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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 weak soft tissue reactions. Although a number of short-term reports highlighted excellent and encouraging outcomes after HRA, mid-term follow-up is 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/m². 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 neuropaxia of the sciatic nerve occurred in one of the cases. Clinically, ROM significantly improved after surgery. Hip flexion increased from 19.2 ± 12.5° to 28.8 ± 9.1° (p = 0.0001), abduction from 27.3 ± 10.5° to 40.2 ± 11.0° (<0.0001). The HHS significantly increased from 55.9 ± 12.3 points to 95.6 ± 5.5 points. The OHS averaged 14.3 ± 3.9 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.

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 orthopaedic surgeon. The assignment at hand shows the results of the follow-up results of 50 hips (83 patients) treated with PAO for 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.

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.

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 symptomatic 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 50 hips (83 patients) treated with PAO for 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 preoperative 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 89.6–90.4%. 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.

The “Zweymüller” stem, Follow-up of 20 years and more. One single surgeon study
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Introduction: The distal fitting stem called “Zweymüller” 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 hands shows the results of the follow-up results of implanted Zweymüller 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. 15 patients have been operated on both sides. 57 Zweymüller – 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 ± 10.4 years. Indication for implantation was mainly related to the primary osteoarthritis, 9% femurhede necrosis, the remaining 5% are due to dysplasia or postruamtic 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 deceased, information could be gathered trough relations and/or their respective house doctors.

Results: Early complications: 6 trochanter avulsions, 3 thromboembolies, 2 secondary haemorrhages. No infections and no reimplantations. 99 Zweymüller 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 postoperatively because of a periprosthetic fracture, and two stem revisions after 13 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 eptocic ossifications, 23% show radio lucent lines.

Conclusion: This follow-up study over 20 years of the Zweymüller stem, implanted by one single orthopaedic surgeon shows an excellent long-term performance of this distal fitting implant. The translugela approach shows consistent, good results.
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 refractions 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. Nevertheless, this complication does not negatively influence outcome once the fracture has healed.

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 complications were compared.

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% vs. 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 ± 8.5. Patient satisfaction was significantly higher in the older group (84 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 significantly higher than among the younger group. The medical complication rate and the 3-months-mortality were higher.
Femoral revision with impaction grafting of the un cemented 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 un cemented modular revision prostheses “MRP-TITAN” with a diastilpal near 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, revision grafting and the presence of radiolucient 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–IV, and secondary, a significant reduction of the proximal femoral bone atrophy due to femoral stress-shielding (5.71% vs. 17.9%); p < 0.05) which 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 Harris Hip Score (HHS) with a mean follow-up time of 4.38 ± 1.79 years (2.10–9.62 years) showed increasing axial subsidence for controls in comparison to patients with 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 < 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%).

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

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Objectives: The Pemberton percutaneous 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 2005 and recruited 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 (Tennis 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 ± 6.4 years. One patient with bilateral Pemberton osteotomies presented with a unilateral hip arthroplasty due to the patient’s personal wish (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.

Conclusion: The overall outcomes of 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.
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.

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 matched 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.

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 reinsersted abductor muscle. In 7 patients avulsion occurred 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. In 7 patients the expectations could not be fulfilled. 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 reattachment of the abductor muscle to the greater trochanter. In many cases the muscle can achieve 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.

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 inter-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 MRI-arthrography in the assessment of the pathological bony anatomy in patients with femoroacetabular cam, pincer, and mixed impingement.
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 consistent postoperative hypoplasia in the L5/S1 dermatome. 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.

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 subidence 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 subidence 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.

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/TRK) 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 TRK.

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.
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 290 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 13,594 CHF. Almost 80% of the patients returned directly to home.

Lateral group: the mean age was 68.7 years and the mean BMI was 26.7. The average operating time was 117 minutes. The mean number of intra-hospital physiotherapy sessions 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 result in fewer patients in rehabilitation centers.

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 dysplasia but otherwise healthy newborn children. The patients were all documented clinically and radiologically until after walking age.

Methods: More than 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 GRAP’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 for 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.

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 1.3 mm (±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.
Lateral release versus lateral retinacular lengthening for hypercompression syndrome of the patella. A prospective randomized double-blind study

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Introduction: The lateral release (RR) is an established treatment for hypercompressionsyndrome of the patella (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) (Nowneiler & 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 68.4 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 change of the MG changed from 0.4(RR)/0.4(RL) to 2.5(RR)/1.6(RL) quadrants which equals 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.

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

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, 3 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).

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 fulfill. 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 sagittal 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.

Conclusion: The study shows that a variation of SFs can have an influence on the mechanical load at the knee joint. Especially in the sagittal 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.

ACL injury and the posterior tibial and meniscal slope on MRI
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The risk for anterior cruciate ligament (ACL) injury is supposed to increase with a greater posterior tibial slope (PTS) but reports are contradictory. 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 plateau 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.
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 hamstring, and 10 hamstring with mesh. BTB-grafts were prepared of the present porcine knees, the hamstrings were simulated by porcine bone tunnel. The tendons were prepared 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 ≤0.001). Load to failure was highest at the mesh group with a significant difference to the hamstring group (p = 0.009).

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.

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 examined 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 arthromotion analysis was surgery of the healthy opposite side. Two patients were clinically unstable and an ACL-reconstruction is planned. MRI-findings showed 14 completely healed ACL with some postrumatic 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.

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 be the same as in the USA, Germany or any other industrial country. The strong regulations for professional activities for specialists (Praxistopp), 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 with the DRG, such as professional- and further training, tariff policy, quality management, judicial subjects etc. is expected to comply with their members' requirements.

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 procedures, mean age 69.8 years; 365 revision cases. 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% preoperatively, 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 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.

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 2000 – possibly influenced surgical training 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 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) and resident (R) n (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 healthcare related costs switched to the DRG system. Data was analyzed undergoing a analysis of variance followed by a post-hoc scheffe procedure.

Results: On the one hand the resident generated additional costs of 41.5% compared to the CS and a longer stay in the hospital [CS 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 grouped to the lowest possible DRG, increased PCCL relevant status and grouping the case to a more profitable DRG. Hereby, the additional costs are partly more redeemed.
in order to adjust the outcome for age and gender. The new questionnaire is a reliable and valid tool for the assessment of all types of treatments focusing on the local motor system. The questionnaire should be complemented by generating population based reference values in order to adjust the outcome for age and gender.

**Conclusion:** The SWISS spine 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.

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**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 local 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 local motor system. It is short and easy to administer and it is the only questionnaire available in the field that provides reference values to adjust the outcome for age and gender.

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**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. Indicators 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 Kelgren-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 wildly 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.

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**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 (47 levels) 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 operated 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 more than 70–75 mm$^2$ in early postoperative MRI were found out to be the thresholds for clinical significance.
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.

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 in adolescents and young 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 surgery and to 28.9 ± 18.1% at the latest follow-up (p = 0.263). Lumbar lordosis changed from 70.4 ± 13.0° to 54.6 ± 7.2° at the last follow-up. The slip angle improved from preoperative to the last follow up. All preoperative L5 sensory and motor symptoms resolved. There were no permanent neurological complications.

Conclusion: This technique provides good deformity correction of spondylolisthesis and lumbosacral kyphosis.

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), including 0-10 leg/buttock pain (LP) and LBP scales; at 12 mo, global outcome was rated on a Likert-scale and dichotomized 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 11.2 (±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).

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 (p = 0.13). 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 and 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 24.9 mA 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 where different users at various stages of their learning curve are involved in pedicle instrumentation.

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

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Introduction: The presence of a scaphoid fracture is important to diagnose early as nonunion or delayed union may lead to serious complications such as complex regional pain syndrome. In case of clinical suspicion of scaphoid fracture, sonography has proven to be a useful screening test. However, the interpretation of ultrasound scans by emergency department physicians has recently raised controversy.

Methods: 34 ultrasound scans of scaphoids were performed by three different emergency radiologists (one in the emergency department and two in the radiology department) on patients with clinical suspicion of scaphoid fracture. Afterward, two independent experienced musculoskeletal radiologists evaluated the sonography scans.

Results: The independent evaluation of the sonograms revealed a sensitivity of 80% (28/35) and a specificity of 100% (41/41). The agreement between the emergency physicians and the experienced radiologists was poor (κ = 0.24).

Conclusion: For the detection of occult fractures of the scaphoid, sonography is a useful first step in the diagnostic process. However, due to the variability of interpretation, sonography should be performed by an experienced musculoskeletal radiologist when clinical suspicion of scaphoid fracture is high.

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 RSA group (p = 0.002) with a risk 10.0 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 disturbance. 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.

A new technique of biologic augmentation in repair of chronic rotator cuff tears using autologous platelet rich fibrin (PRF): Vascularization 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 found in 9 of 10 cases 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 tendons in PRF 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 vascularization response. Increased vascualrization may potentially precede an increased and earlier cellular response and an increased healing rate.

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 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 insertion 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.

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 rhythm 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 deltoideus, supraspinatus, subscapularis and infraspinatus combined with teres minor. Arm motion and force patterns were achieved by muscles. The reverse and anatomic Aequalis prostheses (Torner Inc) were inserted. Two scapulo-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 of the scapula-humeral rhythm induced biomechanical consequences which could preclude the use of an anatomic implant in young patients. However, an altered scapula-humeral rhythm, even severe, should not be a contra indication for the use of a reverse prosthesis.
Outcome after surgical treatment of symptomatic delayed unions and nonunions of midshaft clavicle fractures

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Introduction: Nonoperative treatment of displaced midclavicle fracture in association 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. Llial bone graft was used in 15 atrophic cases, and graft from the calvarium 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 nonhealing 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 successfully treated with local corticosteroids.

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.

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 surgical 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 ± 4.7) (p = 0.01). There was a significant change in flexion (143° before surgery to 144° at follow-up; p = 0.07), external 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.

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 phase on functional outcome and pain.

Methods: Between 06/2003 and 09/2006 180 consecutive shoulder arthroplasties with non-cemented stem were performed on 163 patients and included in a prospective controlled cohort study. Post-operative cryoimaging was performed at time of surgery. The humerus was 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 clinical 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 contra lateral side and 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 ± 2.6 mm (range: 3 to 35 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 (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.

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 subscapularis tears 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 from (range 50–80) to 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 hyperflexus athletes. Arthroscopic stabilization is effective to relieve pain and allows the return to sports.
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 investigate 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 Sprague Dawley rats were assigned, 6 per group, according to treatment: fibrin carrier alone; juvenile chondrocyte plus fibrin carrier; sham; 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 histomorphometric 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 as assessed by the von Frey technique, histologically and immunohistochemically. 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 myelin stainings.

Conclusion: No chronic adverse effects were observed following implantation of chondrocytes in fibrin carrier on the spinal nerve tissue of immune competent rats as assessed by the von Frey technique, histological, and immunohistochemical analyses. The results of our study suggest 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 tissues, should the investigative material extrude from the treated disc. The animals remain in direct contact with the spinal cord, the nerve root or the dorsal root ganglia.

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 contraction and compromised joint functionality. The multiple 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 therapeutic 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 mg 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 bone volume ranging from 0.001–1.649 mm³ were found. The mean bone volume in the control group was 0.976 mm³ whereas the mean bone volume in the echinomycin group was 0.092 mm³. Range: 0.01–0.488 mm³ (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 therapeutic agent in the prevention of Heterotopic ossification.

Introduction: Additional tendon length is occasionally needed for the surgical realignment 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: Call 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, mattress sutures were made with 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 (FMmax) were determined postoperatively.

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 270° ± 21° and 270° ± 21°, respectively. There was no difference between the groups. The optimal extension of the tendon lengths 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 load, without suffering any kind of further 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.

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 extended in 17 sheep and allowed to retract for 10 months (group I, n = 5) and 4 months (group II, n = 11). 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, were retracted without any repair. Tendons were assessed macroscopically, by MRI, histology and TEM.

Results: Compared to control tendons, increased 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), whereas in group IV, a FMmax 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 load, without suffering additional 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.

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 unspecified
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 infections with. 9 female, age 52–81, mean 66) were analysed regarding PCT, 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 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 an 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 normal postoperative PCT serum levels could reproducibly be determined and compared to other laboratory values.

**Key words:** Procalcitonin, Total hip replacement

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**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 evaluated 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 customised 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). Spearman correlation (r-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 most 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.

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**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 femoracetabular 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 mechanical hold mostly relying on presssing the graft with the end of the procedure, the femoral head-neck junction was digitzed 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.
Can plate osteosynthesis of stable femoral periprosthetic fractures cause early cement mantle failure around the hip stem? A biomechanical evaluation

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Introduction: 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 from a standard locking plate system and a control group. The specimens were tested in a biaxial material testing machine under axial compression (including addition 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 a 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.

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 and 36 screws were inserted. The specimens were tested in a biaxial material testing machine under axial compression (including addition 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.

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Introduction:
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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 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 prosthetic shoulder 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 only in two of the 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 prosthetic shoulder designs and compared them to the healthy shoulder. Our results suggest that the use of larger glenosphere, whenever it is possible.

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 prosthetic shoulder relative to the healthy shoulder, considered as the control group.

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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 Hingea, 16 STAR, 15 Mobility) and 47 ankle fusions (22 open, 25 arthroscopic) were prospectively evaluated including patients at the Zurich Board of Orthopaedics and Rheumatology and the University of Bern. All patients had 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 impact on ankle and hindfoot alignment in ankle (AA) and tibiotalocalcaneal (TT) arthrodesis. The HAV-angle in ankle was –0.75 ± 7.83 degrees for ankle, –1.19 ± 8.39° for TTC arthrodesis. Visual alignment only predicted the corresponding HAV-angle in 48%. The static alignment had a strong correlation to the dynamic load pattern; however, it did not result in a relatively large standard deviation of ±7–8° and a mean of 4.1 ± 1.3 years were assessed clinically with AOFAS- and FM 69

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

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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 and its correlation to plantar pressure.

Methods: 89 patients (AA = 56, TTC = 42) with a mean 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-angl e 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 the 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:

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Introduction: Among patients with ankle osteoarthritis (OA) a strong correlation to the dynamic load pattern. visual hindfoot alignment and load parameters were found. This study evaluated radiographic 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 and Lawrence (KL) 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 had a Weber A fracture, 56% 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 included. Mean duration of follow up was 17.3 years (±3.3). Advanced OA (KL grade >3) was present in 68% of patients (26.6% for ankle OA, 61.2% for TTC arthrodesis). The HAV-angle had significant differences between the groups (P <0.001). Significantly more major complications in TAR group were reported (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 higher in TAR than in ankle fusion, the impact on the outcome is significant only in ankle fusions.

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 metatarsal loading under the metatarsal head which exceeds the local 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 biomechanical parameters of the plantar forfoot.

Methods: We performed 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 with hallux valgus deformity operated 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 9 months in the 1st group and 40 months in the 2nd group. Each patient was reviewed clinically and radiographically.
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 attempts 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 with preserved mobility in the MTP I joint. b) the prosthesis results in a good MTP-I mobility, c) the prosthesis allows stable presst 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 dorsiflexion. 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 with 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 prosthesis (METIS) shows to be a good solution in the treatment of hallux rigidus in short term follow-up. The prosthesis achieved excellent pain relief 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 shoe wear in the majority of the patients. The unicmented three component prosthesis proved good osteointegration 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 replacement might therefore begin to play a more important role in the treatment of hallux rigidus. Long-term follow-up will have to prove this promising short time results.

A static cavovarus foot deformity was simulated in eight patients. The image was recorded: –0.53 MPa for the Z-shaped osteotomy with lateralization, 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 < 0.001). A significant peak pressure reduction was recorded.
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 removal treatment is chosen, polyethylene exchange is strongly recommended.

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 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 preoperatively 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.


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 arthrotherapy 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 parental regimen for a total duration of two weeks.

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.

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, subatmospheric pressure at 125 mm Hg
Results: The foam-wound interface of the Vacuum Assisted Closure device caused a 4-fold increase of wound surface proliferation (compared to OD) and an increase in angiogenesis (2.2-fold) compared to OD. Finite element modelling was used to predict wound surface deformation under dressing modes and cross sections of sites in situ fixed tissues were used to measure actual microstrain.

Conclusion: The Vacuum Assisted Closure device induces significant wound growth in diabetic wounds. The foam wound interface influences treatment outcomes in such wound conditions that stimulate tissue growth by angiogenesis and cell proliferation. It needs to be taken into account that the clinical setting different wound types may profit from different elements of this suction device.

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 deformity. Proper documentation and comparison of 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 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 biocalcaneal, 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 ± 15 years) undergoing 70 (48 primary, 22 secondary) hindfoot arthrodeses in which 58 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. Of 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 a significant association between 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.
Conclusion: Hindfoot measurements on MR images using TCAm are feasible and correlate moderately with TCAI on plain films. The methods are interchangeable within the limits of two standard deviations.

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: 8–30; 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) were 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 (TAT) in combination with lengthening of the short agonist (TAL) to achieve optimal postoperative function in stance and swing phase.


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® Total Ankle Replacement were followed 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®) as measures.

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.

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 56 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 (Urief®) 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 followup 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.

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. 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.
Inlay thickness: risk factor for osteolysis after ankle arthroplasty

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Objectives: Ankle replacement causes a high rate of severe periprosthetic fractures, 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 THA 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 / x-ray 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: ostolyse >1 cm diameter, 1. no ostolyse, 2. small periprosthetic changes, 3. some small lytic zones, 4. two one more greater lytic zones diameter <1 cm, 5. ostolyse >1 cm diameter (one one ore).

Results: Severe periprosthetic lesions were identified in ankles with an inlay of 4 mm thickness. Revision because of osteolysis had to be 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.

Treatment 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, 1.0–10.7) were equivalent as was the intravenous component (OR 1.1, 1.0–1.3). In a subgroup analysis of only immunocompromised patients, 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 rank sum 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 recurrences and different strategies by surgical and medical parameters. The accumulation of recurrence in few patients suggests unknown endogenous risk factors.

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 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 Salten-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 epiphysiolysis 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 epiphys 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.
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 are based 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 39–86) 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 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 95% 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.

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 months (range 6–85 months) 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 microorganism. The establishment of an interdisciplinary infectiological conference at the beginning of the treatment and a weekly infectiological-surgical ward round served to determine 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 diffuse-to-treat microorganism. No microorganism 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. Less than 28 days of symptom duration at index surgery and the microorganism 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 microorganism (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 state 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.

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 function in patients progressing to the development 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) [2].

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 postoperatively) 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 soft tissue interventions including agonist lengthening and antagonist shortening. The favourable short-term results were preserved till mid-term follow-up (5 years).

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).

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.

References:
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, 1 after failed rotator cuff surgery, 6 for failed arthropathies, 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.

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 suggested a ischemia of the vascular supply in the region of the maximum deformity. No other aetiological factors as trauma, infections or haematologic disorders could be evaluated. 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 occurred. 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 of the 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.
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 recruited 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 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.

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 113 patients, treated either by standard or reversed shoulder arthroplasty, a controlled cohort studies 212 patients undergoing standard and reversed shoulder arthroplasty were follow-uped between 10/2006 and 08/2008. Cases with complete preoperative, postoperative and follow-up measurements could not be included. The mean age was 69.4±15 years. 88.2% were women and the mean age was 69.2±15.6 years. The majority of patients with rotator cuff lesions underwent anatomic arthroplasty (100±30 degrees) in comparison to patients undergoing reversed arthroplasty (90±30 degrees) (p=0.05). The 6-months follow-up strength improved for both prosthetics systems (p<0.05). In the 18-months follow-up strength improved for both prosthetics systems (p<0.05). Values measured using the Isobex™ device showed similar characteristics, however, they were found when comparing the two methods.

Results: Of the 212 arthroplasties were implanted in 212 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±15.6 years (range 35–95 years). In 34.1% of the preoperative cases measurements could not be completed due to an abduction of the shoulder joint (considered 0kg). The mean abduction strength measured postoperative by spring balance differed significantly in patients undergoing standard shoulder arthroplasty (12.4±3kg) in comparison to patients undergoing reversed arthroplasty (0.34 kg, p<0.05). At the 6-months follow-up strength improved for both prosthetics systems to 3.35±0.7kg and 3.35±0.7kg respectively, without any significant differences at each time point (p>0.05). Values measured using the Isobex™ device showed similar characteristics, however, they were found when comparing the two methods.

Conclusion: Standard shoulder arthroplasty showed significant improvements of the postoperative 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.
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 scapholunate 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 Keiser’s classification five patients were stage 2, 14 stage 3 and 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 measured with the dynamometer of Jamar reached 96% of the contralateral side. Mean DASH Score was 6.1 points (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 scapholunate ligament may achieve similar results. Further studies with longer follow-up are required to confirm these encouraging results.

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 translational 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 sacral fracture patterns and the need for 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 ± 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 was observed. In 2/32 cement leakage occurred around the nerve root L5 and S1. Intermittent radiculopathy under local 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: The results according 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.

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-surgical 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) metastases 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 stabilization 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 option for patients with spinal metastasis to improve spinal stabilisation, neurological deficits and back pain in order to achieve significant higher life quality.

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. 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 was observed. In 2/32 cement leakage occurred around the nerve root L5 and S1. Intermittent radiculopathy under local 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: 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 scapholunate ligament may achieve similar results. Further studies with longer follow-up are required to confirm these encouraging results.

Method and materials: 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 range 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.
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: 46 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.

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 the 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 group.

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.

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

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

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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: Arthritis 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 dysplastic 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, hip 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 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 hip 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.

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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 disease 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 years) under general anesthesia. All patients were examined and interviewed for Harris-hip-score and WOMAC-score preoperative, 3, 6 and to 12 months postoperatively, after 6 weeks and after 6 months. Range of motion and score results were then 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 86 (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 to total hip arthroplasty. Four arthroscopic revisions were necessary because of one adhaesive capsulitis and three because of inaccurately resection of head-neck-junction or acetubular 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.

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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
Juxtaarticular cyst of the hip as a cause of sciatica. A case report
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Introduction: Sciatica is usually caused by a disc prolaps of the lower lumbar spine, but rarely may have more obscure nondiscogonic origin. Cystic lesions about joints are either gangliar or synovial in nature. Gangliar 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. 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 gluteal region two large cystic lesions in the retro- and supracetabular region 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.


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 component in a compliant orientation 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 specifically 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.

Discussion: 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.

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 ostearthritic 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.
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, but it is quite common in 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 hamstring avulsion that have occurred in 2009 in our hospital. Interestingly, the three patients were not 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 a subacute 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 contralateral side. Posterior femoral haematoma and swelling appeared and one patient even suffered of slight numbness in contralateral side. Posterior femoral haematoma and swelling appeared and one patient even suffered of slight numbness in contralateral side.

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.

Early clinical and radiological outcome of total hip replacement with the short uncremented 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 uncremented 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 53 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 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 uncremented 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.

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 months. In this group, five patients died in the emergency room. 8 patients died at once and the average stay in the trauma mainly motor-cycles and car traffic trauma. In this group, five patients died in the emergency room. The average stay in the trauma mainly motor-cycles and car traffic trauma. In this group, five patients died in the emergency room.

Results: All the patients were managed in the emergency room according A.T.L.S. guidelines (9 patients with a 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 arthroplasty.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 with laparotomy without any external fixation. All of them died on the table even the two ones for whom an arthroplasty 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 venous and low pressure bleeding, we think that pelvisclamp is a secure and quick way to stabilize patients before laparotomy or arthroplasty.
Tibioplasty: 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, “tibioplasty”, using a percutaneous PMMA augmentation.

Methods: 5 elderly 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: Tibioplasty represents a feasible treatment option for the management of insufficiency tibial plateau fractures in elderly 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.


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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 tibia the tibial tubercle was 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 Lysholm 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 (81%) had a normal total IKDC group A (normal), 8 (13%) group B (nearly normal), 4 (6%) group C (abnormal) and 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 p.a.-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.

Tibial osteotomy: 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 approach before total knee arthroplasty (TKA)) 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 approach with step-cut 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 reoentgenographic 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 first 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

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 approach before total knee arthroplasty (TKA)) 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 approach with step-cut 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 reoentgenographic 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 first 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 radiolucentencies (>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 B (15%) was higher than in group B (15%), 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 TKR. It is however not clear if this 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.

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 fractures classification according to AO/OTA with an additional 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, 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-traumatized, 38% having open fractures. All except two went to union (98%) 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 loosening 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.

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 one stage arthroscopically assisted reconstruction of multiple ligament injured knees always involving the posterior cruciate ligament (PCL).

We reviewed consecutively 17 patients (19-62 yrs) with multiple ligament injury, 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, radiographic assessment and arthrometer testing (Rottler).

Results: At final IKDC evaluation, six patients (35%) were graded level A, nine (53%) level B and one (6%) 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 (Rottler) 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 IKDC 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 sport. We believe that the influencing factors regarding different additional injured ligaments or using different grafts, but timing of surgery seems to be important concerning the development of osteoarthrits.

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 normal standards for 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, Tuttingen, Germany) was constructed and adapted so that force could be applied directly through Steinmann pin 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 with respect to normal. We believe this force-determining balancer can be used for further analyses, e.g. to explore the effects of selective ligament resection.

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. A 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 mediailised patella with a positive apprehension sign was found in an otherwise normally aligned lower extremity. MRI showed a slight trochlear dysplasia and a hypertrophic medial collateral ligament. 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 osteotomy was performed: A hypertrophic medial patello-femoral ligament (MPFL), and a particularly distal insertion of the medial vastus muscle were found. No femoro-patellar dysfunction was observed. Dissection of the MPFL and a proximalisation of the vastus medialis 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

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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 or soft tissue 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.

**Percutaneous lateral ankle stabilization an anatomical 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 tunneled 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 calcaneal branch of the tibial nerve was found to be 7 mm (SD ± 3.7). The medial calcaneal 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 calcaneal branch of the tibial nerve remains the structure at greatest risk.

**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-cultural validity in an English speaking population.
Transcannal 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 (transcannal suture technique with supplemental double-angle plate fixation and additional VY-advancement) for the treatment of a distal sleeve avulsion rupture.

Case: A 63-year-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.


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 open treatment of chronic sleeve avulsion ruptures of the Achilles tendon is challenging. Transcannal suture techniques allow anatomical reconstruction of the tendon without “sacrificing” other structures. By using two additional anchors, tear-resistance can be increased without much morbidity.

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

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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 frame.

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 osteolysis 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-osteoarthropathy.

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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 approximately 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 very satisfied on the left side and moderately satisfied with oral antibiotics. A solid union and a braceable foot were achieved.

Conclusion: Intensive collaboration with haematologist and physiotherapist is essential to improve the results of the procedure and satisfaction of the patient.

1 Schweizerische Hämophile-Gesellschaft S.H.G., www.shg.ch

Irreducible postero-medial 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.

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 derotation 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 of the calcaneum. Sufficient fixation across the theoretical fracture was radiographically evident in all patients between 6 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 scores (i.e. function, absence of pain, gait, satisfaction) significantly better than patients with transfibular or other types of hindfoot amputations (i.e. Piragoff, 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 salvageable 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 punctures 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:** 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 weeks 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-reimplantational invasive diagnostics and CRP for the predilection of recurrence was 0.58, 0.88, 0.53, 0.96, and 0.17, 0.81, 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 is 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, malalignment and loss of motion.

**Results:** 28 patients (15 girls, 13 boys) with Garden Type III fractures 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 with sural nerve autograft. 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 cosmetical results were good (8%) or excellent (92%) only one patient (4%) showed loss of carrying-angle of 20°. The functional outcomes 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 facilitating the prefabrication of fixation, some surgeons prefer interosseus 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.

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

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**Introduction:** Slipped capital femoral epiphysis (SCFE) with epiphyseal metaphyseal discontinuity are at increased risk for osteonecrosis after surgical treatment. In so called unstable cases with clinically suspected discontinuity of the epi-metaphyseal junction, 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 epiphyseal and metaphyseal growth plate. Fifteen male and 13 female and 14 male patients, the average age was 11.7 ± 14 years (9–14 years). Mean follow up was two years (12–38 months). Results: All but one of the twenty-eight hips (96.4%) had excellent clinical and radiological outcome. All but one case derestricted range of motion of the treated hips comparable to the unaffected sides; flexion was 103° ± 14°, 60°–90° versus 110° ± 31°, 9° ± 0° (p = 0.374), internal rotation 31° ± 12°, 10°–50° versus 31° ± 12.3°, 10°–50° (p = 0.930) and all hips reached full extension. At follow up, the Hip–Hip and the Merle d’Aubigné scores were 99 and 17 respectively. AVN were observed 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 slip from developing early osteoarthritis due to FAI, as well as decrease adverse events such as AVN in the treatment of unstable slipped capital femoral epiphysis.

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 osseous osteoma [5, 6]. A few cases of chondroblastoma treated by radiofrequency 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 curedtted 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 chondroblastoma was shown in the curedtted specimen. He is asymptomatic at 18 month postoperatively with incorporation and remodeling of the bone graft. Radiofrequency thermal ablation for treatment of bone tumor was first described in 1992 [4] and has become the treatment of choice in osseous osteoma [5, 6]. A few cases of chondroblastoma treated by radiofrequency have recently been reported [7-10].

Conclusion: RF ablation, the standard in treating osteoid osteoma, appears to be an option to treat chondroblastoma and may especially be considered in locations difficult to access surgically as in our two patients.

References:


Growing Prognosis for Osteosarcoma of the Distal Femur in the Growing Skeleton

Bruno Fuchs
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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 isplateral proximal femur. After completing neoadjuvant chemotherapy according to the Euronos protocol, the patient underwent limb-sparing surgery. Because the femoral vessels were free of tumor, rotationplasty would be preferred over amputation. Because of ethnic 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 radiographs revealed 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 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.

Growing Prosthesis for Osteosarcoma of the Distal Femur in the Growing Skeleton

Bruno Fuchs
Uniklinik Balgrist

Case: A 7 year-old girl was diagnosed with osteosarcoma of the proximal left humerus. After completing neoadjuvant chemotherapy according to the Euronos protocol, staging revealed that both the shoulder joint and the neurovascular supply to the hand was uninvolved by the tumor. A transarticular resection was indicated. There are no good options for reconstruction in the growing skeleton. Epiphysial 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 reflected 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 articular cartilage, neurovascular plexus and its supply to the fibular head. Postoperatively, the shoulder was immobilized for six weeks, after which passive range of motion exercises 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:** Epiphysial Growth Plate Transfer is surgically challenging, but may represent a 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**

*Bruno Fuchs Uniklinik Balgrist*

**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 years old) who both had a huge chondrosarcoma of 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 distinct biofilm formation 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 months. As published a two-stage revision procedure was advised after 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 infectious-surgical ward round and was evaluated by erasure rate of infection after one year. **Results:** We detected 8 multiresistent staphylococci, 6 chinnolon-resistant 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 explanation. 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.

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**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 separately 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 pathogen 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 involved 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 12GS 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 intravenously 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.
Feasibility study on the use of collagen cross-linking to reinforce tendon mechanisms

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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 mechanisms.

Methods: Cross-linking agents were selected based on their reported cross-linking potential and sufficiently low toxicity. Rat tail tendon fascicles were dissected and harvested 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 tendons or for halting disease progression toward a full tear. This method is now being tested in a clinically relevant model of partial tendon tear propagation.


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-collagenous 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. Immunohistochemistry (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.
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 retraction 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.

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 experience 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, mirroring of the image may be beneficial 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.

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 young adulthood. It is associated with a very poor prognosis particularly for those patients with metastasis at diagnosis. Prolyteotic 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 overexpressing 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. 5X10^6 tumor cells were orthotopically injected into the tibia of SCID mice. The size of the leg (length and width) was 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 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.

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, hematopoiesis, wound healing, immune response and tumor progression. HA and CD44 also promote drug resistance in variety of 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 (MGI, HOS, HUd, OS), and respective sublines (MG63-M4, Hu09-M132, 143B, LMS) with high metastatic activity. Extracellular deposition of HA was analysed by particle exclusion assay. Previously, it was shown via the WST-1 assay that highly metastatic cell lines MG63-M6 and –M8 exhibit higher sensitivity to therapeutic 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 metabolism 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.

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
Posters

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 is performed 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 developed an application for preoperative planning and another application for conduction of navigation ostectomies 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 a prospective study, 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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EWS-FL1 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-FL1) to primary MSC, and transcriptional and protein analysis.

Results: We show that the EWS-FL1 fusion gene, associated with Ewing sarcoma cancer stem cells, increases 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-FL1 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-FL1 on its target gene expression and repression of microRNA-145 (miRNA145) promoter activity. Finally, we provide evidence that EWS-FL1 and miRNA145 function in a mutually repressive feedback loop and identify their target gene, 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.

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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 strong 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 ilioibial band. The aim of this interdisciplinary investigation was to end up with a fixation device, which fulfills 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 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 to allow for optimization of the device 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 Kerbolb 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.
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 recurred disease continue to have a very poor prognosis. Cyr61 is a multifunctional protein that can stimulate angiogenesis and tumor growth. Abrupt 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 in the lung as well as a significant decrease of mouse survival. 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, immunohistochemical expression analysis 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 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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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 intensivity 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].

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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 μg/ml) of FL for 8 hours or for indicated time periods (0, 0.5, 1, 2, 4, 6, 8, 10, 12, 24hrs) with 2.5 μg/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 in the low metastatic 143B cells lysates incubated with FL for 5 hours and left untreated (dark toxicity) 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.

References:

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 assess the impact of this program on participants’ working behavior.
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