Additionally a humeral lengthening was necessary in one case. Follow-up was uneventful, no complications occured. Good functional and cosmetic result were achieved in both cases.
Conclusions: Although rarely presented in clinical practice proximal humerus varus can cause significant functional and cosmetic impairment in the affected young patients. Surgical treatment may be indicated with valgus osteotomy ± lengthening of the humerus. According to the angiographic findings in the presented two cases a congenital vascular pathology can be postulated causing the deformity. This in addition to the previous presumed aetiologies as trauma or infection.

P 7

Interscalene Regional Anesthesia in Shoulder Surgery – an Analysis for Side Effects and Complications

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Introduction: Interscalene regional anesthetic techniques are widely used in shoulder surgery. The present retrospective study should put some light on the success rate as well as the side effects & complications based on our own patient data.
Methods: We reviewed in retrospect the records of 507 shoulder procedures, that had been treated by one and the same orthopedic surgeon within the last 3 years. 108 patients underwent surgery in general anesthesia. 15 patients were provided with isolated interscalene anesthesia. 61 patients were treated with scalene block in association with general anesthesia (ISB), and an additional indwelling catheter (ISC) for continuous anesthesia was added in 323 patients. All blocks were performed with use of a blunt-needle technique with the patient awake and with use of nerve stimulation for localization.
Results: An immediate need for intravenous opiate during recovery was encountered in 16% indicating primary block failure. Postoperative 8 ISC (2.5%) were removed early due to malposition or accidentally by the patient. Acute side effects were 6 recurrens nerve paresis (hoarseness), 3 phrenic nerve paresis (respiratory deficiency), 5 Horner syndromes. As subacute neurologic complications we found 2 mild sensoric lesions (dysesthesia) of the upper plexus resolving spontaneously within 3 months, 2 sensomotoric upper plexus-lesions confirmed by electroneuromyography, persisting for 12 months after ISC. There was one concomitant inferior plexus-lesion (Nervus Axillaris) after shoulder dislocation before surgery resolving within 12 months but complicating shoulder rehabilitation. One case of CRPS developed within 3 weeks after surgery. 4–6 weeks after surgery, we registered 5 sulcus ulnaris and 2 carpal tunnel syndromes, requiring surgical decompression only in one case. As to acute complications after ISB there were 2 pneumothoraces and 4 ISC associated infections requiring surgical intervention. On average, the ISC was left in place for about 2.9 days.
Conclusion: In shoulder surgery, regional anesthetic techniques are applied successfully with minimal risk for long term complications (0.5%). The preoperative informed consent though, should contain information as to the prevalence of unwanted side effects, complications and the efficiency of this technique.

P 8

Open anterior stabilisation of shoulder (Bankart-Neer) for post-traumatic instability: is recurrence predictable?

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Introduction: Recurrent traumatic anterior shoulder dislocation results in soft tissue injuries, including lesions compatible with a scarring process associated with disuse atrophy within the substance of the subscapularis muscle, which is a major anterior stabilizator of the shoulder. The hypothesis of the current study is that lesions to the subscapularis muscle seen on a peroperative biopsy during open stabilisation for recurrent traumatic anterior shoulder dislocation may be a predicator of postoperative recurrence of instability.
Patients and methods: 52 patients were operated on between 1994 and 1998 with the open Bankart/Neer technique for post-traumatic anterior shoulder instability. Biopsies of the subscapularis and deltoid muscles were taken during surgery and examined by a pathologist: histopathologic changes compatible with a scarring process associated with disuse atrophy were identified in nearly 40% of the subscapularis muscle specimens. 34 (65%) of the patients were reviewed with a mean follow-up of 12.9 years. History and clinical examination of the affected shoulder were obtained.
Results: 5 patients (15%) sustained recurrence of shoulder instability (postoperative painful subluxations or at least one episode of post-operative dislocation), 3 (9%) without adequate traumatism and 2 (6%) after adequate traumatism; 3 patients (9%) needed new surgery because of recurrence (both patients with adequate traumatism and 1 without adequate traumatism). 11 patients (32%) had abnormal subscapularis muscles (histopathologic changes compatible with a scarring process associated with disuse atrophy): 4 (36%) of them had recurrence of shoulder instability (2 (18%) with adequate traumatism and 2 (18%) without adequate traumatism; both patients with adequate traumatism required new surgery). 23 patients (68%) had no histopathological abnormality in their subscapularis muscles: 1 (4%) of them had recurrence of shoulder instability without adequate traumatism and required new surgery.
Conclusion: Based on this study, a correlation could be highlighted between histopathological abnormalities of the subscapularis muscle and recurrence of shoulder instability after open anterior stabilisation.

P 9

Recovery of grip strength after surgical treatment of tennis elbow

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Introduction: Lateral epicondylitis is a common condition affecting people during their working years. Non operative treatment is successful in most individuals. Surgery, however, is an option for severe cases. This study evaluates grip strength as a monitor for the recovery process.
Methods: Patients with surgical treatment of unilateral tennis elbow were prospectively recruted between 1999 and 2007. A Nirschl procedure with open release, debridement and repair was performed by one surgeon. All patients failed non operative treatment for at least six months. Preoperative assessment included bilateral grip strength measurements and follow-up grip strength measurements at two, six, 12 and 18 weeks. The postoperative recovery of grip strength was analysed.
Results: A total of 55 patients, 28 female and 27 male, were included in the study. Their occupations were divided into 17 heavy, 15 medium and 22 light workers. The mean preoperative percentage of grip strength of the affected side compared to the contralateral side was 55.6% (SD 20.9). Postoperatively the mean percentage dropped to 40.8% (SD 20.1) at two weeks and raised to 72.2% (SD 17.7) at six weeks, 80.7% (SD 21.4) at 12 weeks and 85.5% (SD 20.9) at 18 weeks. All except one patient returned back to work. The mean time off work before returning to light duties was 70 days and normal duties was 125 days.
Conclusion: In our series the return of grip strength after surgical treatment of tennis elbow was reproducible amongst the study group. The average grip strength returned to the preinjury level at approximately four weeks after surgery and continued to improve. Grip strength is a simple tool to monitor the recovery process.

P 10

Recovery of shoulder abduction strength in patients after standard and reversed shoulder arthroplasty

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Objective: Rotator cuff lesions associated with osteoarthritis have major impact on shoulder function in general. Do patients treated with reversed shoulder arthroplasty have limitations in the postoperative recovery of abduction strength in comparison to patients treated with standard shoulder arthroplasty?
Methods: In two prospective, controlled cohort studies 212 patients undergoing standard and reversed shoulder arthroplasty were follow-uped between 10/2006 and 08/2008. Cases with complete measurements preoperatively, 6 and 12 months postoperatively were included. Abduction strength was measured in 90° abduction of the scapula plane in two different ways: at first, maximum strength using a spring balance and second, mean endurance strength by the isometric device Isobex™.
Results: The 212 arthroplasties were implanted in 201 patients, 120 as anatomical standard prosthesis (PROMOS Standard™) and 92 as reversed prosthesis (PROMOS Reverse™). The majority of the patients were women (88.2%) and the mean age was 69.2 years (range 35–95 years). In 74.1% of the preoperative cases measurements could not be completed due to an abduction <90° (considered as 0kg). The mean abduction strength measured preoperatively by spring balance differed significantly in patients undergoing anatomic arthroplasty (1.24 kg) in comparison to patients undergoing reversed arthroplasty (0.34 kg, $p < 0.05$). At the 6-months follow-up strength improved for both prosthetic systems up to 3.35 kg and 3.78 kg, respectively. At the 12-months follow-up both values increased to 4.41 kg and 4.38 kg, respectively, without any significant differences at each time point ($p > 0.05$). Values measured using the Isobex™ device showed similar characteristics, however, they were constantly below the values measured with spring balance.
Conclusion: Both patients undergoing standard and reversed shoulder arthroplasty showed significant improvements of the post-operative abduction strength until the 12-months follow-up. Despite having a worse starting point due to their rotator cuff defects patients undergoing reversed shoulder arthroplasty benefit in a similar way concerning abduction strength compared to patients undergoing standard arthroplasty.

P 11

Replacement silicone wrist implant after failed silicone wrist arthroplasty. Three case reports in inflammatory arthritis

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Introduction: Revision surgery after failed silicone wrist arthroplasty is often challenging. In most cases, particular in inflammatory joint disease, an extensive bone loss is found. This leads to a high complication and non-union rate in wrist fusion as a salvage procedure. In addition some patients might be in a poor medical condition, with corresponding low demands for activities of daily living (ADL). For that situation, revision arthroplasty with a silicone implant might be a relatively easy method to solve the situation.
Material and methods: In three cases of severe inflammatory wrist joint destruction after primary silicone arthoplasty with extensive bone loss, a revision arthroplasty with debridement and replacement with a new silicone implant was performed. At the time of revision mean patient's age was 61 years and primary silicone arthroplasty was done 11 years ago. In one case an additional decompression of the median nerve in the carpal canal was necessary. In one other case a transposition of a extensor-tendon (ECU to ECRB) was performed to neutralize the ulnar drift of the wrist.
Results: In all three patients a limited mobility in the wrist with painfree function could be achieved. The patients were satisfied with this procedure and showed only a mild restriction in their ADL.
Conclusion: Revision after silicone wrist arthroplasty with severe bone loss without or only minimal carpal bone stock and a thin "trumpet-like" distal radius is difficult. Revision arthrodesis often ends in a non-union despite substantial bone-grafts. Debridement and revision with another silicone implant is easy to perform and a reasonable function and pain free situation might be achieved, especially in low demand patients.

P 12

The outcome after vascularized and non-vascularized bone grafting of scaphoid pseudarthrosis. A retrospective study in 18 patients

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Introduction: Scaphoid Fractures account for approximately 60% of all carpal fractures with a non-union rate ranging between 5 and 15%. As scaphoid non-unions can result in debilitating wrist problems due to carpal collapse or degenerative arthritis various treatment strategies have been described during the last few decades, however the ideal treatment remains controversial. Currently the most promising treatments are either vascularized bone grafts or non-vascularized bone grafts with or without supplementary internal fixation. The purpose of this retrospective study was to compare the treatment of scaphoid non-unions using either a non-vascularized bone graft with screw fixation or a vascularized pedicle bone graft from the dorsal radius originally described by Zaidenberg.
Methods: 18 patients with scaphoid non-unions undergoing a total of 21 surgeries were treated by two surgeons between 2005 and 2008 using either a non-vascularized bone graft from the iliac crest or a vascularized bone graft from the radius based on a 1,2 inter-compartmental supraretinacular artery pedicle. Postoperatively radiographic and clinical controls were carried out at 6 and 12 weeks and thereafter according to the patients needs up until fracture consolidation.
Results: Of the 21 surgeries only 19 could be followed up. Union was achieved in 9 of 11 cases in the vascularized bone graft group and in 7 of the 8 cases in the non-vascularized bone graft group with no statistical significant difference in average time to union between the two treatment groups. As a functional parameter wrist range of motion was compared, however also here no significant difference could be found when comparing the two methods.
Conclusion: The management of scaphoid pseudarthrosis is a challenging task and treatment strategies are so far controversial. In this study we compared two treatment options for patients with radiographic confirmed scaphoid pseudarthrosis and were able show that there was neither a significant difference in average time to fracture union nor in wrist range of motion at the time of confirmed fracture union.

P 13

Arthroscopic dorsal capsuloplasty in chronic scapholunate dissociation: a new technique and preliminary results

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Introduction: Scapholunate ligament injury can lead to instability and carpal arthritis. Wrist arthroscopy allows early diagnosis and treatment. In chronic scapholunate dissociation when the ligament is not repairable but the sacpholunate space is reducible (stage 2 to 4 according to Garcia-Elias), a new arthroscopic dorsal capsuloplasty has been performed, in order to avoid complicated reconstruction with frequent stiffness.
Methods: 22 patients (27 to 55 years) with chronic scapholunate ligament instability underwent arthroscopically assisted dorsal capsuloplasty between the dorsal capsule and the dorsal part of scapholunate ligament. In stage 4, after reduction of the scapholunate interval percutaneous pinning was necessary. Postoperatively a volar splint was applied for 2 months.
Results: Dorsal capsuloplasty was performed upon 22 patients (15 men, 7 women). The mean delay from trauma to surgery was 9 months (range, 3 to 24 months). According to Geissler's classification five patients were stage 2, 14 stage 3 and 3 stage 4. Using Garcia-Elias staging system three patients were classified stage 2, eight patients stage 3 and eleven patients stage 4. Mean follow-up was 18 months (range, 12 to 28 months). 19 of the 22 patients achieved 85% of the range of motion compared to the opposite side. Grip strength of the injured wrists meaured with the dynamometer of Jamar reached 96% of the contralateral side. Mean DASH Score was 6.1 ponts (range, 0 to 18.18 points).
Conclusion: Prolonged immobilization of the scapholunate ligament in acute injuries without displacement achieves satisfactory outcomes. In selected chronic cases where displacement is reducible, the addition of an arthroscopic dorsal capsuloplasty, in order to reinforce the dorsal part of sacpho-lunate ligament, may achieve similar results. Further studies with longer follow-up are required to confirm these encouraging results.

P 14

Single stage dorsal vertebra resection and instrumentation for solitary and multilevel metastasis of the thoracolumbar spine

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Introduction: Single stage dorsal vertebra resection (VR) and instrumentation is a surgical demanding, radical treatment option for solitary and multilevel metastases of the thoracolumbar spine, but was shown to markedly minimize local recurrences, decrease neurological deficits, increase spinal stabilisation and improve patient quality of life. This study analyzes the onco-sugical results after VR and reconstruction with dorsal titan instrumentation and vertebra body replacement cage palacos composite in a collective of patients.
Methods: 25 patients treated with single stage dorsal VR and instrumentation for spinal solitary (n = 7) and multilevel (n = 18) metastasis were retrospectively investigated. All patients were staged preoperatively according to the Tomita et al. classification. Tumor resection and 360° defect reconstruction were performed with posterior stabilisation and cage implantation. Clinical follow-up were performed for histopathological tumor type, pain, neurological deficits, duration of surgery, blood loss, complications, and adjuvant therapies. Radiographs and MRI were analyzed at follow up.
Results: Depending on tumor grading/biology an adjuvant therapy was performed in 60% of the patients. 10% of the patients died in 24 months following surgery. With a mean follow up of 20 (6–48) months 90% of the patients were postoperatively free mobilized. Decreased postoperative neurological deficits were found in 80% and increase postoperative neurological deficits in 5 % of the patients.
Conclusion: In patients with mono- or multilevel spinal tumor involvement radical vertebra resection and spinal reconstruction can be achieved in single stage dorsal procedure. This is a demanding but very effective surgical method for patients with spinal metastasis to improve spinal stabilisation, neurological deficits and back pain in order to achieve significant higher life quality.

P 15

Sacroplasty – technical notes and complications

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Background: Percutaneous cement augmentation of the sacrum (sacroplasty) has shown to be a reasonable treatment for sacral insufficiency fractures and, in combination with transiliacal screw fixation, for some types of pelvic ring fractures in osteoporotic bone. The technique has an excellent outcome with regard to pain relief but only limited data about complications is available. Due to the special anatomy of the sacrum, fracture patterns and the difficult intraoperative monitoring cement extravasation is believed to occur more frequent as compared to vertebroplasty and may lead to serious complications due to its proximity to neural structures.
Methods: Between 2004 and 2008 SIF was treated in 32 patients (6 male; mean age 74 a, 49 – 92) with sacroplasty alone (15/32; 3/15 unilateral) or with PMMA augmented iliosacral screw fixation (17/32; 2/17 unilateral). Extravasation rates were determined by intra- and postoperative radiological controls, patients with symptomatic extravasates underwent CT and/or MRI examination.
Results: No relevant intraoperative complication occurred in any patient and all surgeries could be finished. The median operation time was 45 minutes for sacroplasty alone and 60 minutes with additional iliosacral screw fixation. Resolution of symptoms could be achieved immediately after surgery in 15/32 patients, no venous extravasation or even cement embolism were noticed. In 2/32 cement leakage occurred around the nerve root L5 and S1. Intermittent radiculopathy under axial load was observed only in one of these in the postoperative course (L5) and could be treated successfully by epidural infiltration. One patient required revision surgery for wound complications.
Conclusion: In accordance to the literature sacroplasty results in immediate postoperative pain relief in a large proportion of our patients. Due to the limited access, difficult intraoperative radiological control and typical sacral fracture patterns the control of cement distribution remains difficult in sacroplasty. Thus, special attention should be given to fracture patterns, needle placement and application of the cement at the proper viscosity. The risks of cement leakage, persistence of the symptoms and neurological impairment has to be explained to the patients.

P 16

Relation between intraoperative EMG values and final pedicle screw position as seen on CT images

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Introduction: Intraoperative EMG based neurophysiological monitoring is increasingly used to assist pedicle screw insertion. We carried out a study comparing the final screw position in the pedicle measured on CT images in relation to its corresponding intraoperative muscle compound action potential (CMAP) values.
Material and methods: A total of 189 screws were inserted in thoracolumbar spines of 31 patients during instrumented fusion under EMG control. An observer, blinded to the CMAP value, assessed the horizontal and vertical 'screw edge to pedicle edge' distance perpendicular to the longitudinal axis of the screw on reformatted CT reconstructions using OsiriX software. These distances were analysed with their corresponding CMAP values. Data from 62 thoracic and 127 lumbar screws were processed separately. Interobserver reliability of distance measurements was assessed.
Results: No patient suffered neurological injury secondary to screw insertion. Distance measurements were reliable (paired t-test, P = 0.13/0.98 horizontal/vertical). Two screws had their position altered due to low CMAP values suggesting close proximity of nerve tissue. Seventy five percent of screws had CMAP results above 10mA and had an average distance of 0.35cm (SD 0.23) horizontally and 0.46cm (SD 0.26) vertically from the pedicle edge. Additional 12% had a distance from the edge of the pedicle less than 0mm indicating cortical breach but had CMAP values above 10mA. A poor correlation between CMAP values and screw position was found.
Discussion: In this study CMAP values above 10mA indicated correct screw position in the majority of cases. The zone of 10–20mA CMAP carries highest risk of a misplaced screw despite high CMAP value (17% of screws this CMAP range). In order to improve accuracy of EMG predictive value further research is warranted including improvement of probing techniques.

P 17

Impact of body vibration training versus physiotherapeutic back training on muscle characteristics in the lumbar spine

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Introduction: This randomized controlled study was initiated to investigate the effect of a 3-month body vibration training (Power Plate International, London, UK) versus conventional intensive back training in young and healthy adults. Both groups underwent a 3-month training period under physiotherapeutic surveillance. Trainings were performed twice a week. The test group participated in a 10-minute vibration training. The control group performed a 1-hour back training. Magnet resonance imaging (MRI) was used to determine changes in muscle characteristics.
Methods: 40 young and healthy volunteers were randomized and assigned in two groups undergoing a conventional back training or a body vibration training. MRI images of the lumbar spine were acquired from both groups before and after the training period. In our study transversal MRI slices were considered containing the third lumbar pedicles. Changes in muscle characteristics were assessed and compared by measuring density and volume of erector spinae muscles.
Results: Muscle density and volume increased in both groups. A particular rise of muscle density was observed in the body vibration group.
Conclusion: A 10- minute body vibration training twice a week can effectively substitute a 1-hour conventional back training.

P 18

The Hip Sports Activity Scale (HSAS): Evidence of Reliability and Validity

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Introduction: Femoroacetabular impingement (FAI) has now been recognized as a distinct diagnosis and as such, surgical treatment is more commonly considered in young, active patients with groin pain. Given the importance of sports for FAI patients, a sports rating scale particularly addressing this patient group would benefit clinicians and researchers wishing to assess the efficacy of surgery. A sports activity rating scale facing young patients with hip complaints was developed and in this study validated.
Methods: A nine level Hip Sports Activity Scale (HSAS) was constructed. Thirty consecutive patients undergoing a surgical hip dislocation for the treatment of FAI completed a questionnaire set consisting of the HSAS, the University of California at Los Angeles (UCLA) activity scale and different hip joint-specific and generic outcome tools. For reliability assessment, the HSAS was completed twice about 10 days apart. Evidence of reliability and validity was investigated by classical psychometric analyses, and floor and ceiling effects were also determined. To assess responsiveness, the HSAS was administered to a separate age- and gender-matched patient cohort recruited at the time of their one-year follow-up visits.
Results: Reliability was excellent with an intraclass correlation coefficient of 0.94. Evidence of convergent validity was supported by a high correlation with the UCLA activity scale preoperatively (0.78) and at the one-year follow-up (0.84), and by moderate to high correlations with the joint-specific measures (–0.43 to 0.76). Evidence of divergent validity was supported by a weak correlation with the SF-12 Mental Component Scale (0.12). Floor and ceiling effects occurred in 10%, both, preoperatively and at follow-up. The effect size was 0.55.
Conclusion: The HSAS is a reliable and valid tool to determine sports levels in patients suffering from FAI. Its use in future studies investigating outcomes in young patients with hip disease may be very helpful.

P 19

Influence of labral tears on the long-term survival of hip shelf arthroplasties: a prospective study with a minimal follow-up of 16 years

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Introduction: Arthrosis and severe dysplasia (center edge angle <0°) are known to minimize the long-term survival of hip shelf arthroplasty. It has been described recently that labral tears in dysplasic hips indicate the beginning of arthrosis and increase the risk of instability. The aim of this study was to evaluate if labral tears can influence the long-term outcome of hip shelf arthroplasties.
Methods: 18 adult patients (18 hips) were consecutively enrolled in a prospective study. During the hip shelf arthroplasty procedure, arthroscopy was systematically performed to search and excise labral tears. Two patients died during the follow-up and one was lost to follow-up; the minimum follow-up of all the other patients was 16 years.
Results: During arthroscopy, 10 hips showed labral tears (55.6%). At the final follow-up, 8 hips were re-operated in favour of total hip arthroplasty: except one case, all these hips showed labral tears at the time of the shelf arthroplasty procedure ($p < 0.001$). At 18 years of follow-up, the survival of the hip shelf arthroplasty was 41.3%; it was 83.3% comprising only hips without labral tears and 15.2% comprising only hips with labral tears ($p = 0.048$).
Conclusion: Labral tears minimize the long-term survival of hip shelf arthroplasty. Therefore it is necessary to explore the labrum before performing hip shelf arthroplasty (MRI or CT-arthrography) in order to inform the patient of the lower survival rate. It would appear to be preferable to excise labral tears during the initial shelf procedure, in order to prevent persistent pain and considering it would be very difficult after the modification of the femoral edge covering.

P 20

Hip-Arthroscopy: Clinical outcome and patient satisfaction after hip-arthroscopy; a two years prospective study

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Introduction: Hip-arthroscopy is getting more and more to be common practice in the last years. Therapy is possible for femoro-acetabular impingement, labral lesions, loose bodies, beginning degenerative arthritis, synovial desease and more. We present preliminary results of a prospective study designed to evaluate clinical outcome and patient satisfaction measured with Harris-hip-score and WOMAC-score.
Methods: Hip-arthroscopy was realized in 40 patients (19-57 yrs) under general anesthesia. All patients were examined and interviewed for Harris-hip-score and WOMAC-score preoperative, 3 days postoperative, after 6 weeks and after 3 and 6 months. Range of motion and score results have been compared.
Results: Harris-hip-score and WOMAC-score present better results after hip-arthroscopy in patients without signs of degenerative arthritis. Average preoperative Harris-hip-score of 66 (44-87) raise to 81 (54-96) after 3 and to 88 (78-100) after 6 months, while average WOMAC-score fall from 121 (46-130) preoperative to 75 (30-117) after 3 and to 55 (25-77) after 6 months. Patients with degenerative arthritis have poorer results than those with a single femoro-acetabular impingement or labral lesion. 4 of 15 Patients with degenerative arthritis of Outerbridge Grade 2 and 3 have to be converted in total hip arthroplasty. Four arthroscopic revisions were necessary because of one adhaesive capsulitis and three because of inadequately resection of head-neck-junction or acetabular rim-trimming.
Conclusion: Hip-arthroscopy is a good method for treating hip pain in younger patients although it is not appropriate for all lesions, i.e. for dorsoinferior labral lesions or osteophytes in this area. Patients with degenerative arthritis have poorer outcome, so we have to wait for long-term results in order to see, if hip-arthroscopy can retard total hip replacement. Finally, in our study learning curve is flat and long.

P 21

Hip muscle function in femoroacetabular impingement patients

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Introduction: Femoroacetabular impingement (FAI) is a relative recent pathology, which causes hip pain and disability in young and active adults. It is unclear to what extent FAI also affects hip muscle function, which is essential for physical function. Therefore, the aim of the study was to quantify hip muscle strength and muscle fatigue in individuals with FAI, so as to provide better understanding of the pathology.
Methods: Twenty-two FAI subjects and 22 healthy matched controls were tested. Maximal voluntary strength was measured for all hip muscles. Hip flexor torque output variability and EMG activity were also investigated during a sustained submaximal isometric contraction to quantify muscle fatigue. Physical function was assessed by way of spatiotemporal gait parameters at normal and fast walking speeds. Muscle and physical function of FAI subjects were systematically compared to matched controls.
Results: Muscle strength was significantly lower in FAI than in controls for hip adduction (43%, $p < 0.001$), flexion (46%, $p < 0.05$), external

rotation (28%, p <0.05) and abduction (13%, p <0.05). Muscle fatigue significantly differed between FAI subjects and controls for torque output variability (p <0.001), with FAI showing a larger increase in torque fluctuations, but not for EMG activity. Spatiotemporal gait parameters did not differ between groups at normal walking speed, but FAI showed lower velocity, cadence and single support (p <0.05) at fast walking speed.
Conclusion: FAI subjects present a significant impairment in hip muscle strength and fatigue as well as in moderate physical-demanding activities.

P 22

Juxtaarticular cyst of the hip as a cause of sciatica. A case report

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Introduction: Sciatica is usually caused by a discal prolaps of the lower lumbar spine, but rarely may have more obscure nondiscogenic origin. Cystic lesions about joints are either ganglial or synovial in nature. Ganglial cysts are typically lined with connective tissue and contain mucinous fluid, while synovial cysts are lined with synovial cells, contain fluid, and may communicate with the joint. In this case report, we present a patient who had a two juxtaarticular cysts of the hip joint and associated symptoms and signs of sciatic nerve compression.
Case description: A sixty-five-year-old woman presented in our institution with a five-year history of worsening pain in the right buttock and radiation of the pain down the right lower limb and intermittent paresthesias. On physical examination palpable swelling posterior to the tip of the greater trochanter was observed. Hip motion was found to be normal and without signs of hip impingement. Standard radiographs did not show arthritic changes of the hip. Magnetic resonance imaging scan of the spine did not reveal discal prolaps. But, in the gluteal region two large cystic lesions in the retro- and supraacetabular region were found, one of them in close contact with the sciatic nerve. We recommended to the patient surgical excision of the cysts. A Kocher-Langenbeck approach to the hip was used; the external rotators of the hip as well as the sciatic nerve were identified. One cystic lesion was found between the piriformis and the superior gemellus muscles (3x2x2 cm) compressing the sciatic nerve. The second (7x4x3 cm) expanded underneath the minimus muscle onto the supraacetabular region and was of articular origin. Careful excision of both cysts together with a part of the posterior hip capsule was performed. No labral lesion of the posterior acetabular border was seen. A benign, fibrous-walled cyst, was identified on histological examination
Discussion: Sciatica is regularly of discal origin. In case of absence of lumbar disc pathology other causes of sciatica should be considered, as compression of the sciatic nerve along any part of its route may cause symptoms. Nevertheless it is very rare that synovial cysts become large enough to impinge on adjacent neurovascular structures.
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P 23

The SBG-Femur-Shaft (Smith&Nephew), medium term results

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Introduction: Today's market boasts a wide range of cement-free femur shaft products. Surprisingly, clinical studies demonstrating the efficiency and safety of such implants are remarkably sparse. With the introduction of cement-free SBG-femurshafts in our clinic, we set ourselves the goal of documenting prospective outcome. The proximal hydorxylapatit-coated SBG-shaft (Smith&Nephew), anchored with the "fit and fill" principle is anatomically commensurate with the natural curve of the proximal femur. The medium-term results (2 years) show a good clinical and radiological outcome.
Material and method: A total of 150 patients (25-82yrs) were included in the study. All of them underwent a THR from Jan 2004 to Dec 2006 by using the anatomical SBG-shaft. In each case, patients were clinically and radiologically documented with the help of a standardised protocol, preoperatively, and subsequently postoperatively, at 3 months, 1 year, 2 years, and 5 years. With a remarkably high-level of participation, we have up till now (2 years post-operatively) been able to examine 148 of 150 (98.6%) of our patients: the first 5-year results are consequently available.
Results: Two years postoperatively, this shaft showed a satisfactory radiological bone integration with 143 of 148 (96.6%) of our patients. Three of our patients showed a slight hemming (<2 mm) on the proximal shaft in zones 1,2,13, and 14 – albeit without clinical discomfort. Two shafts with osteolysis as a result of low-grade infection had to be subsequently replaced. The Harris HS rose preoperatively to postoperatively from av. 53.6 to 96.0 over 2 years and subsequent patient satisfaction was very high (95% very-/ satisfied). 3 calcar-fissures, one shaft-fissure, and 1 fracture of the trochanter happened intraoperatively. Early complications included: 1 wound infection, 1 femoral nerve paresis as well as 2 haematomas that required revision. In two cases a loosening the femoral shaft component subsequent to infection was observed as a late complication.
Conclusion: The anatomical SBG-shaft demonstrated very good medium-term results. Taking into consideration the learning curve to be expected with four different operators the results are encouraging. This speaks for the relatively simple technical handling involved in the implantation procedure as well as for a good anatomically commensurate and functional shaft design. Subsequent to these results we will continue to use the SBG-femurshaft as the standard shaft for uncemented total-hip-replacement in our clinic.

P 24

Total hip implantation according to the safe-zone using the navigation trial head and stem-first technique: Background and clinical application

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Introduction: In total hip arthroplasty a maximized range of movement (ROM) without prosthetic impingement should be realized by positioning the components in a compliant orientation to each other according to the safe-zone. This goal can be achieved by using computer navigation or applying the stem-first technique. This study shows how components can be implanted in their correct relative orientation using a specially designed trial head intraoperatively. The aim was to perform the surgery without additional electronic equipment and there should be no need for a major modification of established surgical procedures.
Material and methods: Based on a three-dimensional geometric mathematical computer model of a total hip arthroplasty the specific safe-zone for cup and stem was determined for the type of prosthesis that was used. This relative orientation was transferred to the special trial head so that the circumferential rings on the trial head serve as indicators for the cup orientation during implantation. In all cases surgery was performed via the anterior approach. The patient was positioned supine on a fracture table. Leg length was controlled additionally. During measurements the patient's hip joint was kept in the neutral position.
Results: In all patients cup and stem could be oriented in the safe-zone. No dislocation or subluxation, no squeaking or impingement did occur in any patient including those receiving a ceramic-on-ceramic bearing within the two year postoperative period.
Conclusion: This trial head supports the surgeons in aligning cup and stem in the correct orientation according to the safe-zone during surgery in a very simple way. It helps to greatly reduce the rate of dislocations and to get an optimal ROM. There is no need to use time-consuming computer based navigation tools intraoperatively. It can be used in any standard or minimal-invasive approaches and it fits quite well into common standard surgical procedures. No additional time for surgery is required.

P 25

Traumatic anterior hip dislocation – outcomes in a case series

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Background: Traumatic anterior dislocations of the hip joint are rare. Additional injuries to the hip joint due to dislocation are even more rare. The outcome is mainly limited by osteoarthritic joint degeneration or the occurrence of avascular necrosis of the femoral head at the long-term. We describe our experience with this rare injury in a case series.
Methods: Between 2001 and 2008, a total of 66 traumatic dislocations of the hip were admitted to a level one trauma centre. 53/66 were posterior dislocations, 6/66 were central and 7/66 showed anterior dislocations. Of those, 6/7 were available for follow up evaluation (5 men, 3 right hips, mean age: 34, 22-48, 3 anteroinferior dislocations). After closed reduction 4/6 were treated conservatively and 2/6 required surgery to address additional injuries. Patients were evaluated retrospectively at a mean follow up of 5 years (1-8) clinically using the Harris Hip-, the Womac-, the SF-12-, the UCLA-Score and radiologically for the occurrence of osteoarthritis (OA), heterotopic ossifications (HO) or avascular femoral head necrosis (AVN).
To further evaluate the results the Epstein criteria were used.

Results: The mean score ± SD was 83 ± 22 for the Harris Hip Score, 22 ± 25 for the WOMAC Score, 42 ± 14 and 59 ± 6 for the physical and mental SF-12-, and a level 6 for the UCLA Score. Radiologically 4/6 showed an excellent and 2/6 a fair result. AVN with collapse of the femoral head was not observed.
Conclusion: This case series recollected data of a infrequent trauma and focussed on a curiosity of concomitant injuries due to dislocation. The case-related management of presented injuries yielded satisfying clinical and radiological outcomes.

P 26

Acute proximal hamstring avulsion – presentation of 3 exceptional cases

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Acute proximal hamstring rupture is considered a rare injury in the general population whereas it is quite common among athletes. Avulsion of hamstring origin from the ischial tuberosity is due to forceful hip flexion combined with ipsilateral knee extension. Early surgical repair is strongly recommended when at least two of the three hamstring tendons are avulsed from their origin. Nonoperative treatment may result in muscle weakness, significant function loss and sciatic neuralgia with subsequent failure of achieving previous activity level. This study presents three cases of complete proximal tendon hamstring avulsion that have occured in 2009 in our hospital. Interestingly, the three patients were non athletic females with an average age of 49 years (range 47–51 years). Upon injury, they reported a sudden onset of pain with tenderness in the buttock and proximal thigh, as well as a subsequent difficulty in walking and sensation of knee instability. Sitting aggravated the pain. The strength in knee flexion and hip extension was decreased compared to the contralateral side. Posterior femoral haematoma and swelling appeared and one patient even suffered of slight numbness in dorsomedial femur region. Magnetic resonance imaging clearly demonstrated the hamstring origin tear without osseous lesions. In two cases, the semitendinosus and the long head of the biceps femoris were affected. Only in one of the cases, the three muscles were avulsed from the ischial tuberosity. We measured a retraction distance that ranged from four to seven centimetres. One patient, who was diagnosed accurately only three months after trauma, showed incipient muscular fatty degeneration. In all cases, surgical treatment took place as soon as the proximal hamstring rupture was confirmed. Once the tendon ends had been mobilized, they could be reinserted into the ischial tuberosity using Mitek® anchors. Compared to standard treatments, we provided exceptional post-operative conditions to these patients. They wore a hinged knee brace with free flexion and an extension stop at 30° for 4 weeks while mobilization on crutches was partial weight-bearing. One patient was exempted, and instead was immediately allowed full weight-bearing to the pain threshold without wearing a brace. Clinical outcomes were positive as patients resumed activities of daily life without any loss of function.

P 27

Management of unstable pelvis fractures

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Purpose: Our objective was to analyse our management of these fractures for optimizing patients care. Mortality is a consequence of continuous haemorrhage within the first 24 hours of hospitalization whereas coexisting cerebral injuries, thrombo-embolism, and multiple organ failure explain most of the mortality. Hemostatic measures such as pelvic binders or external fixation may help to control low pressure bleeding from lacerated veins or broad fracture surfaces. High pressure arterial bleeding may require embolization or open pelvic packing.
Methods: 450 patients admitted , to our institution, a level one trauma centre, presenting with a pelvic or an acetabulum fracture were prospectively entered into our “polytrauma” data base over three years.. From January1998 to December 2008 136 patients who presented with a type B or C pelvic fracture were identified. From 80 unstable pelvis, we had collected 60 unstable patients who had needed blood transfusions and intensive care. The average I.S.S. was 53 and their mean age was 38,6 years old (range 24–51). The fractures were diagnosed on the initial AP pelvis routinely performed on patient’s arrival with additional CT Scan.
Results: All the patients were managed in the emergency room according A.T.L.S. guidelines. All of them were implied in high velocity trauma mainly motor-cycles and car traffic trauma. In this group, five patients died in the emergency room.). The average stay in the hospital was 10 days .70 patients were selected with unstable fracture and unstable haemodynamic status.8 patients died at once and 2 were stabilized only with pelvic belt. Group 1 identified 29 patients with immediate external fixation and no laparotomy, All of them survive. Group 2 identified 12 patients who underwent external fixation first followed by arteriography.One patient died.Group 3 included 11 patients with first external fixation followed by laparotomy. Two patients on the operating table from massive haemorrhage. 8 patients were in Group 4 and laparotomy was done at once without any external fixation. All of them died on the table even the two ones for whom an arteriography was done.
Conclusion: In this series of unstable pelvis fractures, early laparotomy seems to have a very bad issue (100% of deaths). Even if external fixation is only useful for veinous and low pressure bleeding, we think that pelviclamp is a secure and quick way to stabilize patients before laparotomy or / and arteriography.

P 28

Early clinical and radiological outcome of total hip replacement with the short uncemented Fitmore stem

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Introduction: One of the modern treatments of degenerative joint disease especially in young patients is hip replacement with the use of short stems. The rationale for short stems is proximal load transfer and absence of distal fixation resulting in preserved femoral bone stock for, possibly, revision surgery. Furthermore, the short stem design enables minimally invasive surgery. The aim of the study was an analysis of early results and our own experiences with the implantation of short stems for total hip arthroplasty using Fitmore titanium stems.
Methods: We prospectively evaluated the clinical and radiographic results of 55 total hip arthroplasties (in 55 patients) performed with an uncemented Fitmore femoral stem combined with a Fitmore cup since January 2008 with a minimal follow-up of 1 year. Clinical results were assessed in terms of Harris hip score and survival rate.
Results: The mean age was 63 years ranging from 29.7 to 89.2 years. According to the Harris hip score, clinical status improved from 55 preoperatively to 88 one year after after the operation. No stem revision was reported. One hip underwent reoperation for a periprosthetic femur fracture (Vancouver type B1) following trauma at 2 months post-operatively. Radiological imaging revealed very good and rapid integration between implant and bone. Only one patient showed an asymptomatic subsidence at 5 months after surgery without signs of stem loosening. One patient had some heterotopic ossification at 3 months post-operatively without any symptoms.
Conclusion: Short uncemented Fitmore stems show an excellent survival rate in the short term with very good primary stabilization allowing early full weight bearing. Further advantages are bone conservation, providing sufficient bone stock for future revision surgery, and a design which allows muscle and soft tissue-sparing approaches enabling MIS surgery. Nevertheless, long-term studies are required.

P 29

Morphology of the Iliocapsularis Muscle

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The iliocapsularis muscle is a little known muscle that originates from the inferior border of the anterior-inferior iliac spine and the hip capsule and inserts just distal to the lesser trochanter. Nevertheless, this muscle is an important landmark for exposure of the Bernese periacetabular osteotomy. Speculations about the function of this muscle as a tightener of the hip capsule have grown. The aim of this study was to compare the morphology of the iliocapsularis muscle between patients with decreased (developmental dysplasia of the hip) and increased acetabular coverage (pincer-type of femoroacetabular impingement) using Arthro-MRIs. Dysplasia of the hip (Group I) was defined as an LCE angle of less than 25° with a minimal acetabular index of 14° and pincer type of FAI (Group II) was defined as and LCE angle exceeding 39° on conventional radiographs. This resulted in 37 hips in Group I and 45 hips in Group II. The morphology of the iliocapsularis muscle was measured on axial slices of Arthro-MRIs. The parameters were muscle thickness, width and cross section at 4cm distal of the spina iliaca anterior inferior and also distal of the femoral head as well as muscle volume. All parameters were significantly increased in Group I compared to Group II ($p < 0.05$). In Group I the mean thickness was 20 ± 4.5 (range, 12–29) mm, width 26 ± 5.2 (range, 17–37), and cross section 281 ± 10.7 (range, 139–591) mm^2 compared to Group II with a mean thickness of 16 ± 4.4 (range, 10–27) mm, width 21 ± 5.0 (11– 31), and cross section 235 ± 10.3 (range, 90– 535) mm^2. The muscle volume in Group I was 6.5 ± 2.9 (range, 2.2– 13.0) cm^3 compared to Group II with 8.9 ± 3.7 (3.4– 18.1) cm^3. In hip dysplasia the anterior acetabular coverage is decreased. Because of the iliocapsularis muscle›s origination on the hip capsule, contrition of the muscle theoretically can tighten the

anterior hip capsule, thus helping to stabilized the femoral head within the dysplastic acetabular. Although the true function of the iliocapsularis muscle remains unknown, constant use of this muscle in attempting to stabilize the femoral head in hip dysplasia theoretically would explain the apparent hypertrophy of this muscle.

P 30

Tibiaplasty: Percutaneous cement augmentation for the treatment of depression fractures of the tibial plateau

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Introduction: Management of insufficiency fractures of the tibial plateau in osteoporotic patients can be very challenging, since it is difficult to achieve a stable fixation, necessary for patients' early mobilization. The purpose of this study is to present a minimal invasive technique for the treatment of proximal tibial plateau fractures, "tibiaplasty", using a percutaneous PMMA augmentation.
Methods: 5 elder osteoporotic patients (8 fractures) with a non-traumatic insufficiency tibial plateau fracture were treated with this technique at the authors' institution from 2006 to 2008. There were 1 man and 4 women. The mean patients' age was 76.4 (62–88) years. The intervention was performed under general or spinal anaesthesia in a percutaneous technique; after the intervention immediate full weight bearing was allowed. Patients were followed up after 2, 6 and 12 months.
Results: The technique was feasible in all patients and no complications related to the intervention were observed. All patients reported a relevant reduction of pain, were able to mobilize with full weight bearing and would undergo the operation again. No secondary loss of reduction or progression of arthrosis was observed in radiological controls; no revision surgery was required.
Conclusion: Tibiaplasty represents a fare treatment option for the management of insufficiency tibial plateau fractures in elder osteoporotic patients. The technique is minimally invasive, safe and allows immediate mobilization without restrictions. In our small group of patients we found excellent early to mid-term results.

P 31

Long-term results of arthroscopically assisted anatomical single bundle anterior cruciate ligament reconstruction using patellar tendon autograft- "Bruderholz"- technique

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Introduction: Several different technique and fixation devices are used in reconstruction of the anterior cruciate ligament (e.g. cross pins, interference screws). These fixation devices represent a significant cost factor. The purpose of our study was to analyze the clinical and radiological long-term outcomes in patients treated for anterior cruciate ligament (ACL) tears by anatomical single bundle anterior cruciate ligament reconstruction with patellar tendon autograft ("Bruderholz-technique").
Material and methods: 63 consecutive patients (m:f = 54:9, mean age at surgery 27 ± 7 years) with an anterior cruciate ligament tear who were treated by an arthroscopically assisted anatomical single bundle ACL reconstruction with ipsilateral patellar tendon autograft were evaluated with a mean follow-up of 16 ± 1 years. The femoral fixation of the bone-patellar tendon- bone graft was performed in onlay technique using a 3.5 mm AO screw. On the tibial side the sutures were fixed around an AO-screw and the bone block press-fit. The patient rated their individual level of pain and satisfaction (0-10) on a visual analogue scale. Ability and time to return to sport activity was recorded. The IKDC2000, the Lysholm/Tegner score and the WOMAC were used. The examination included assessment of ACL laxity with the KT-1000 arthrometer. Weight-bearing radiographs of the injured knee (anteroposterior and lateral), a Rosenberg view and a skyline view of the patella were obtained. The extent of osteoarthritis of the knee was graded according to the Kellgren-Laurence OA score.
Results: The mean VAS pain (0-10) was 1 ± 1. Three patients (5%) showed a pain level >3. At follow-up 89% of patients were still active in sport. 49 patients (78%) had a normal total IKDC group A (normal), 8 (13%) group B (nearly normal), 4 (6%) group C (abnormal) und 2 (3%) group D (severely abnormal). The relative Lysholm Score was 95 ± 12. The Tegner Score at follow-up was (median 6, range 2-10) and preinjury (median 7, range 4-10). The side-to-side a.p.-translation (KT 1000, 134N) was <3 mm in 48 patients (76%), 3-5mm in 14 (22%) and >5 mm in one patient (2%). With regards to the Kellgren und Lawrence Score 17 patients (27%) had no signs of OA. 30 patients (48%) showed a incipient OA (Kellgren 1-2) and 12 patients (19%) a moderate to severe OA.
Conclusion: The single-bundle anatomical ACL reconstruction with patellar tendon autograft showed good functional and radiological long-term results with stable knee joints and highly satisfied patients minimum 14 years after surgery. These results are at least comparable to the published short-term results of the "modern" ACL fixation techniques. In the era of DRG`s the described technique with less cost intensive fixation devices might be an increasingly interesting ACL reconstruction technique.

P 32

The pathoanatomy of osteoarthritic and dysplastic patellofemoral joints

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Introduction: The trochlear groove plays a major role in the mechanics and patho-mechanics of the patellofemoral joint. Our primary goal was to compare normal, osteoarthritic and dysplastic PFJs in terms of angles and distances.
Materials and methods: Computed tomography scans of 40 normal knees (>55 years old), 9 knees with patellofemoral osteoarthritis (group A) and 12 knees with trochlear dysplasia (group B) were analysed using 3D software. The femurs were orientated using a robust frame of reference. A circle was fitted to the trochlear groove. The novel trochlear axis was defined as a line joining the centres of two spheres fitted to the trochlear surfaces, lateral and medial to the trochlear groove. The relationship between the femoral trochlea and the tibiofemoral joint was measured in term of angles and distances (offsets). T-test for paired samples was used ($p < 0.05$).
Results: The normal trochlear groove closely matched a circle (RMS 0.3 mm). It was positioned laterally in relation to the mechanical, anatomical, and trans-condylar axes of the femur. It was not co-planar with any of the three axes. After aligning to the new trochlear axis, the trochlear groove appeared more linear than when other axes were used. In comparison to the normal knees; the medial trochlear was smaller in group A ($p = 0.0003$). The lateral trochlear was smaller in group B ($p = 0.04$). The trochlear groove was smaller in groups B ($p = 0.0003$). Both trochlear centres in groups A+B were more centralised ($p = 0.00002$-0.03). The medial trochlear centre was more distal in group A ($p = 0.03$) and the lateral trochlear centre was more distal in group B ($p = 0.00009$). The trochlear groove started more distal in group B ($p = 0.0007$).
Conclusion: In osteoarthritic and dysplastic patellofemoral joints, the trochlea is both smaller and more distally located in relation to the tibiofemoral joint. These two factors may contribute to excessive loads that lead to early joint wear.

P 33

Anterolateral approach with tibial tubercle osteotomy versus standard medial approach for primary total knee arthroplasty: does it matter?

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Introduction: The purpose of this prospective consecutive multicenter study was to investigate whether the type of surgical approach (medial parapatellar (MPA) or lateral parapatellar with tibial tubercle osteotomy (TubOT)) influences the early clinical and radiological outcomes of primary total knee arthroplasty (TKA).
Methods: Ligament balancing primary TKA with a rotating platform was performed in 143 knees (m:w = 1:1.6; mean age 69 ± 8 years). The TKA was done by a lateral parapatellar subvastus approach with stepcut osteotomy of the tibial tubercle (53%; n = 76, group A) or medial parapatellar approach (47%; n = 67, group B). The outcome was assessed at 1 and 2 years postoperatively by the American Knee Society score (KSS) and the knee society total knee arthroplasty roentgenographic evaluation and scoring system (TKA-RESS). The patient`s pain level and satisfaction was noted by a visual analogue scale (VAS). Data were analyzed by an independent statistician with a level of significance of $p < 0.05$.
Results: Although having a lower degree of preoperative flexion (112° ± 15° versus 115° ± 15°) patients in group A showed a significantly ($p = 0.027$) higher degree of flexion (118° ± 10°) at their last follow-up than patients in group B (114° ± 10°). Patients in group A showed a significantly better mean VAS pain ($p = 0.0001$) and satisfaction ($p = 0.0058$) at 2 years follow-up. The pain free walking distance was significantly ($p = 0.036$) longer for group A than group B. Patients treated with a lateral approach were significantly more stable in terms of valgus stress ($p = 0.049$). The Knee society score was significantly ($p = 0.0009$) higher at two years follow up in group A compared to group B. The postoperative mechanical alignment and

positioning of the prosthesis were not significantly different. Patients in group B presented with significantly (p = 0.0017) more tibial radiolucencies (>2 mm) at their last follow-up than patients in group A. There was no prosthesis related revision in either group. The revision rate in group A (4%) was higher than in group B (1.5%), which was mainly due to two cases of traumatic secondary displacement of the tibial tubercle and need for refixation.
Conclusions: The TubOT led to slightly better functional results and less pain two years after primary TKA. It is however not clear if the improved outcome can outweigh the higher risk of early complications and revisions. Long-term studies are necessary to show whether there is any difference in prosthesis longevity between both types of approach.

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Mid term results of Distal Femoral Fractures treated with a Polyaxial Locking Plate

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Objectives: Distal femoral fractures are a challenging entity to treat. In the recent past Locking Plates have become a standard implant in the treatment of these fractures. Newer designs add the possibilities of the application of lagging, polyaxiality and locking at the same time/screw. We report the clinical and radiological results of 62 prospectively enrolled distal femur fractures treated in 2 major Trauma Centres in Switzerland and Germany with the polyaxial NCB® DF plate (Zimmer, Warsaw, USA).
Materials and methods: All distal femoral fractures treated in both institutions with the NCB® DF plate were prospectively enrolled in the study cohort. The minimum follow up was 12 months. Besides evaluation of fracture classification according the AO/OTA system and the trauma mechanism radiological evaluation (incl. union, non-union, mal-union, lateral/ ap shaft alignment and intra-articular steps) and complications were documented. Clinical evaluation consisted of the Short Form SF12 questionnaire (SF12), the Hospital for Special Surgery Score (HSS) and clinical assessment of rotational differences to the contra lateral side.
Results: 25 patients with 26 fractures were available for follow-up at an average of 37 months postoperatively with a minimum follow-up of 13 months. According to the OTA/AO Classification 81% of the fractures were intra-articular. 48% of the patients were multi-traumatised, 38% having open fractures. All except two went to union (92%) with the primary procedure. The range of motion at the knee joint of the operated side reached on average 90% (117° ± 20° vs. 131° ± 14°) of the contra lateral side. The HSS Score was 79 ± 18 and the SF 12 (physical and mental) 40 ± 12 and 54 ± 11 at follow-up. There were 7 patients requiring surgical revision (28%). In total 4 infections, 1 screw penetration into the joint, 2 pull outs of the plate and 2 non-union occurred.
Discussion: Distal intra-articular fractures are often combined with concomitant injuries, despite the challenges in the treatment of these complex fractures using modern locked implants respecting their biomechanical properties high union rates can be achieved with a good function and patient satisfaction.

P 35

Outcome after reconstruction of multiple ligament injured knees involving the PCL

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Purpose of this study was to evaluate the possible influencing factors concerning the outcome after one stage arthroscopically assisted reconstruction of multiple ligament injured knees always involving the posterior cruciate ligament (PCL).
Methods: We reviewed consecutively 17 patients (19–62 yrs) with multiligament injured knees, including the PCL. Seven patients showed even a frank knee dislocation. The minimum follow up was 2 years (range, 24.3–40 months). Primary outcome measures were the International Knee Documentation Committee (IKDC) score and stress radiography (Telos). All patients were evaluated with the Lysholm Score, physical examination, radiologic assessment and arthrometer testing (Rollimeter).
Results: At final IKDC evaluation, six patients (35%) were graded level A, nine (53%) level B and two (12%) level C. Subjective IKDC Score was 61.1 (26.1–87) points postoperative and Lysholm Score 81.2 (42-100). Posterior tibial translation (TELOS) was reduced from 13.9 mm (range, 6–35 mm) to 8.3 mm (range, 1–25 mm) and side to side difference decreased from 10.9 ± 6.6 mm to 6.2 ± 6.0 mm (p <0.001). Arthrometer testing (Rollimeter) showed 2.9 ± 1.9 mm (range, 0-8 mm) total anterior-posterior side to side difference. Positive correlation was found between arthrometer testing and stress radiography (p <0.002), as well as between arthrometer testing and IKCD values (p <0.001). Severe subjective instability was reduced significantly by the operative procedure (p <0.001). Only three patients (18%) suffered postoperatively from persistent knee instability, 82% went back to their initial work and 53% restarted sport activities, three of them even professional.
Conclusion: Multiligament knee injuries, the PCL involved are complex injuries. But two years after reconstruction 88% of our patients showed good results and satisfactory stability when returning to daily activities or even back to sports. We couldn't find any influencing factors regarding different additional injured ligaments or using different grafts, but timing of surgery seems to be important concerning the development of osteoarthritis.

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Development of a force-determining ligament balancer to measure physiologic knee ligament gaps without bone resection using a total knee arthroplasty approach

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Introduction: Ligament balancing is a challenging but essential part of successful total knee arthroplasty. There is general agreement that flexion and extension gaps should be equal and symmetrical. However, to date there are no available comparisons to physiologically normal knee joints that have not undergone bone resection. As well, no standards have been established regarding which instruments (e.g. spacers, distractors, trial components, navigation systems) and particularly what degree of force for gap distraction should be used.
Methods: To measure the physiological extension and flexion gaps, a prototypical force-determining ligament balancer (Aesculap, Tuttlingen, Germany) was constructed and adapted so that force could be applied directly through Steinmann pins inserted medially and laterally on the tibia and femur, independent of each other and without the need for bony resection. Ten normal cadaveric knees were assessed using a standard medial parapatellar total knee arthroplasty approach with patellar subluxation. Gap measurements were carried out twice each alternating 100N and 200N.
Results: Implementation of the prototype was successful. The repeat measurements showed only slight deviation from the original, resulting in a minimal standard error. Accuracy did not vary with application of greater force (200N), however gap size increased significantly.
Conclusion: The successful assessment with cadaveric knees indicates that this prototype can be applied to measure flexion and extension gaps without the need for bony resection. Increasing the distraction force to 200N does not improve results, therefore 100N per compartment appears adequate. Most likely the extension and flexion gaps are physiologically asymmetric and unequal, and the kinematics are markedly altered after resection of the PCL and/or ACL. This force-determining balancer can be used for further analyses, e.g. to explore the effects of selective ligament resection.

P 37

Primary recurrent medial patella sub-/dislocation due to a hypertrophic patello-femoral ligament? A case report

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Objective: Primary medial patellar sub-/dislocation is an extremely rare finding in human beings. In the only case reported in literature, an excessive femoral antetorsion could be found which was corrected by successful subtrocanteric-derotational osteotomy. We present a case with recurrent medial sub-/luxation of the patella reporting our treatment and follow-up, with review of the literature and discussing possible underlying causes.
Case report: A 15 year's old girl sustained a skiing injury with a first episode of medial patellar luxation of her left knee. In the following nine months she reported further ten spontaneous episodes which resolved with autoreposition. Clinically a slightly medialised patella with a positive apprehension sign was found in an otherwise normally aligned lower extremity. MRI showed a slight trochlear dysplasia and a hypoplastic medial condyle. A CT-scan of the lower extremity including rotational measurements, confirmed regular rotational alignment and physiological bone axis. After unsuccessful conservative treatment during ten months she underwent surgery. A lateral longitudinal parapatellar approach and arthrotomy was performed: A hypertrophic medial patello-femoral ligament (MPFL), and a particularly distal insertion of the medial vastus muscle were found. No femoro-patellar dysplasia was observed. Dissection of the MPFL and a proximalisation of the medial vastus muscle was performed and furthermore the lateral retinaculum was dissected and distalized. At the end of surgery regular patellar tracking was achieved. 12 months after surgery she

was symptom free without further episodes of sub-/dislocation, but clinically and radiologically we observed similar findings at the other knee.
Discussion: This case of medial patellar dislocation without any underlying bony structural abnormalities can be considered unique. The intraoperative finding of a hypertrophic MPFL could be the main cause or the consequence of the recurrent sub-/luxations of the patella respectively of the sustained trauma, whereas the recurrent patella dislocation of the opposite knee suggests rather a congenital cause.

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Percutaneous lateral ankle stabilization an anatomic investigation

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Background: The current study investigates the topographic anatomy of the percutaneous anatomical lateral ankle stabilization in relation to the neurovascular hindfoot structures. The study should serve as an aid for planning and performance of this new minimal invasive technique.
Materials and methods: Eleven cadaver specimens were dissected exposing the nerves, vessels, ligaments and tendons. The portals and transosseous tunnels were performed by using K-wires. All distances of the K-wires and the neurovascular structures were measured with reference to clearly identifiable bony landmarks.
Results: On the medial side the average distance of the K-wire to the medial calcanear branch of the tibial nerve was found to be 7 mm (SD ± 3.7). The medial calcanear branch was hit twice by the transosseous K-wire. On the lateral side the mean distance of the fibular exit point of the K-wire to the sural nerve was 13.3 mm (SD ± 3.6). The superficial peroneal nerve was never found at risk or damaged. The posterior tibial artery showed a safe distance to the K-wires.
Conclusion: The percutaneous approach to lateral ankle stabilization is a safe procedure with a low risk of nerve or vessel damage. However, the medial calcanear branch of the tibial nerve remains the structure at greatest risk.

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Item reduction of a novel foot score using Rasch analysis

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Introduction: A universal foot score as an outcome measure after fore- and hindfoot surgery is currently lacking. Existing questionnaires are limited to either the fore- or hindfoot and are of multidimensional nature and therefore lack modern psychometric properties such as internal construct validity, i.e. linearity and unidimensionality, which is a requirement for arithmetic operations to be valid in outcome studies. It was the goal of the present study to develop a novel questionnaire which fulfills the requirements of internal construct validity and is valid for a variety of foot disorders and interventions.
Methods: A German questionnaire of 56 items on a Likert-scale relating to pain and daily activities which may be limited by a foot disorder was distributed to 215 patients (mean age 49 years, female 125). For item reduction the questionnaires were subjected to Rasch analysis using the RUMM2020 software package. Rasch analysis involves an iterative process on which items are kept based on the psychometric properties of the resulting questionnaire, which comprise threshold ordering, linearity, unidimensionality, differential item functioning and reliability indices.
Results: Ordered thresholds and internal construct validity could be achieved by keeping 7 items, which showed a person separation index (PSI) as a reliability measure of 0.83, however. Adding three previously omitted items which are foot specific increased the PSI to 0.91 and did not introduce misfit to the Rasch model (chi-square interaction $p = 0.17$) and was found to yield a unidimensional (5.2% positive t-tests) 10-item questionnaire which did not show any differential item functioning between fore- and hindfoot disorders.
Conclusion: Reduction of the 56 items using Rasch analysis yielded a novel 10-item questionnaire which is valid for a variety of foot disorders and fulfills modern psychometric properties. In a second study, the questionnaire will be probed for external validity as well as cross-cultureal validity in an English speaking population.

P 40

Non-ultrasound guided ethanol injections for the treatment of interdigital neuroma – An efficient treatment?

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Introduction: Repetitive ethanol injections for the treatment of symptomatic interdigital neuroma have shown to yield good-to-excellent success rates. Due to the technical requirements ultrasound-guided injections might limit its use in practice. The present study was performed to assess the efficacy of local ethanol injection for the treatment of interdigital neuroma. The hypothesis was that non-ultrasound guided injections would lead to similar results found in the literature for both ultrasound-guided injections (20–30% ethanol; 84–90% success) and non-guided injections (4% ethanol; 74–89% success).
Materials and methods: A prospective study was performed. All patients received at least four injection of 20% ethanol mixed with 0.25% of bupivacaine into the affected webspace. Injections were repeated after 2 weeks. The evolution of pain was assessed by the visual analogue scale (VAS). The time interval from beginning of symptoms until first injection was recorded. Patients were classified into responders and non-responders. Those patients who did not respond to the first series of four injection or those who decided to go for surgery were classified as non-responders. Most of the patients (24) received MRI in order to confirm the diagnosis of interdigital neuroma and to measure its size.
Results: Thirty-one patients were enrolled into the study. There were 19 females and 12 males. The average age of the entire study group was 59 years (range 26 to 81). The mean duration of symptoms before first ethanol injection averaged 27 months (range 4 to 200). The second webspace was affected in 20 patients while the third was involved in 18 patients. The size of neuroma averaged 5 millimeters (range 4 to 8). The average pain scores at initial presentation and after the first through fourth injection were as follows (VAS-scores): Initial: 7; (first) 6; (second) 5.8; (third) 5.1; (fourth) 5. Four patients wished to continue local injections and achieved a final VAS score between 2.5 and 8 points. However, only seven patients were successfully treated. The other 24 patients (77%) were non-responders. Of these 17 considered surgical resection and 7 were successfully treated by surgical resection. Of the latter diagnosis of neuroma was confirmed by histology.
Conclusions: Despite the good-to-excellent results published in the literature we were not able to achieve similar results as reported for non-ultrasound guided injections. Based on our study data a series of four non-ultrasound guided injections is of limited success.

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Arthroscopic subtalar arthrodesis in a patient with talocalcaneal coalition using an accessory sinus tarsi portal

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Introduction: We present a case of a patient with arthroscopic treatment of a painful talocalcaneal coalition. After unsuccessful conservative treatment, an arthroscopic assisted subtalar fusion was performed. While approaches using two portals are established for hindfoot arthroscopy (1), few experience exists on treatment of talocalcaneal coalition using an additional sinus tarsi portal (2). The accessory approach was used to improve visibility and to facilitate the removal of articular cartilage of the anteromedial part of the subtalar joint.
Material and methods: The standart diagnostic procedure includes a CT-Scan, which showed a medial position of the talacalcaneal coalition. For the surgical procedure the patient was placed in prone position. The two standard incisions (postero-lateral and postero-medial to the Achilles tendon) were performed initially. The cartilage of the posterior facet of the subtalar joint was removed using ring curettes and shaver. An additional sinus tarsi portal was then used to facilitate the approach to the anteromedial part of the posterior subtalar joint. A blunt trocar was introduced via the posteromedial portal to open up the subtalar joint. Through the accessory sinus tarsi portal the articular cartilage in the anterior subtalar joint could then be removed using ring curettes, shaver and chisel. Pridie drillings showed a good vascularity of the subchondral bone. Under fluoroscopic control two K-wires were placed for the temporary fixation of talo-cacaneal joint. Starting medially two 6.5mm screws were placed through the calcaneus into the talar neck with good compression of the subtalar joint. The postoperative procedure included immobilisation of the foot in a Vacoped and partial weight bearing for six weeks. Radiological follow up was performed at six and twelve weeks post-operatively with standart anteroposterior and lateral x-rays.

Result: The radiological follow at six and twelve weeks showed stable position of the implants, the patient reported good pain relief. A deep vein thrombosis was treated with marcoumar for three months.
Conclusion: Arthroscopic fusion of the subtalar joint is facilitated by the use of an additional portal at the level of the sinus tarsi. The accessory approach provides a safe method for additional visibilty and improved accessibility to the anteromedial portion of the subtalar joint.
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P 42

Latest results of a multidirectional and angular stable plate system in the foot – developing and design

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Introduction: The multidirectional and angular stable plate-systems demonstrate improved results in the hand and wrist. The experience was now applied in foot-surgery. In the last years plates and screws were improved step by step. The titan-screws present a tapered core to improve torsional and bending stability. The Triloc-System accepts a spherical locking with a variable angle of ± 15°. The newest fore- and midfoot plate with 2,8mm screws replaced the older 2.5 mm plate system with the same stability of conventional 3,5 mm screws in other locked systems in july 2009.
Method: A total of 60 patients with need for midfoot arthrodeses were treated with different plates from february 2006 to january 2010. The frame-plates with 2.5 mm screws were used in 20 cases. The fore- and midfoot plates with 2.5 mm screws were implanted in 33 cases. The new fore- and midfoot plates with 2.8 mm screws were used in 7 cases.
Results: The older frame-plates with 2.5 mm showed complete healing after 6 month in 75%, but screws brake in 40% of cases. The fore- and midfoot plates with 2.5 mm screws present complete healing in 91% and screws brake in 21%. The new fore- and midfoot plates with 2.8 mm screws don't show any screws braking up to now. The healing results will be evaluated in the next months.
Conclusion: The multidirectional and angular stable plate-systems are simple and have increasing reliability in stabilisation of arthrodeses and osteotomies in the midfoot. So far the results show superior healing results with earlier weight bearing although the midfoot plate has smaller design than conventional plates.

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Postero-lateral plate fixation of the Volkmann triangle in trimalleolar luxation fractures

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Introduction: The need for the fixation a Volkmann triangle which is bigger than 25% of the articular surface, is well established. Current techniques are either indirect reduction from anterior or direct fixation by a postero-lateral approach. However, the latter has, as yet, been poorly investigated.
Methods: Between 2000 and 2009, 39 patients (11 male, 28 female; average age 55.07 (range: 29–88) with trimalleolar fractures (AO 44 B3-C3) were treated with open reduction and direct postero-lateral plate fixation of the Volkmann triangle. ORIF of the fibula and the medial malleolus was performed in the usual manner. Surgery was performed in lateral decubitus, or prone position, and access was gained to the distal tibia posterior to the peroneal tendons.
Results: In all cases anatomic reduction could be achieved. No secondary dislocation was observed and all fractures healed uneventfully.
Discussion: Indirect reduction of the Volkmann triangle from anterior makes an image intensifier mandatory and has the potential of not achieving anatomic reduction due to intercalated tissue. The buttressing effect of a lag screw, anterior, in larger fragment fixation, might not be sufficient to avoid secondary displacement.
Conclusion: With the use of a postero-lateral approach and a dorsal plate for the fixation of the Volkmann triangle, it is possible to reliably obtain an anatomical reduction of the dorsal articular surface of the tibia, thus potentially minimising the risk of posttraumatic osteoarthritis.

P 44

Transcalcaneal Suture Technique for the Repair of a Delayed Achilles Tendon Sleeve Avulsion

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Introduction: 25% of acute Achilles tendon ruptures are clinically misdiagnosed. Untreated, chronic ruptures lead to a significant loss of function. Distal sleeve avulsions are a rare entity. Various techniques are described in the literature (direct tendon suture, augmentation techniques, aponeurosis flaps, transosseous fixation). In our case we used a limited dual incision technique (transcalcaneal suture technique with supplemental double-anchor fixation and additional VY-advancement) for the treatment of a distal sleeve avulsion rupture.
Case: A 63-y old female, with type 2 diabetes mellitus, presented in our outpatient station with a chronic Achilles tendon rupture 4 weeks after adequate trauma. An MRI showed a distal rupture of the tendon with avulsion at the calcaneus and a 4 cm retraction of the tendon.
Technique: Prone position. Small incision, dorso-medial at the calcaneus. Sharp dissection to the bone level. Haglund's excision. Roughening of the posterior calcaneal surface. Mobilisation of the tendon. Small para-midline proximal incision at the level of the gastrocsoleus aponeurosis for VY-advancement and release of the tendon. A Krakow suture is placed in the Achilles tendon. Two transcalcaneal drill holes are placed. The sutures are passed through, and tied over the plantar fascia, which is exposed through a small transverse plantar incision. Two Mitek Super anchors are placed dorsally in the medial and lateral aspect of the calcaneus. The tendon is secured by another two Krakow sutures tied through the anchors on the calcaneal surface. After treatment, a plantar flexed soft cast in a walker boot, with partial weight bearing for 6 weeks. The initial 3 cm-heel-wedge is gradually declined over a period of 12 weeks, after which a plantigrad position is reached.
Results: After 3 ½ months the patient is fully mobilised without the use of crutches. Preload of the tendon compared to the contralateral non-operated side is slightly increased, but there is no limping and a remarkable difference in push-off force.
Conclusion: The operative treatment of chronic sleeve avulsion ruptures of the Achilles tendon is challenging. Transcalcaneal suture techniques allow anatomical reconstruction of the tendon without „sacrificing" other structures. By using two additional anchors, tear-resistance can be strengthened without much effort.
Literature: Bibbo C. Limited dual incision technique for repair of Achilles sleeve avulsions. Foot Ankle Int. 2004;25(7):513–5. Bibbo C, et al. Repair of the Achilles tendon sleeve avulsion: Quantitative and functional evaluation of a transcalcaneal suture technique. Foot Ankle Int. 2003;24(7):539–44. Pavlou G. Repair of the Achilles tendon sleeve avulsion: A transcalcaneal suture technique. Foot Ankle Int. 2009;30(1):65–7.

P 45

Salvage of failed pantalar arthrodesis with the Ilizarov apparatus: A case report

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Introduction: Revision surgery for failed pantalar arthrodesis is associated with a high risk for nonunion, deep infection and residual deformity. We here report a case of failed pantalar fusion successfully treated using an Ilizarov circular frame.
Case: A 54 years old female with polyneuropathy was treated with pantalar arthrodesis for severe painful destruction of the ankle joint and flatfoot deformity. A standard technique with titan screws was used. At 3 months, collapse of talus body with concomitant aseptic screw loosening resulted in an increased hind foot valgus. Revision surgery was performed including talectomy and arthrodesis between tibia, calcaneus, navicular and cuboid was performed using Ilizarov frame. Immediate full weight bearing was allowed.
Results: One episode of pin track infection was successfully treated with oral antibiotics. The circular Ilizarov frame was removed after 4 months when a union and plantigrade foot were achieved. An ankle-foot-orthosis was used to protect the arthrodesis site for further six 6 months.
Conclusion: In selected patients with failed pantalar fusion the Ilizarov apparatus may be used as salvage procedure to achieve a solid union and a plantigrade foot.

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Extensive tarsal resection with direct forefoot-tibio-calcanear fusion using an Ilizarov frame: A case of limb salvage in advanced neuro-osteoarthorpathy

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Introduction: Severe destruction of hindfoot and mid-foot due to Charcot arthropathy leads to progressive foot deformity with subsequent ulcerations. While it is often difficult to achieve sufficient stability, a high risk of amputation exists. We here report a case with most severe destruction of the ankle and mid-foot successfully treated with the Ilizarov method.
Case: A 38 years old woman presents with acro-osteolysis ulcero-mutilans Thevenard with progressive equinus and hindfoot varus deformity. Due to instability and severe neuropathic ulcerations bracing was no longer an option. Radiological imaging revealed extensive ostelysis of the tarsus with only the tibia and calcaneus still distinguishable. The forefoot presented with severe "candy stick deformities" of the metatarsals.
After resection of destructed elements stabilization and compression of tibia, remaining calcaneus and forefoot with Ilizarov circular frame were performed. Full weight bearing was allowed.
Results: The Ilizarov frame was removed after 6 month. While no major complications occurred, a pin track infection was successfully treated with oral antibiotics. A solid union and a braceable foot were achieved.
Conclusion: Extensive intercalary resection of destructed joints and compression arthrodesis with Ilizarov frame is an alternative to below knee amputation even in most advanced cases of neuro-osteo-arthropathy.

P 47

Simultaneous bilateral total ankle replacement for treatment of hemophilic ankle arthritis: a unique case report

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Introduction: Severe hemophilia occurs almost exclusively in males and affects approximatively 850 patients in Switzerland [1]. There are two main types of hemophilia: hemophilia A (factor VIII deficiency) and hemophilia B (factor IX deficiency). Hemophilia A is the most common type with more than 60% of all concerned patients. People with severe hemophilia (factor VIII activity level <1%) suffer recurrent internal bleeding episodes into joints, muscles and tissues which can lead to chronic synovitis and severe arthritis. The ankle joint is the second most affected joint after the knee [2]. Total ankle joint replacement can be a surgical option in the treatment of severe arthritis.
Case presentation: S.W. is a 45 year old male patient with severe hemophilia A, chronic hepatitis C and history of multiple joint replacements (knee right 1992, left 1996, hip left 1992 and elbow right 2004). He developed chronic bilateral ankle pain by severe degenerative arthritis. After unsuccessful conservative treatment we performed a simultaneous bilateral total ankle replacement with right subtalar fusion and z-lengthening of both achilles tendons in september 2008. There were no intra-operative and post-operative complications. The patient was mobilised in wheel-chair for 6 weeks after the procedure and partial weight bearing of 15 kg was permitted after 2 weeks post-operatively. At the last follow-up 12 months after the procedure the patient was very satisfied on the left side and moderately satisfied on the right side. He developed a valgus tendency of the right hindfoot which had to be compensated with orthotics. The total costs of the procedure were evaluated at around CHF 80000.–, including hemophlic substitution (CHF 52945.–).
Conclusion: To our knowledge this is the first reported case of simultaneous bilateral total ankle replacement in a hemophilic patient. The patient is very satisfied with the result 12 months after the procedure. Intensive rehabilitation was needed to improve the functional result. The global costs of the procedure could be reduced to almost 50% in comparison to a two stage procedure. By bilateral painful ankle arthritis is the simultaneous total ankle replacement an interesting option which helps reduce the costs of the global treatment. Intensive collaboration with haematologist and physiotherapist is essential to improve the results of the procedure and satisfaction of the patient.
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P 48

The Extensile Approach for the Operative Treatment of Complex Pilon Fractures: Our Experience since 2003

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Introduction: Several surgical approaches for internal fixation of tibial pilon fractures have been described in the literature. We report on our clinical experience with use of the extensile approach (EA) which was described at our institution (senior author). This approach enables simultaneous visualisation of the articular surfaces, as well as the medial and lateral tibia columns, facilitating reduction and fixation of complex tibial pilon fractures (43-C). This study reviews the impact of the surgical approach on: 1/ soft tissue healing, and 2/ bony consolidation, in a series of consecutive patients treated at our institution since 2003.
Methods: Cohort of consecutive adult patients treated at our institution for 43-C fractures with use of the EA, since 2003. Outcome parameters: soft tissue healing assessed with clinical follow-up; bone healing assessed with radiographic analysis every 6 weeks.
Results: 48 patients have been treated by ORIF through an extensile approach. Ten were open fractures Gustilo I or II. Some fractures had proximal extension up to the metaphyso-diaphyseal area. Definitive surgical treatment was performed after a mean time interval of 15 days after the index trauma. One patient needed antibiotic treatment for a superficial wound infection. Another patient had superficial wound necrosis which healed without additional surgery. All fractures showed evidence of radiographic bone healing at 18 weeks (absence of hardware failure or loss of correction), except one patient who required bone grafting in the diaphysis area and who is still not fully healed at 8 month.
Discussion: The EA offers direct and simultaneous visualisation of both columns as well as the entire articular surface. It also allows for anatomic reduction of the joint surfaces and facilitates positioning of the fixation plates on the medial, anterior, and/or lateral sides of the distal tibia. Complications related to the EA are rare, but surgeons should not underestimate its tricks. Of upmost importance, recognition of the need to delay primary surgery is the most important advancement in the surgical treatment of these high energy fractures.

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Irreducible posteromedial talar body dislocation in Hawkins type III fractures: medial malleolar osteotomy used for reduction

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Introduction: Talar neck fractures result from high energy trauma. In the type III (Hawkins classification) the body usually dislocates postro-medially and can be reduced and fixed by mean of a dual surgical approach (medial and lateral). In some rare cases, the posteriorly dislocated body is entrapped, and cannot be reduced by standard means. This condition requires an additional medial malleolar osteotomy.
Method: Since 2003, we have identified 3 patients who presented at our institution with a Hawkins III fracture-dislocation of the talar neck. All required an additional medial malleolar osteotomy to reduce an otherwise unreducible talar body. We are describing, step by step, the surgical procedure that eventually permitted reduction and fixation of the talar neck fracture.
Results: The 3 patients are presented with a minimum follow-up of 2 years. All healed their osteotomy and their talar neck fracture within 3 months. At 2 year follow-up, there were no signs of talar body necrosis or bone collapse.
Discussion: Hawkins III fracture-dislocations of the talar neck are best treated with a dual surgical approach. However, in some rare cases, reduction is not possible and requires an additional medial malleolar osteotomy. Knowledge of this surgical trick may help trauma surgeons exposed intraoperatively to this challenging situation. The outcome is still good and does not seem to favour AVN of the talar body, as observed in this limited series of patients.

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Primary subtalar arthrodesis using a minimally invasive technique for comminuted fractures of the calcaneum: technical report of a new method

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Introduction: Management of comminuted calcaneal fractures is controversial, and multiple factors, including fracture pattern and severity, soft-tissue integrity, medical co-morbidities, and lifestyle

issues, influence the decision-making process. In an effort to minimize complications related to soft tissue lesions, a minimally invasive technique was developed that combines percutaneous reduction of the joint, restoration of the calcaneus shape (hindfoot) and subtalar joint debridement for primary arthrodesis.
Method: A minimally invasive technique was used in an experimental series of four patients with a comminuted calcaneal fracture Sanders type III and IV. All patients were operated on within 8-10 days of injury. Complications were recorded and pre-op, post-op and final follow-up radiographs analysed.
Results: Four patients were included, 2 with Sanders III and 2 with Sanders IV fractures. Radiologic follow-up showed no loss of height the calcaneum. Fusion across the arthrodesis site was radiographically evident in all patients between 8 and 12 weeks. No wound complications or infection were observed. Using the AOFAS score, the results were good in three cases and excellent in one case. 3 patients returned to their professional activity within 6 months and 1 was retired.
Conclusion: We found this minimally invasive technique with primary fusion of the subtalar joint an effective and safe treatment option in selected patients with comminuted fractures of the calcaneum. These preliminary results justify future use of this technique.

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The Syme Ankle Disarticulation – report of a cohort of 18 consecutive patients

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Introduction: The Syme Ankle Disarticulation is a very functional level of amputation. It provides an end-bearing stump that allows ambulation without prosthesis over short distances. Patients with Syme amputation score (i.e. function, absence of pain, gait, satisfaction) significantly better than patients with transtibial or other types of hindfoot amputations (i.e. Pirogoff, Boyd). An intact heelpad and adequate functioning posterior tibial artery are mandatory to ensure successful healing of the stump. The goal of this study is to report on a cohort of 18 patients who were disarticulated between 2003 and 2010.
Method: Cohort; consecutive patients who underwent a Syme disarticulation. Recorded parameters: age, gender, cause of amputation, need for revision surgery, time to prosthetic fitting, use of the prosthesis, satisfaction (IAQ).
Results: There were 12 men and 6 women. Causes of amputation were: trauma (12), vascular (3), non salvable neuropathic foot (2), foot tumor (1). Three patients needed repeat surgery (x2) for wound healing issues (2 had an infection; 1 had skin breakdown), however all three stumps could be saved. Time to prosthetic fitting was 3 months (1-6). All used their prosthesis except 1 patient who was paraplegic.
Discussion: The Syme Ankle Disarticulation is a very functional level of amputation with a predictable positive outcome. Surgery must be done with great care so as to preserve the posterior neurovascular bundle, and as well the integrity of the heel pad during dissection. The heel pad flap should be perfectly anchored and centered in order to prevent any migration. In well selected patients, this level of amputation should be favoured to a transtibial level, or partial hindfoot (Pirogoff/Boyd) amputation procedure.

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Utility of pre-reimplantational microbiological samples in the predilection of recurrent arthroplasty infection

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Objectives: During a two-stage exchange for infected arthroplasties (PJI), joint punctions or serum inflammatory markers are used before reimplantation to exclude persistent infection. We investigate the performance of pre-reimplantational punction/biopsy, intraoperative samples, Gram-staining, clinical exploration and serum inflammatory markers in the predilection of recurrent PJI among asymptomatic patients during a two-stage exchange.
Methods: Analysis of PJI treated at Geneva University Hospitals.
Results: A total of 62 PJI were found in 58 patients. All patients had intraoperative microbiological samples. Additionally, 18 joint punctions and 1 open biopsy had been performed. Recurrence of PJI occurred in 12 cases (12/62, 19%) with mean and median time delays of 218 and 88 days after reimplantation. No patient had recurrence during the antibiotic-free time window (mean 109 days, range 2 to 634 days) after six week's of antibiotic treatment. Only five invasive joint samples grew a pathogen in cultures. Only in 1 case, intraoperative clinical assessment and Gram-staining had suspected persistent infection. In 5 PJI, patients had a normal C-reactive protein (CRP, <10 mg/L) levels before reimplantation. The sensitivity, specificity, positive predictive and negative predictive values of pre-reimplantional invasive diagnostics and CRP for the predilection of recurrence was 0.58, 0.88, 0.5, 0.84 and 0.17, 0.81, 0.13, 0.86, respectively.
Conclusions: Pre-reimplantational punctions, intraoperative samples, clinical exploration or serum inflammatory markers poorly predict PJI recurrence that usually occurs far later.

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Pitfalls in Lateral External Fixation for Supracondylar Humeral Fractures

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Introduction: Dislocated supracondylar humerus fractures (SHF) are common in the paediatric age group and in general the most frequent fractures of the elbow region in children. Closed reduction and percutaneous pinning have become a standard method of treatment. However, the management of completely dislocated fractures remains challenging. In this study we evaluate the results treated with lateral external fixation with attention given to the treatment method and potential complications.
Materials and methods: 29 patients with SHF were treated with lateral external fixation. Patient's charts were analysed retrospectively. Functional and cosmetical outcome was assessed at f-up examinations with regard to carrying angle, malalignement and loss of motion.
Results: 28 patients (14 girls,15 boys)with Gartland Type III fracture and one with Y-type fracture of the distal humerus were included. The mean age at injury was 6.5 years (range 2.4-9.9 years). Postoperatively 3 (10%) patients showed complete radial palsy. On surgical revision in one case the radial nerve showed superficial lesions and direct contact with the proximal pin, in one patient the radial nerve was totally transsection above the level of the pin and in the third patient no macroscopic damage of the nerve was detected. The transsected nerve was reconstructed using a sural nerve autograft. In all patients complete recovery has been observed within 2 to 6 months. All 3 patients in common was a high inserted proximal pin, 2.9–3.6 cm above the fracture line. The cosmetic results were good (8%) or excellent (88%) only one patient (4%) showed loss of carrying-angle of 20°. The functional outcome was satisfactory in all patients, 83% showed excellent, 10% good and 7% fair results.
Conclusion: lateral external fixation of SHF is an alternative method for the treatment of displaced or unstable fractures. Even if this method is simple facilitating reduction and stability of fixation of the fracture, iatrogenic radial nerve injury during insertion the proximal pin is a risk. We therefore strongly recommend inserting the proximal pin under direct vision within 2 cm from the fracture line, using a trocar system.

P 54

Surgical treatment of unstable slipped capital femoral epiphysis with a modified Dunn procedure

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Introduction: Slipped capital femoral epiphysis (SCFE) with epi-metaphyseal discontinuity are at increased risk for osteonecrosis after surgical treatment. In so called unstable cases with clinically suspected discontinuity of the epi-metaphysis, in situ pinning with or without closed reduction is the preferred treatment of most surgeons. Recently developed clinical awareness of subtle anatomic abnormalities and altered biomechanics leading to hip impingement and osteoarthritis have fostered surgical strategies designed to restore the femoral head-neck offset after SCFE to improve long-term outcome. We evaluated the results of a modified Dunn procedure for the treatment of unstable slipped capital femoral epiphysis with regard to clinical outcome and adverse events such as avascular necrosis (AVN) and chondrolysis.
Methods: This retrospective case series (Level of Evidence IV, therapeutic study) assessed the results of a modified Dunn procedure in 28 cases of SCFE with intra-operatively confirmed discontinuity between the epiphysis and metaphysis. The gender ratio was 14 female and 14 male patients, the average age was 11.7 ± 1.4 years (9–14 years). Mean follow up was two years (12–83 months). Results: All but one of the twenty-eight hips (96.4%) had excellent clinical and radiological outcome. All but one case demonstrated range of motion of the treated hips comparable to th e unaffected sides; flexion was 103 ± 14°, 60°–120° versus 110 ± 31°, 9 0°-120° (p= 0.374), internal rotation 31 ± 12.8 °, 10°–50° versus 31 ± 12.3°, 10°-50° (p = 0.930) and all hips reached full extension. At follow up, the Harris Hip and the Merle d Aubigne' scores were 99 and 17 respectively. AVN occured in one case (3.5%) while there was no chondrolysis evident. Radiological

measurements demonstrated a successful correction of the slipping angle (pre-op: 62 ± 12.3°, 30°-80° post-op: 4.9 ± 4.2°, 0°-16°, p <0.001).
Conclusions: The modified Dunn procedure is a reasonable treatment for SCFE. The results demonstrate it prevents the hip from developing early osteoarthritis due to FAI, as well as decrease adverse events such as AVN in the treatment of unstable lipped capital femoral epiphysis.

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Radiofrequency Thermal Ablation (RF) for the Treatment of Chondroblastoma

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Introduction: Chondroblastoma accounts for about 1% of primary bone tumors. Most lesions are located in the epiphysis of adolescent patients with still active epiphyseal growth [1]. Recurrence of this benign lesion is 10–35% [2] and biopsy path contamination has been reported [3]. The recommended treatment is surgical removal by curettage either alone or in conjunction with bone grafting [1, 2].
In some cases the location may be difficult to access surgically. Radiofrequency thermal ablation for treatment of bone tumor was first described in 1992[4] and has become the treatment of choice in osteoid osteoma [5, 6]. A few cases of chondroblastoma treated by radio-frequency have recently been reported [7–10].
Methods: We have treated two patients with suspected chondroblastoma with RF. Both patients had still open physes. One lesion was located in the femoral head in a 15 year old boy and the other was posteriorly in the proximal tibia in a 14 year old girl. The lesions were proven to be chondroblastoma by needle biopsy. Subsequent RF ablation was performed during the same procedure with slow removal of the still heated RF probe (80°).
Results: The lesion in the boy was curetted in a second procedure and the femoral head was filled with cancellous bone graft because of the size of the lesion and its subchondral location. No condroblastoma was shown in the curetted specimen. He is asymptomatic at 18 month postoperatively with incorporation and remodeling of the bone graft. The Girl was pain free immediately following RF ablation and the signal activity around the lesion has disappeared indicating inactivation of the chondroblastoma.
Conclusion: RF ablation, the standard in treating osteoid osteoma, appears to be an option to treat chondroblastomas and may especially be considered in locations difficult to access surgically as in our two patients.
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Growing Prosthesis for Osteosarcoma of the Distal Femur in the Growing Skeleton

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Case: A 6 year-old girl presented with an osteosarcoma of the left distal femur. Staging revealed that there was no metastatic disease, however, there was a skip lesion in the ispilateral proximal femur. After completing neoadjuvant chemotherapy according to the Euramos protocol, the patient underwent limb-sparing surgery. Because the femoral vessels were free of tumor, rotationplasty would be preferred over amputation. Because of ethnical background of the family, a mutilating surgery was denied under any circumstances. We chose to insert a growing prosthesis of the femur. There were no intraoperative complications, and adjuvant chemotherapy was completed uneventfully. Nine months postoperatively, two undetermined lesion in the lung were detected by chest CT. A bilateral thoracotomy revealed no evidence of metastasis. At six months as well as nine months, the prosthesis was lengthened by 3 and 4 mm, respectively. The lengthening procedures were performed on a outpatient basis, taking only five minutes and without any pain. At the one year follow-up, the radiographies revelaed good incorporation of both the femoral and tibial shafts, and the patient was walking without crutches.
Conclusion: A growing prosthesis constitutes an alternative to rotationplasty in selected cases in tumor patients with a growing skeleton. Patients and parents need to be aware that such prosthesis does not represent a durable construct in the longterm, and is very expensive.

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Hemicylindrical Excision of the Posterior Proximal Part of the Tibia for Chondrosarcoma

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Case: A 15 year old girl from Russia was diagnosed with a chondrogenic tumor of the posterior aspect of the proximal tibia. Amputation was recommended, which was however refused by the parents. One year after diagnosis, sought medical attention in Switzerland with the quest to keep the leg despite the fact that the tumor grew to 7 cm in size displacing the dorsal neurovascular bundle in and distal of the poplitea. A biopsy revealed chondrosarcoma grade 2, the tumor was infiltrating the dorsal third of the tibia and growing between tibia and fibula anteriorly, with intimate contact to the popliteal vessels with its distributions, as well as to the tibial and peroneal nerves. A dorsal midline as well as antero-lateral incisions were performed, keeping the neurovascular supply to both heads of the gastrocnemii as well as the tibial artery alone (and clipping of the tibial anterior and peroneal arteries) intact. This allowed performing an osteotomy from the anterior to the dorsal incision thereby cutting the tibia in half without violating the tumor. Horizontal osteotomies were performed in the depth of the poplitea under protection of all neurovascular structures as well as the posterior cruciate ligament. The tumor was completely removed together with the fibula (keeping only the most proximal part), margins were negative for tumor as analyzed by pathology. The bony defect was filled by adapting an allograft into the defect, fixed with three srews. Postoperatively, there were no complications, particularly no neural deficits. The patient was allowed partial weight bearing and was mobilized with crutches. At three months followup, the graft showed incorporation and weight bearing could be increased.
Conclusion: Malignant tumors of the dorsal posterior aspect of the tibia represent a challenge because of their proximity to important anatomical structures. Besides nerves and vessels, the ligaments (particularly the LCL and posterior cruciate ligaments) have to be carefully studied preoperatively. A local resection without segmental tibia resection (or entire resection of the proximal tibia) is possible from posteriorly if the vital structures can be preserved.

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Epiphyseal Growth Plate Transfer after Tumor Resection in the Growing Skeleton

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Case: A 7 year old girl was diagnosed with osteosarcoma of the proximal left humerus. After completing neoadjuvant chemotherapy according to the Euramos protocol, staging revealed that both the shoulder joint and the neurovascular plexus continued to be uninvolved by the tumor. A transarticular resection was indicated. There are no good options for reconstruction in the growing skeleton. Epiphyseal Growth Plate Transfer is a viable option for tumor patients with the growing skeleton. The fibula is usually used for transfer. Because the epiphysis of the fibula is perfused by the anterior tibial artery (and not the peroneal artery), harvesting of the vascularized fibula for transfer is a real challenge because it is based on the tibial artery and not the superficial peroneal artery. For this purpose, the peroneal nerve with its branches have to be dissected off and the intraosseous membrane perforated to visualize the anterior tibial artery leading to the popliteal artery. Half of the biceps femoris tendon is used to reattach the fibula at the insertion of the long biceps tendon of the shoulder. The LCL is refixed to the tibia. The entire fibula was then intubated into the remaining humeral shaft providing a press-fit. The rotator cuff was reattached to the neo-humeral head taking care not to compromise the microvascular anastomosis and its supply to the fibular head. Postoperatively, the shoulder was immobilized for six weeks, after which passive range of motion exercised were begun. There were no intra- and postoperative complications, the tumor was removed with wide margins, and adjuvant chemotherapy could be

resumed less than 2 weeks postop. At nine months followup, the girl had no pain and was able to use her arm with limitations only above shoulder level. Radiologically, the fibular head is perfused and radiographically starts to remodel.
Conclusion: Epiphyseal Growth Plate Transfer is surgically challenging, but may represent a good biological option for reconstruction in the growing skeleton after tumor resection.

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The Friedman-Eilber Resection Arthroplasty of the Pelvis for Type II Resections

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Case: Major tumor resection of the pelvis without reconstruction of the pelvic ring is thought to be associated with poor ambulation and poor acceptance of the patients. Therefore, reconstruction of the pelvic ring –after type II resections- continues to be envisaged depending on the patients' expectations and situations. However, each pelvic reconstruction is associated with considerable complications which may lead to dismal outcome. We have treated two patients (79 and 62 year old men) who both had a huge chondrosarcoma of the pelvis (type II and type II-III resections) with resection arthroplasty, removing the pelvis and in one patient including the femoral head. The remaining femur was cerclaged to the remaining pelvis, and the hip was immobilized for 12 weeks in a hip-leg cast to allow cicatrisation. A shoe lift of 2 and 3 cm respectively was necessary. At a follow-up of at least one year, both patients were able to ambulate without crutches, and to walk on stairs.
Conclusion: The Friedman-Eilber resection arthroplasty of the pelvis for Type II resections is a good option for selected patients and situations. Reconstruction is safe and minimal, the rate of complications is low, and functional outcomes acceptable. Immobilisation of the hip seems to be the key.

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Interdisciplinary treatment of periprosthetic infections with germs difficult to treat

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Introduction: Treating patients with periprosthetic infections caused by germs difficult to treat (GDT) is challenging. A standardized procedure is often complicated both by multiple antibiotic (AB) resistances as well as by partially distinctive biofilm creation of bacterial subpopulations. According to the "Liestaler Treatment Algorithm" we present our results of periprosthetic infections with germs difficult to treat.
Methods: Between 2006 and 2008 21 patients (knee: n = 9, hip: n = 12) with periprosthetic GDT infections were treated. The clinical follow up was 15 ± 3 month. As published a two-stage revision procedure was aspired without foreign material. We investigated local and systemic risk factors, resistances, and duration as well as appropriateness of AB therapy. Our treatment was based on a weekly infectiological-surgical ward round and was evaluated by erasure rate of infection after one year.
Results: We detected 8 multiresistent staphylococci, 6 chinolon-resistent pseudomonas, 4 chinolon-resistant enterococci, 2 vancomycin-resistant enterococci, and 1 ESBL. 14 patients (66.6%) were free of infection after 1 year. 5.4 ± 3.5 [1–18] revisions were necessary after explantation. In 19 (90.5%) cases, our antibiotic therapy had to be individualized from the published treatment algorithms. Considering antibiotic resistances 16 patients (76.2%) were treated adequately while 5 patients (23.8%) were treated at least partially inadequate resulting in a reduced salvage rate (75% vs. 40%). In 5 cases (23.8%) a temporary spacer was implanted. This procedure not concurring with our initial algorithms was performed because the germ was not characterized as difficult to treat preoperatively. The correct characterization was not successful until intra-operative probes were cultivated.
Conclusion: Treating periprosthetic infections with germs difficult to treat requires an individualized treatment strategy. A two stage revision without foreign material should be set as standard procedure. Implanting temporary spacers cannot be recommended because of reduced salvage rates if treating germs difficult to treat.

P 61

Do surgical drains constitute a potential risk factor for surgical site infections in orthopedic surgery?

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Clinical questions: Do surgical drains become colonized by skin flora from outside in? Do surgical drains become colonized by bacteria of known surgical site infections?
Material and methods: Surgical drains were removed under sterile conditions and the part inside of the wound was separated and labelled in four pieces starting with number 1 to 4 from the skin towards the inside of the wound. The fist 3 pieces were separated every two centimetres; the last piece was kept as long as the remaining drain. Each drain piece was transported to the microbiology testing in a separate sterile container and analyzed for bacterial growth. If growth occurred, the pathogen was identified and the colony forming units were counted. Drains were pulled on the postoperative day as specified by the surgeon.
Results: 102 drains in 57 patients were analyzed. 15 drains (14.7%) grew organisms in 11 patients (19.3%). Two patients (6 drains, 5 with growth) had a known surgical site infection and the pathogen identified on the drain was identical to the pathogen in intraoperative biopsies, one patient with Enterococcus and one with staphylococcus capitis. Nine drains (9 of 96, 9.4%) in 9 patients of 55 non-infected patients grew organisms on the drain. The majority of this growth occurred in the parts of the drains close to the skin. The pathogens of these non-infected drain colonizations were skin flora consisting of coagulase negative staphylococcus aureus (7 drains), staphylococcus hominis (1 drain), and staphylococcus aureus (1 drain).
Conclusions: Drains represent a foreign body and skin bacteria can colonize and migrate along these into the wound. Drains also do grow microorganisms of surgical site infections. Drains constitute a surface for biofilm formation. If drains are removed on day one or two after surgery they likely do not represent a risk for drain induced surgical site infection but if left in place longer there is potential for biofilm formation through skin bacteria and/or persistence of bacteria from surgical site infections. These biofilms do constitute a risk for "outside-in" or persistent "inside" infections.

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Biological relevance of Chemokine Receptors CXCR4 and CXCR7 and their ligand CXCL12 in Osteosarcoma Metastasis

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Introduction: Osteosarcoma (OS) is a malignant bone tumor with high propensity for metastasis and consequently poor prognosis. It predominantly occurs in children and young adults between 5 and 25 years of age. Despite the introduction of neo-adjuvant chemotherapy in combination with surgical resection of the primary tumor, patients with metastatic disease have a 5-year survival rate of only 10–20%, therefore new therapeutic approaches are urgently needed. The Chemokine receptor CXCR4 and its ligand CXCL12 (SDF-1) were shown to be implicated in primary tumor growth and metastasis of tumors. Tumor cells expressing CXCR4 follow a CXCL12 gradient guiding them to secondary organs (homing) where they produce metastatic lesions.
Methods and results: We performed an antibody therapy study using LacZ tagged 143B cells in a xenograft OS mouse model. We orthotopically injected 143B (OS) LacZ cells into the tibia and intravenously administered the anti-CXCR4 antibody 12G5 at two different concentrations (low and high). We found a massive reduction of osteolysis (assessed by X-ray) comparing the antibody treatment groups (low and high) with the control group. Further we observed a massive decrease of the primary tumor size between the treated animals with high antibody concentration compared to the control group. Most importantly we found statistically significantly ($p < 0.001$) less micrometastases in mouse lungs of the two treatment groups compared to lungs of the control group animals. Further we found that the number of macrometastases was massively reduced (3 out of 8) in the high antibody treatment group compared to the low antibody and the control group.
Conclusions: In an antibody therapy study using an orthotopic xenograft mouse model where we intratibially injected LacZ tagged 143B cells we could show that the administration of a CXCR4 blocking antibody led to reduction of osteolysis and primary tumor growth. Further we found that the application of this antibody led to significant reduction of lung micrometastases ($p < 0.001$) as well as to a decrease of the number of macrometastases.

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In-vitro testing of biofilm formation on infected bone grafts and bone substitutes

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Background: Bacteria form biofilms on the surface of orthopaedic devices, causing persistent infections. Monitoring biofilm formation on bone grafts and bone substitutes is challenging due to heterogeneous surface characteristics. We analyzed various bone grafts and bone substitutes regarding their propensity for in-vitro biofilm formation caused by *S. aureus* and *S. epidermidis*.
Methods: Beta-tricalciumphosphate (β-TCP, ChronOs™), processed human spongiosa (Tutoplast™) and PMMA (Palacos™) were investigated. PE was added as a growth control. As test strains *S. aureus* (ATCC 29213) and *S. epidermidis RP62A* (ATCC 35984) were used. Test materials were incubated with 10^5 cfu/ml. After 24 h, test materials were removed and washed, followed by a standardised sonication protocol. The resulting sonication fluid was plated and bacterial counts were enumerated and expressed as cfu/sample. Sonicated samples were transferred to a microcalorimeter (TA Instrument) and heat flow monitored over a 24 h period with a precision of 0.0001°C and a sensitiviy of 200 µW. Experiments were performed in triplicates to calculate the mean ± SD. One-way ANOVA analysis was used for statistical analysis.
Results: Bacterial counts (log_{10} cfu/sample) were highest on β-TCP (*S. aureus* 7.67 ± 0.17; *S. epidermidis* 8.14 ± 0.05) while bacterial density (log_{10} cfu/surface) was highest on PMMA (S. aureus 6.12 ± 0.2, *S. epidermidis* 7.65 ± 0.13). Detection time for *S. aureus* biofilms was shorter for the porous materials (β-TCP and Tutoplast, p <0.001) compared to the smooth materials (PMMA and PE) with no differences between β-TCP and Tutoplast™ (p >0.05) or PMMA and PE (p >0.05). In contrast, for *S. epidermidis* biofilms the detection time was different (p <0.001) between all materials except between Tutoplast and PE (p >0.05).
Conclusion: Our results demonstrate biofilm formation with both strains on all tested materials. Microcalorimetry was able to detect quantitatively the amount of biofilm. Further studies are needed to see whether calorimetry is a suitable tool also to monitor approaches to prevent and treat infections associated with bone grafts and bone substitutes.

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How degree of correction affects first metatarsal osteotomy biomechanics in hallux valgus treatments

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Introduction: The chevron osteotomy has been shown to provide superior mechanical stability, but excessive correction can lead to complications. The scarf osteotomy has a great corrective potential, but complications such as fracture or troughing have been reported. An intermediate design, the reversed-L osteotomy, has recently been developed at our institution to combine the advantages of the scarf and chevron. This parametric study compares the reversed-L, scarf and chevron for different severities of correction, in terms of fragment contact area, stiffness, and bone strain distribution.
Methods: An intact human first metatarsal bone was scanned using a µCT system. Using 3D reconstruction, a finite element model of 150'000 elements was created. The elastic modulus of each element was set according to corresponding bone density. Corrections were simulated in 1mm steps, from 0 to 10 mm for the scarf and reversed-L, and from 0 to 5mm for the chevron. Immediate post-operative / healed behaviors were modeled by tying both fragments only at the interface compressed by the screw / over the whole cut interface respectively. The proximal end was held fixed and loads were applied to the distal end. Cantilever and a physiologic configuration mimicking loads at push-off were applied. The models were validated against previous experimental measurements.
Results: The model was in excellent agreement with validation experiments, permitting further investigation with the model. The simulated reversed-L stiffness and bone strains were comparable to the chevron, while achieving a greater contact area. The reversed-L osteotomy was stiffer than the scarf in all cases, and peak stresses were lower, except for corrections exceeding 7 mm under physiological loading in the simulated postoperative state. Increasing correction generally decreased both contact area and bone stiffness and increased bone stresses for all tested osteotomy designs.
Conclusion: This study is the first to quantitatively examine biomechanical consequences of first metatarsal osteotomy as a function of severity of correction. The reversed-L osteotomy allowed more correction than the chevron while generally achieving a superior biomechanical performance than the scarf. The high stresses under physiologic loading in the directly postoperative state support the importance of a recovery period for corrections of more than 7 mm in the reversed-L.

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Feasibility study on the use of collagen cross-linking to reinforce tendon mechanics

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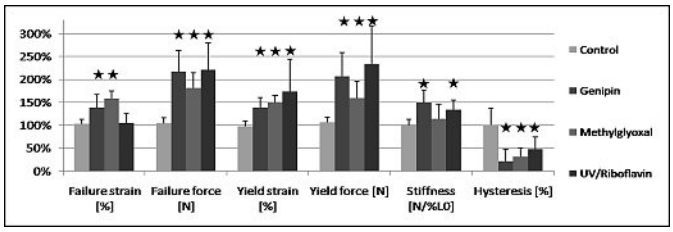
Introduction: Exogenous collagen cross-linking in vertebral disc annulus has indicated that improved tissue strength, fatigue and tear resistance can lead to improved whole disc biomechanics [1–4]. We hypothesize that similar treatments could be used in tendon to prevent progression of partial tendon lesions. The goal of this preliminary study was to quantify the effect of three potential cross-linking methods on tendon mechanics.
Methods: Cross-linking agents were selected based on their reported cross-linking potential and sufficiently low toxicity. Rat tail tendon fascicles were dissected and cut in half for paired analysis. One half was cross-linked using Genipin (n = 7), Methylglyoxal (n = 7), or UV irradiation with a photosensitive crosslinker (riboflavin, n = 6). The other half of the fascicle pair was designated as a matched (untreated) control. A further control group with two untreated halves verified the paired testing approach (n = 6). All samples were finally tested in uniaxial tension until failure [5].



Results: See figure. Treatment effects were normalized to the matched control. (*denotes significant difference with a p-value <0.05).
Conclusion: Cross-linking improved stiffness, failure behavior, hysteresis and cyclic relaxation (data not shown). Based on these results, all three cross-linking methods are candidates for use in reinforcing injured or healing tendon or to halt progression toward a full tear. This method is now being tested in a clinically relevant model of partial tendon tear propagation.
1 Wagner, et al. (2006); 2 Chuang, et al. (2007); 3 Hedman, et al. (2006); 4) Yerramalli, et al. (2007) 5 Fessel and Snedeker (2009).

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Can a natural insertion of the Rotator Cuff be induced by Tenocytes of Chronic Tears? The role of Platelet Released Growth Factors on Cell-Proliferation and ECM Synthesis in vitro

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Introduction: Bone to tendon healing after rotator cuff repairs is mainly impaired by poor tissue quality. The tenocytes of chronic rotator cuff tendon tears are not able to support the synthesis of physiologic fibro-cartilagenous tissue and extracellular matrix (ECM), especially the collagens 1,2,3 and 10 and the proteoglycans decorin, biglycan and aggrecan.
Methods: To test the hypothesis that PRGFs may improve cell proliferation, and ECM synthesis in chronic rotator cuff repair, we cultured tenocytes from 8 chronic rotator cuff tears for 4 weeks in different media: Group 1 with normal medium (NM = IMDM+ 10% FCS+1% EAA+0,5µg/ml ascorbic acid) and group 2 with additional 10% PRGF (PRGF). Cell proliferation was measured at 14, 21 and 28 days by cell counting. Messenger RNA (mRNA) levels of Coll-1, -2, -3, -10, decorin, biglycan, and aggrecan were measured using real time RT-PCR normalized to 18S RNA. Immunohistocyto-chemistry (IHC) was also performed.
Results: The proliferation rate of tenocytes was significantly higher at all time points when cultured in PRGF than in NM (x4.9, x5.8, x4.1, and x4.9 respectively, p = 0.0001). The tenocytes also maintained their phenotype over time. At 14 and 28 days, the mRNA levels for Coll-1, -2 , -3, -10 and for the analyzed proteoglycans decorin, aggrecan, and biglycan were higher in the PRGF group than in the NM group. The mRNA overexpression in the PRGF group was confirmed at a protein level by IHC.
Conclusions: PRGFs enhance tenocyte proliferation and promote synthesis of ECM similar to physiologic human rotator cuff insertion in culture. PRGFs should be further studied as a potential source of autologous growth factors for rotator cuff repair.

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Effect of age on fatty infiltration of supraspinatus muscle after experimental tendon release in rats

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Introduction: Rotator cuff tears are a highly prevalent musculoskeletal disorder leading to deterioration of the musculotendinous unit, characterized by atrophy, fibrosis and irreversible fatty infiltration of the muscle. The pathophysiology of fatty infiltration is not well known. A small animal model in which investigations of cellular and molecular mechanism were feasible is therefore desirable. While there have been efforts to establish a rat model for chronic rotator cuff tears, fatty infiltration has not been shown so far. Most of the investigated models used young animals with higher regeneration potential compared to aged animals. We hypothesized that fatty infiltration may be seen after retraction of musculotendinous unit in aged rats, whereas it should not or to a lesser extent be seen in younger animals.
Materials and methods: The supraspinatus tendon was released by tenotomy in 3 aged (24 months old) and 3 young (6 weeks old) Sprague Dawley rats (group I and II). Other 3 aged (24 months old) rats underwent sham surgery and served as a control group (group III). In group I and II retraction of the musculotendinous unit was allowed for 6 weeks. All animals were killed 6 weeks after surgery and the supraspinatus muscles were harvested. Each sample was divided by half and subsequently fatty infiltration of the muscle was quantified by histological methods and micro-CT.
Results: Tenotomy resulted in an insignificant increase of fat cells in histological sections in both, aged and young rats. Micro-CT was able to quantify small differences in the linear attenuation coefficient of muscles; the absorption of the muscle samples was 8.1% ± 11.3% lower in retracted muscles (group I and II) compared to the control (group III), indicating a tendency towards a higher amount of intra- and/or extracellular fat. Absorption was 4.28% ± 3.2% higher in aged compared to young muscles; however, this could not be confirmed in histology.
Conclusion: Fatty infiltration following chronic retraction after tenotomy of the supraspinatus muscle of aged rats could not be shown in the present model by histology. Although micro-CT was able to reveal differences in absorption, the differences seem insufficient to make the rat supraspinatus model relevant for investigations considering fatty infiltration of the chronically retracted muscle.

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Skill performance of novice, intermediate and experienced surgeons in a novel mirrored arthroscopic versus conventional arthroscopic view

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Introduction: Three-dimensional orientation in arthroscopy can be technically very demanding and is, besides patient and organ-specific factors, depending on variables such as: Experience of the surgeon, personal ability and orientation of the arthroscope and instruments relative to the surgeon. When the arthroscope is directed towards the surgeon, the displayed instrument is moving in the opposite direction to the executed motion which can be avoided by mirroring of the image. Therefore we speculated that when the camera is directed towards the surgeon, in a mirrored projection on the video screen, arthroscopic orientation is likely to be easier and more natural. The aim of the study was to evaluate if mirroring of the arthroscopy image may facilitate to complete a simple task in respect of the personal ability and experience.
Methods: We designed a simple box for skill testing with two openings at the surgeon's side and two on the opposite side. The skill test entails grasping and transfer of six wooden sticks with the time until completion recorded. Three groups (students, residents with few arthroscopic experience and experienced arthroscopic surgeons) performed the test, each with four different positions of camera and instrument, once with conventional projection and once with mirrored image.
Results: The time to completion of the tests was strongly variable between positions and type of display. Far easiest for everyone were tasks, in which the surgeon was behind the camera. With camera orientation towards the surgeon, inexperienced surgeons tended to benefit more from a mirrored view.
Conclusion: Arthroscopic surgeons can improve their performance significantly by standing behind the camera. This is particularly the case for inexperienced surgeons. If the orientation of the camera has to be towards the surgeon, mirroring of the image may be beneficial for individual surgeons.

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Overexpression of Matrix Metalloproteinase 1 (MMP-1) in HOS osteosarcoma cells induces formation of primary tumor and lung metastases in vivo

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Introduction: Osteosarcoma is the most frequent primary malignant tumor of bone typically affecting children and young adults. It is associated with a very poor prognosis particularly for those patients with metastasis at diagnosis. Proteolytic activity is important at multiple stages of metastasis, including invasion and migration. We have shown that MMP-1 is strongly upregulated in highly metastatic 143-B osteosarcoma cells in comparison to the parental HOS cells. In different in vitro assays we have compared HOS/LacZ cells containing the empty vector with the cells overexprssing MMP-1.
Methods: Two cell lines (HOS/LacZ+empty vector and HOS/LacZ+MMP-1) were generated by retroviral infection and MMP-1 protein expression was analyzed by Western blot with cell supernatants. 5X10E5 tumor cells were orthotopically injected into the tibia of SCID mice. The size of the leg (length and with) were measured using a caliper rule. Tumor growth and osteolysis in the bone were visualized by x-ray. Isolated lungs were stained in X-Gal solution and metastases were quantified.
Results: By western blot analysis we found no MMP-1 protein in the supernatant of HOS/LacZ+empty vector cells, but significant amounts for HOS/LacZ+MMP-1 cells. 60 days after injection of HOS/LacZ+empty vector cells into the tibia neither a primary tumor nor metastases in the lung were detected. After injection of HOS/LacZ+MMP-1 cells we observed primary tumor growth and strong osteolysis in the tibia of the injected legs and many micrometastases (Ø <100 µm) in the lungs, the primary organ of metastases for osteosarcoma.
Conclusions: Our results from in vivo experiments indicate that strong expression of MMP-1 protein promote the formation of osteosarcoma primary tumor in the bone and metastases in the lung.

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Role of CD44/Hyaluronan Interaction in Metastasis and Chemoresistance of Osteosarcoma

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Introduction: Osteosarcoma (OS) is the most common primary malignant bone tumor in children and adolescents and the 5-year survival rate of osteosarcoma patients who present with metastasis is only 20%. The poor survival rate of these patients is largely due to the lack of responsiveness to chemotherapy. CD44 is often overexpressed in tumor cells and has been implicated in metastasis. It is a cell-cell and cell-matrix adhesion molecule and the principal receptor for hyaluronan (HA). CD44 is a transmembrane glycoprotein involved in development, inflammation, hematopoesis, wound healing, immune response and tumor progression. HA and CD44 also promote drug resistance in variety of cancer cell types.
Methods: The expression of CD44 was investigated by Western blot analysis of cell extracts of four established human OS cell line systems, consisting of parental cell lines with low metastatic potential (MG63, Huo9, HOS, Saos-2) and respective sublines (Mg63-M8, Huo9-M132, 143B, LM5) with high metastatic activity. Extracellular deposition of HA was analysed by particle exclusion assay. Prevously, it was shown via the WST-1 assay that highly metastatic cell lines MG63-M6 and –M8 exhibit higher resistance to chemotherapeutic drugs than the parental MG63 cell line. Here, MG63 cells were cultured on HA coated plates, while MG63-M8 cells were pretreated with the inhibitor of HA synthesis 4-MU, hyaluronidase or low molecular HA and the cytotoxicity of cisplatin, doxorubicin and etoposide was assessed with the WST-1 assay.
Conclusions: CD44 is upregulated at the protein level in three out of four highly metastatic OS sublines compared to the respective parental cell lines, implicating a role for CD44 in metastasis of OS. Inhibition of HA synthesis, perturbation of HA deposition and growth on exogenous HA had no effect on resistance of MG63 and MG63-M8 cells to etoposide, cisplatin and doxorubicin. Therefore, HA/CD44 interaction seems not to affect the chemoresistance of this particular OS cell line.

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Quercetin: a potential drug in osteosarcoma treatment

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Introduction: Osteosarcoma (OS) is the most common malignant bone tumor in children and young adults. Since chemotherapy was introduced the 5-year survival rate of OS patients with non-metastatic disease reaches ~70%. The main problems in OS therapy are metastases, severe side effects of aggressive chemotherapy and

chemoresistance. The present study investigates the anti-proliferative and cytotoxic potential of quercetin in two different OS cell lines. Quercetin is a flavonoid, which is widely found in the plant kingdom. Several studies indicate that quercetin exerts anti-proliferative effects and/or apoptosis inducing activity. Moreover, the effects were shown to be rather selective for cancer cells. Because quercetin appears to be associated with little toxicity when administered orally or intravenously we sought to assess the relevance of this compound in OS treatment.
Methods and results: As a first screening for a potential growth inhibitory effect of quercetin on OS cells the WST-1 assay was performed for three OS cell lines and their higher metastatic sublines. Treatment of all OS cell lines with quercetin resulted in a dose-dependent decrease of viable cells. The effect was comparable among all OS cell lines. Further it was investigated whether the quercetin dependent decrease of viable cells is due to cytotoxic or cytostatic effects. Therefore the cell number and cell viability was determined 48h following quercetin treatment in 143B and MG63 cells using Guava Cell Viability Assay. The results indicate that quercetin has cytostatic effects and dose and time dependent induced cell death. Dose dependent inhibition of cell division following quercetin treatment was shown using the CFSE Assay. Moreover it was shown by Flow Cytometry with 24h quercetin treated, fixed and PI stained cells that cell growth inhibition is due to G2/M arrest. Quercetin treatment and inhibition of quercetin induced PARP cleavage by the pancaspase inhibitor Z-VAD-FMK suggests that induction of apoptosis is the mechanism through which the drug causes cell death.
Conclusions: This in vitro project investigates the potency of the natural compound quercetin in OS treatment. We could show in two different OS cell lines that quercetin treatment induces growth inhibition by G2/M phase arrest and apoptosis. The in-vivo effect of Quercetin has to be assessed in further experiments.

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A Comprehensive Computer-assisted Application for Diagnosis, Planning and Conduction of Navigated Joint Preserving Surgery in Patients with Femoroacetabular Impingement

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Traditional clinical and radiographic examinations for diagnosis of femoroacetabular impingement (FAI) do not comprehend the three-dimensional and dynamic characteristics of the disease. Furthermore, preoperative planning tools are rare. A comprehensive computer-assisted application for diagnosis, planning and conduction of navigated joint preserving surgery was developed and validated. The diagnosis application utilizes a 3D model of the patient's hip joint, that can be created from different radiographic imaging studies (e.g. CT, MRI). After collision detection is performed, location and extent of impingement is depicted. In the planning application a virtual osteochondroplasty can be performed manually, or automated by definition of desired range of motion or 3D alpha angle. The planned models can be re-tested in the diagnosis application again. Afterwards, an osteochondroplasty can be performed using a navigated reaming device guided by the navigation application. Changes to the bone are tracked by color coding and real-time alteration of morphology. Finally, the diagnosis can be run again, in order to ensure sufficient resection. In an evolutionary process in sawbone and cadaver experiments, we initially validated a novel diagnostic hip joint simulation method called the Equidistant Method. This method proved to be superior to preexisting simulation methods with statistical significance regarding angular and linear accuracy. Based on the diagnosis tool, we developed an application for preoperative planning and another application for conduction of navigated osteochondroplasty procedures using surgical milling devices. Feasibility to plan and conduct surgery was again validated in sawbone and cadaver trials and showed reliable and reproducible results. In conlusion, we present a validated, comprehensive computer-assisted treatment framework for diagnosis, preoperative planning and navigated treatment of FAI. Future research is directed at implementation into arthroscopic procedures.

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Development of a multi optional device for periprosthetic greater trochanter fractures

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Introduction: Fixation of periprosthetic greater trochanteric fractures requests very demanding features on fixation devices. Whereas high dislocating forces ask for strong and bulky implants, the sensitive peritrochanteric region asks for slim implants minimizing interference with the abductor muscle insertion and the iliotibial band. The aim of this interdisciplinary investigation was to end up with a fixation device, which fulfils the following criteria: 1) at least as strong as other devices on the market, 2) best possible fit to the bony surface, 3) modularity in order to adapt on different fracture types.
Methods: In a first step, vectors of dislocating forces were identified using 3 cadaver dissections in consensus of 3 orthopedic surgeons. In a second step 3-D data of a set of more than 20 femora was used to design a new mean anatomical device, which can counteract dislocating forces in several vectors defined previously and ideally fit the bony surface. In a third step nonlinear finite element analysis was used in order to optimize the design in terms of the best relationship between mechanical strength, volume and producibility. Finally the implant was tested again using mechanical tests and nonlinear finite element models and compared with two actually most frequently used devices.
Results: Step 1 led to a device concept which must counteract forces in cranio-posterior, cranial and anterior direction having at least 3 claws. Step 2 resulted in two different designs for left and right hips as well as two sizes. Step 3 optimized the device in terms of mechanical characteristics, including a modular claw which is multi optional and can be implicated in situ. Step 4 verified the new device with regard to mechanical characteristics at least as strong as the Kerboul and the Trofix plate. The first devices have already been implanted in patient and seems to fulfill our expectations.
Conclusion: Conventional fixation techniques still can be improved when – due to interdisciplinary collaboration of surgeons, engineers and industrial partner – distinguished very sophisticated advances in technology become available.

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EWS-FLI-1 modulates miRNA145 and *SOX2* expression to initiate mesenchymal stem cell reprogramming toward Ewing sarcoma cancer stem cells

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Introduction: Cancer stem cells (CSC) display plasticity and self renewal properties reminiscent of normal tissue stem cells but the events responsible for their emergence remain obscure. We have recently identified CSC in Ewing sarcoma family tumors (ESFT) and shown that they arise from mesenchymal stem cells from the bone marrow.
Objective of the study: To analyze the mechanisms underlying cancer stem cell development in ESFT.
Methods: Primary human mesenchymal stem cells (MSC) isolation from adult and pediatric bone marrow. Retroviral delivery of fusion protein (EWS-FLI1) to primary MSC, and transcriptional and phenotypical analysis.
Results: We show that the EWS-FLI-1 fusion gene, associated with 85–90% of ESFT and believed to initiate their pathogenesis, induces expression of the embryonic stem cell (ESC) genes *OCT4, SOX2* and *NANOG* in human pediatric MSC (hpMSC) but not in their adult counterparts. Moreover, under appropriate culture conditions, hpMSC expressing EWS-FLI-1 generate a cell subpopulation displaying ESFT CSC features *in vitro*. We further demonstrate that induction of the ESFT CSC phenotype is the result of the combined effect of EWS-FLI-1 on its target gene expression and repression of microRNA-145 (miRNA145) promoter activity. Finally, we provide evidence that EWS-FLI-1 and miRNA-145 function in a mutually repressive feedback loop and identify their common target gene *SOX2*, in addition to miRNA145 itself, as key players in ESFT cell differentiation and tumorigenicity.
Conclusion: Our observations provide insight for the first time into the mechanisms whereby a single oncogene can reprogram primary cells to display a cancer stem cell phenotype.

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Gene profiles in healing rat supraspinatus tendon

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Introduction: The objective of this study was to establish temporal gene expression with respect to structural and functional recovery in tendon to bone healing in a rat model of acute injury and repair. Genes known to be associated with regeneration of component tissues (tendon, muscle, cartilage and bone) were assessed.

Methods: Male Sprague Dawley rats underwent bilateral supraspinatutus tendon (SST) detachment and repair (n = 6 shoulders), as approved by the relevant Swiss authorities. Animals were sacrificed at 1, 2, and 4 weeks post injury and repair (n = 1 each). The SST were isolated, fresh frozen and total RNA was extracted, purified, processed for hybridization to Whole Rat Genome 4x44k OligoMicroarrays (Agilent G4131F) and analyzed according to standard practices of the University of Zurich Functional Genomics Center.
Results: Microarray analysis indicated a total of 9115, 8779, and 7374 re-regulated (twofold change in expression with p <0.01) genes at weeks 1, 2, and 4 respectively. Within these, relevant growth factor and matrix remodelling related gene expression profiles were analyzed, as were known tissue specific markers for tendon, fibrocartilage, and bone generation.
Conclusion: Consistent with the presence of granulated tissue, extremely large numbers of genes were regulated at early healing time points, with diminishing expression at 4 weeks. Within this gene set, known growth factors relevant to tendogenesis and osteogenesis were in some cases consistent with previous reports (Collagen 1, Tenascin C, Decorin, Versican, Elastin, Osteocalcin [1]) and in other cases not (TGF-β3 [2], BMP12 and BMP13 [3]). This study indicates the biological complexity of tendon to bone healing, and the challenges faced in devising a strategy for appropriate temporal sequencing of exogenously applied growth factors.
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Identification of Caprin-1 as a novel Cyr61-interacting protein with a potential role in Osteosarcoma metastasis

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Introduction: Osteosarcoma is the most frequent primary malignant bone tumor in children and adolescents with a high propensity for metastasis. Despite the significant clinical improvements through the use of combination of chemotherapy and surgery, patients with metastatic or recurrent disease continue to have a very poor prognosis. Cyr61 is a multifunctional protein that can stimulate angiogenesis and tumor growth. Aberrant expression of Cyr61 gene was associated with several pathological states including tumorigenesis. Recently, we showed that overexpression of Cyr61 in osteosarcoma cell lines enhanced their metastatic behavior in-vitro as well in-vivo. In this study, we undertook a proteomics approach to identify proteins interacting with Cyr61.
Methods: We have immunoprecipitated endogenous Cyr61 with a specific antibody and performed mass spectrometric analysis to identify Cyr61-interacting proteins. The effect of stable overexpression of human Caprin-1 was assessed by functional metastasis in-vitro assays as well as in-vivo using an orthotopic mouse osteosarcoma model.
Results: We identified Caprin-1 as a novel Cyr61-interacting protein. Furthermore, we showed that Caprin-1 overexpression enhanced cell proliferation, adhesion, migration and invasion in-vitro, thus enhancing their metastatic potential. Finally, by using an orthotopic mouse osteosarcoma model, we demonstrated that Cyr61 overexpression in osteosarcoma cells accelerated intratibial primary tumor growth and increased the number of lung metastatic lesions as well as a significant decrease of mouse survival.
Conclusion: Using a proteomics approach, we identified Caprin-1 as a novel Cyr61-interacting protein. Furthermore, we demonstrate that Cyr61 overexpression in osteosarcoma cell lines enhanced their metastatic behavior in-vitro as well as in-vivo. Currently, we are investigating in details the interplay between Cyr61 and Caprin-1 and their functions in the context of osteosarcoma metastasis.

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Cyr61 modulates the Akt pathway in Osteosarcoma and promotes bone tumorigenesis and lung metastasis in mice

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Introduction: Osteosarcoma is the most frequent primary malignant bone tumor in children and adolescents with a high propensity for metastasis. Surgery combined with chemotherapy significantly improved the outcome of local disease, but patients with metastatic or recurrent disease continue to have a poor prognosis. The human matricellular cysteine-rich protein 61 (CYR61) has been shown to have diverse functions including angiogenesis, tumorigenesis, tumor metastasis, and bone development. However, the function of Cyr61 in osteosarcoma metastasis was not investigated so far.
Methods: The effect of stable overexpression of human Cyr61 was assessed by functional metastasis in-vitro and in-vivo using an orthotopic mouse osteosarcoma model.
Results: We report that stable overexpression of Cyr61 in human SaOS-2 osteosarcoma cells increased their adhesion, migration and invasion in-vitro. Additionally, Cyr61 overexpression led to AKT activation, and cell proliferation acceleration through AKT/GSK3β-mediated inhibition of the nuclear activity of the cell cycle inhibitor p21. Furthermore, using an orthotopic mouse osteosarcoma model, we demonstrated that Cyr61 overexpression in SaOS-2 cells accelerated intratibial primary tumor growth and increased the number of metastatic lesions in the lung as well as a significant decrease of mouse survival. Finally, using a tissue microarray, immuno-histochemical analyses of human osteosarcoma cancer samples demonstrated that more than 89% of tumors were strongly positive for Cyr61, and positive Cyr61 staining at resection correlates with metastasis as well as with worse patients survival.
Conclusion: Collectively, our data demonstrate that Cyr61 overexpression in osteosarcoma cell line enhanced their metastatic behavior in-vitro as well as in-vivo. Thus, Cyr61 may be involved in the regulation of osteosarcoma metastasis.

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Imaging of finger micro-architecture with high-resolution pQCT for monitoring of erosive destructions and implant anchorage

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Introduction: Radiographic monitoring of treatment success in erosive diseases affecting hand and finger joints is limited to semi-quantitative rating of standard X-rays. High resolution peripheral quantitative computed tomography (HR-pQCT) has been utilized successfully in other locations, e.g. distal radius, to obtain additional information. The goal of this study was to quantify bone structural parameters in finger bones from a group of healthy volunteers that were gender- and age-matched to a group of patients with RA to serve as a healthy control group.
Methods: Nineteen healthy volunteers (aged 39 to 69) completed a set of subjective questionnaires and clinical examination to ensure normal hand function. High-resolution-pQCT measurements were performed at the metacarpal-phalangeal (MCP) and at the proximal interphalangeal (PIP) joints of the right hand. Subsequently, standard morphometric parameters were computed and stratified for proximal and distal joint parts. The values were statisticallycompared between the two joint parts, within one finger and with the same region at the other finger using.
Results: Image quality was sufficient in all cases to determine morphometric parameters. Although significant differences in bone density and structural parameters between joint parts, joints and fingers were detected, moderate to high correlations (red arrows in figure 2) were detected. Highest correlations were found for similar joint parts of different fingers, e.g. D100 from proximal part of MCP II correlates strongly with corresponding part of MCP III (r = 0.84) but only moderate with distal part of MCP II (r = 0.695) and only weak with proximal part of PIP II (r = 0.479). We found similar correlations for all morphometric parameters.
Discussion: Beside feasibility the data show distinct patterns of structural relations between joint parts, joints of the same finger and different fingers that can be utilized for analyzing structural changes, e.g. in rheumatoid arthritis and for implant development.

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Evaluation of Photodynamic Therapy with Foslipos Photosensitizer in Osteosarcoma Cell Lines

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Introduction: Osteosarcoma (OS) is a malignant bone tumor with high propensity for metastasis and consequently poor prognosis. Despite the introduction of neo-adjuvant chemotherapy in combination with surgical resection of the primary tumor, patients with metastatic disease have a 5-year survival rate of only 10–20%. Photodynamic therapy (PDT) will be evaluated as a novel strategy to suppress OS primary tumor growth, local recurrence and metastasis. In a preliminary study in dogs, PDT after intravenous administration of a photosensitizer revealed preferential uptake by the primary tumor, and subsequent PDT inhibited primary tumor growth considerably [1].

Methods: Time- and dose-dependent uptake of Foslipos (FL) was investigated in the low metastatic human OS cell line HOS and in the highly metastatic 143B derivative. The cells were incubated with different concentrations (0, 1.25, 2.5, 5, 10 ug/ml)of FL for 8 hrs or for indicated time periods (0, 0.5, 1, 2, 4, 6, 8, 10, 12, 24hrs) with 2.5 ug/ml of FL. FL uptake was estimated by measuring the FL specific relative fluorescence intensity at 652 nm. The cleavage of PARP, caspase 3 and caspase 9, indicating apoptotic cell death, was investigated with respective specific antibodies on Western Blot of 143B cell lysates incubated with FL for 5 hrs and left untreated (darktoxicity) or illuminated with 5 J/cm2 of laser light.
Results: FL accumulates more in highly compared to low metastatic human OS cells. Apoptosis is considered as an important mechanism of PDT-induced cell death in 143B cells: PARP, caspase 3 and 9 cleavage in cells are indicators of this death mechanism.
Conclusions: In conclusion, PDT may have great potential for intraoperative treatment of OS surrounding tissue after primary tumor resection in order to prevent local tumor recurrence and to suppress metastasis, the main cause of death in OS patients.
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Coblation has a anabolic effect on the intervertebral disc by stimulating IL-8 and proteoglycan production

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To better understand coblation's treatment effect, this study characterizes the temporal and spatial pattern of healing following stab injury to the rabbit intervertebral disc with and without plasma-mediated radiofrequency treatment. 23 New Zealand white rabbits underwent annular and nuclear stab injury on 3 consecutive lumbar discs (L2-L5). The three levels were randomly assigned into one of three groups for treatment with a plasma-mediated radiofrequency ablation device: 1) active treatment of the nucleus only (SN); 2) active treatment of both nucleus and annulus (SNA); 3) sham treatment. Unstabbed/untreated discs from L5-L6 (n = 5) served as normal controls. Animals were euthanized at 4, 8, and 28 days post-surgery. Sandwich ELISA immunoassay evaluated concentrations of cytokines TNFα, IL-1β, and IL-8. Histopathologic evaluations were performed on discs and endplates. Tissue sections were stained with Safranin-O to evaluate nucleus pulposus and annulus fibrosus proteoglycan content, and Alcian blue for extracellular proteoglycan content. Intradiscal leakage pressure was evaluated by injecting methylene blue dye into the nucleus.
Results: TNFα was detected in sham discs at 4 and 8 days, IL-1β was below detection in all three treatment groups. IL-8 levels increased in all treatment groups at 4 and 8 days compared to normal control, peaking at 4 days for sham and SN groups and 8 days ($p > 0.3$) for the SNA group (a 2.5-fold increase). Histopathology showed higher proteoglycan production by 28 days in the SNA and SN groups compared to sham. All 3 treatment groups showed ruptured annular fibers from the stab injury, but maintained overall architecture.
Conclusion: Plasma-mediated radiofrequency ablation appears to have an anabolic effect on disc cells, stimulating proteoglycan and IL-8 production and maintaining annulus architecture. Coblation treatment appears to reduce cellular response to pro-inflammatory stimuli and to restore overall disc architecture in the animal model.

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Improving inter-professional teamwork in surgery: a crew resource management program in the Geneva University Hospital

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Introduction: During their hospital stay, 3–16% of patients will experience an adverse event. Half of such events occur within the surgical specialties, and the highest frequency of medical errors occurs in the operating room. The factor of human weakness has been largely studied in aviation, which has led to the introduction of crew resource management programs aimed at improving teamwork and communication, with the goal to reduce accidents.
Objective of the study: To evaluate the effect of a crew resource management program in a surgery department.
Methods: A seminar was developed in collaboration with Swiss International Airlines, chaired by an instructor of Swiss and a senior orthopaedic surgeon with experience in medical education. This session was set up as a 1-day group seminar including workshops on communication problems or medical errors experienced by participants, and theoretical knowledge on patient safety and communication skills. Surgeons, anesthesiologists, nurses, and technicians from the department of surgery were invited to participate. The evaluation included a 10-item standardized questionnaire to assess participants' satisfaction, and a 30-item survey before and after the course to analyze participants' learning.
Results: Preliminary results on the first three groups of participants of the seminar are presented, comprising 33 participants, including 7 surgeons and 6 anesthesiologists. The mean age was 40.4 years and 54% were female. Most participants rated their satisfaction as very high: 91% for course organization, 74% for group dynamics, and 69% for teaching methods. Satisfaction with course content was valued as high or very high by 98% of the participants. After the course, the participants' assessment for nine items of the 30-item survey changed significantly.
Conclusion: The introduction of a crew resource management program within a surgery department appears to be valuable as it contributes to improved knowledge regarding teamwork and patient safety. These preliminary data must be confirmed, and further research is necessary to asses the impact of this program on participants' working behavior.

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Measuring the Clinical Outcome in the Private Practice: A no go? – A Preliminary Report about the Pain Score as an Assessment Tool

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Introduction: The purpose of this study was to show use and practicability of a validated Pain Score as an assessment tool in pre- and postoperative surveys of three defined surgical procedures (total knee replacement TKR, total hip replacement THR and rotator cuff reconstruction RCR) in a private practice.
Method: Since July 2008 all patients scheduled for a TKR, THR or RCR prospectively completed the specific questions of the Pain Score preoperatively and at one year after surgery. Mostly the Score could be completed online, patients were always supported by staff members but not doctors. The reference group of the Pain Score was based on the pain assessment scale for population-based studies (Urs Müller et al. In Pain. May 2008. Vol. 136. No. 1-2. Pp. 72-74 A). At the same time in all cases with TKR KSS and KS Scores and KOOS Score were assessed, in THR the Harris Hip Score and in RCR the Constant-Murley Score to correlate the Pain Score to well established evaluation tools.
Results: Till January 2010 we had 250 patients (143 female, 107 male) which completed the Pain Score. 107 received a TKR (70 female, 37 male), 92 a THR (51 female, 41 male) and 51 a RCR (22 female, 29 male). The average time to complete one Pain Score was 15 min. The postoperative numbers are too weak to present significant conclusions. The Score was extremely well accepted by patients as they felt to be taken serious concerning pain and disability before and after a major surgical procedure.
Conclusion: The Pain Score is a validated assessment tool based on the ADL-SEQ which seems to be useful in daily business of an orthopaedic practice to show pain and disability to the patient and the surgeon involved. It is practical, well accepted by patients, can be completed in an acceptable time and needs probably some support by staff members. Outcome is optically easily comprehensible.
In a short period of time we will be able to present statistically significant results for patients with TKR, THR and RCR.
done.

The numbers refer to the pages of this supplement.