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FM1

Management of acetabular bone loss with 3D printed metal augments: in vivo bone ingrowth and fixation

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Introduction: Management of acetabular bone loss is one of the more challenging aspects of the revision of total hip arthroplasties. Porous metal components are applied clinically nowadays as an alternative to structural allografts or impact grafting, which have been suggested to be less successful with massive bone loss. The metal bone augment has to enable long-term, stable fixation of a well-positioned acetabular component. CT-based preoperative planning combined with 3D printing techniques provides the flexibility to produce augments with a patient-specific external shape and a controllable internal network of pores. However, rapid and extensive bone infiltration into the implant's pores remains essential to obtain strong and durable biological fixation. Therefore, this study quantified in an in vivo goat model the osseointergation of clinically used 3D printed augments with different porous networks, surface treatments and calcium phosphate coatings.
Methods: Six adult goats were implanted with Ti6Al4V constructs that were manufactured by selective laser melting (SLM). The cylindrical constructs (Ø8mm x 14mm) with or without hydroxyapatite coating had an interconnected, regular porous network with porosity of 75%. Three holes were drilled in the subchondral bone of each tibia and femur of the goats. Constructs were inserted into the holes in a press-fit manner. Resonance frequency analysis was used to measure construct stability. Fluorochrome labels were injected at 3, 6 and 9 weeks. In vivo CT scans and X-rays were taken. Resonance frequency analysis, micro-CT, histology, and pull-out tests were performed postmortem at 6 and 12 weeks.
Results: Micro-CT analysis and histomorphometry showed bone infiltration into the scaffold's pores from the bottom and sides. The bone volume in hydroxyapatite coated constructs tended to be higher. The amount of new bone formation increased slightly between week 6 and 12. Fluorochrome labeling confirmed these results. Resonance frequency analysis indicated a noticeable increase in implant stability. Pull-out tests showed an increased fixation at the bone-implant interface.
Conclusion: SLM manufactured titanium constructs allow bone ingrowth and obtain strong biological fixation in a 3 months goat model. As custom-made bone augments, they provide a promising approach to the reconstruction of severe bone defects.

FM2

Navigation of Acetabular Re-orientation in Periacetabular Osteotomy – a Computer-assisted Feasibility Study on Cadavers

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Introduction: The Bernese Periacetabular Osteotomy (PAO) is an established treatment for developmental dysplasia of the hip. In addition to the challenges of preoperative planning, the intraoperative verification of acetabular orientation is difficult and frequently relies on error-prone serial x-rays. Hence, we developed and validated a computer-assisted application for planning and conduction of PAO.
Material and Methods: 10 PAO procedures in Thiel-fixated cadaver pelves were performed. Preoperative CT scans were obtained and three-dimensional (3D) models were reconstructed. Virtual acetabular re-orientation of inclination, anteversion, lateral center edge (LCE) angle, extrusion index and acetabular coverage was simulated using the planning application. The specimen were then rigidly fixed in a supine position. Following a restricted surface matching, the trajectories for the periacetabular osteotomies were cut with a navigated chisel and completed with an oscillating saw. Acetabular re-orientation was then guided by the navigation application according to the preoperative plan. The sequence of fixation went over a manual fixation, followed by a preliminary K-wire fixation. The final fixation was achieved using radiolucent carbon pins. For each moment of fixation, the values for the above named parameters were stored. A post-operative CT scan was obtained and the same parameters were assessed on postoperative 3D models. Statistical comparison between parameters at each point of fixation was calculated.
Results: An analysis of variance (ANOVA) did not show significant difference between preoperative planning, each fixation step and the postoperative acetabular orientation for each value. The postoperative inclination differed from the planning by a mean of 0.81 degrees (SD 0,79°), the postoperative anteversion showed a mean difference of 1.87 degrees (SD 1.33°) to the preoperative plan. Bland-Altman analyses comparing planned and postoperative values showed even distribution along the zero line within narrow 95% confidence intervals for every parameter.
Discussion: Navigation of acetabular re-orientation during PAO is technically feasible. Planning of this procedure and realization of the preoperative plan is possible and associated with good reliability and accuracy. Application to realtime surgery might be challenged by periarticular soft-tissue restraints and increased difficulty for reference marker affixation and intraoperative registration.

FM3

Mechanical alignment correlates with SPECT/CT tracer uptake intensity and distribution

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Introduction: SPECT/CT which offers the combined analysis of mechanical and biological information showed promising results when applied to orthopaedic patients. It was the purpose of this study to investigate if the mechanical and anatomical alignment influences the intensity values as well as the distribution pattern of tracer uptake. If the loading history and intensity values of SPECT/CT show a high correlation with the anatomical and mechanical alignment it could be used for evaluation of postoperative patients after realignment procedures such as high tibial osteotomies or patellofemoral surgery.
Methods: 71 consecutive patients (male:female = 33:38, mean age 48 ± 16) with 85 knees (male:female = 36:49) undergoing SPECT/CT due to knee pain were prospectively collected and included in this study. 99mTc-HDP-SPECT/CTs of the knees were analysed using a previously validated localisation and grading method. The maximum intensity in each femoral, tibial and patellar joint compartment (medial, lateral, central, superior, inferior) was noted using a color-coded grading scale (0–10). AP and lateral weight bearing radiographs as well as Rosenberg and skyline views were analysed in terms of the Kellgren-Lawrence OA score. Long leg radiographs were used to assess the mechanical and anatomical leg alignment, which was then classified as varus, valgus or neutral. We correlated the mechanical and anatomical alignment with the intensity of tracer uptake in each area of interest. The Kellgren Lawrence score was also correlated. The level of statistical significance was $p < 0.05$.
Results: The intensity of tracer uptake on the medial compartment significantly correlated with anatomical and mechanical varus alignment of the knee ($p < 0.05$). The intensity of tracer uptake on the lateral compartment significantly correlated with anatomical and mechanical valgus alignment of the knee ($p < 0.05$). In patients having higher Kellgren Lawrence scores, which reflect a higher degree of osteoarthritis, higher tracer uptake values were found in the corresponding joint compartments.
Conclusions: 99mTc-HDP SPECT/CT reflects the loading pattern of the knee joint with regards to the mechanical and anatomical alignment. It is also related to the degree of osteoarthritis of the knee. Hence, SPECT/CT should be considered as imaging modality for follow-up of patients after realignment treatments such as high tibial osteotomies, deloader braces or insoles and patellofemoral realignment procedures.

FM4

3D CT-based analysis of the effect of an increasing posterior tibial slope in total knee arthroplasty

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Background: 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 to achieve a satisfactory range of motion. If it is determined that the flexion gap is tighter than the extension gap, the surgeon may increase the posterior slope of the tibia. Femoral rollback is nominal on the medial side in a normal knee and the majority of knees work without consistent rollback after TKA anyway. Therefore, increasing the tibial slope enlarges the extension gap likewise.
Methods: 20 formalin-fixed cadaveric knees were obtained for study. For examination by computer tomographic (CT) imaging every specimen was fixed to a newly invented frame in full extension and 90° flexion. The region of interest of the tibia and femur were reformatted with 3D reconstruction. The 3D models of the knee joints were all fit into a coordinate system. Bone cuts were performed on computer. The tibia was cut with increasing posterior slope stepwise. Tibiofemoral contact points were determined. The distance between femur and tibia was measured at tibiofemoral contact points in flexion and extension on medial and lateral side of the joint.

Results: Flexion and extension gap increased almost linearly with increasing angle for all combinations of motion and location (p0.001).
Conclusion/ Relevance: If it is determined that the flexion gap is tighter than the extension gap, increasing tibial slope more than originally planned may not be recommended because it will influence the size of the extension gap significantly. During surgery, the relative difference between flexion and extension gap in size due to some additional tibial slope may result from soft tissue and PCL release, which perhaps automatically results from tibial bone cut simultaneously.

FM5

Micro CT analysis of the subarticular bone structure in the area of the talar trochlea

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Introduction: Certain regions of the talar trochlea are recognized as exhibiting varying cartilage thickness and degrees of subchondral bone mineralization. These changes have been attributed to the long-term loading history. For the current study, we accepted the hypothesis that stress-induced alterations of the joint surface include not only varying degrees of subchondral lamellar mineralization, but also histological changes of the subarticular cancellous bone.
Methods: To examine the structure of the subarticular cancellous bone, ten formalin-fixed talar trochleae were analyzed using micro CT. Sixteen measurement zones were defined and then evaluated in five layers each of 1 mm thickness, enabling assessment of the cancellous architecture extending 5 mm below the trochlear surface using numerical and structural parameters.
Results: Like with mineralization patterns in the subchondral lamella, large variation was observed regarding bone volume as well as trabecular quantity, thickness, and spacing, depending on localization. In addition, like previous reports examining mineralization of the subchondral lamella, two distinct groups could be identified as "bicentric" or "monocentric".
Conclusion: These results show that structural tissue adaptation due to loading history is also evident within the subarticular cancellous bone.

FM6

The Role of the Deltoid Muscle in Basic and Pitching Shoulder Motions using a Cadaveric Model

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Purpose: To study the influence of the deltoid muscle on glenohumeral translations in all three degrees of freedom in a cadaveric setup with an intact torso.
Methods: In a previously published, validated testing system, both shoulders of three fresh-frozen human torsos were tested in an intact specimen and after complete removal of the deltoid in three consecutive trials using five high-speed cameras by means of bone-embedded markers. Abduction (ABD) and abbreviated throwing motion (ATM) trajectories were tested. For statistical analysis, in addition to the absolute trajectories, the area under the curve (AUC) was calculated.
Results: When looking at the AUC the only significant difference ($p = .003$) can be found in the Z-axis (medio-lateral translation) at 30–60° of abduction with values of 0.9 ± 0.4 mm. No other significant different trajectories between the intact specimen and after deltoid removal could be found.
Conclusions: Our finding support studies showing that deltoid removal does not to cause a meaningful change in ABD and ATM trajectories supporting the fact that the bulk effect might play only a minor role in passive glenohumeral stabilization. These findings might help researchers in planning kinematic and dynamic studies for open surgery at the glenohumeral joint.

FM7

Physiological Achilles Tendon Length and its Relation to Tibia Length

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Background: The optimal intraoperative Achilles Tendon Length (ATL) adjustment is crucial for the physiological functioning of the musculotendinous unit. To date, the resting ATL and its relation to Tibia Length (TL) have never been defined in healthy subjects. We thus performed metric measurements of the ATL and TL.
Methods: In this case series, 52 subjects were placed in a 3T-MRI with the ankle in neutral position. Unilateral ATL was measured from the calcaneal insertion to the beginning of the medial gastrocnemius muscle. TL was measured from the intercondylar eminence to the center of the ankle. Qualitative tendon parameters in T2-sequences and human parameters were noted. Results were correlated with age, gender, body height, weight, BMI, side of the AT and TL.
Results: The mean ATL was 180.6 ± 25.0 mm and the mean TL was 371.9 ± 25.4mm with an ATL/TL-ratio of 49 ± 5%. ATL correlated significantly with body height ($R2 = 38\%$, $p < .0001$) and with TL ($R2 = 41\%$, $p < .0001$) but did not correlate with age, BMI and side of the AT. TL correlated with body height ($R2 = 83\%$, $p < .0001$) and in multivariate linear regression, TL was the only independent predictor of ATL the following the algorithm **ATL(mm) = 0.6 * TL(mm) - 53** ($R2 = 41\%$).
Conclusions: We defined a new way to measure the ATL in a consistent way in healthy subjects and could show correlations between ATL, TL and body height and defined an algorithm of ATL based on TL. The ATL and the ATL-algorithm might be important in patients with impaired tendons such as AT ruptures.

FM8

In vivo micro-computed tomography can visualize and quantify osteosarcoma primary tumor growth and pulmonary metastases over time

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Introduction: In osteosarcoma (OS), one important imaging tool to assess the extent of primary tumor growth, metastatic spread (mainly in the patients' lungs), and thus patient prognosis is computed tomography (CT). In the past two decades, this technique has been adapted in order to image small laboratory animals like mice. As such, micro-CT imaging proved its functionality in a number of other cancer types. In our laboratory, we established a method to visualize the presence of single OS tumor cells ex vivo, by means of LacZ tagging. However, what exactly occurs during the course of the disease process remains largely unknown, since in vivo visualization methods are not yet commonly employed in preclinical OS models. We therefore tested if in vivo micro-CT can be employed to monitor the growth of both the primary tumor as well as the pulmonary metastases in a preclinical OS model.
Methods: Female SCID mice received an intratibial injection with LacZ-tagged osteoblastic SAOS-2 or osteolytic 143B OS cells. After growth of the primary tumor, mice were anesthetized and scanned in the Skyscan 1176 in vivo microtomography system using the 35 µm setting. Two separate scans were made, one of the chest area and one of the hind limbs. Scan duration per scan was 8–10 minutes, with a dose of ~0.5 Gy. After two weeks, the scans were repeated. As verification, mice were sacrificed immediately after the second scan, and their lungs were excised, X-Gal stained, air-dried, and scanned again at high (9 µm) resolution.
Results: In mice injected with SAOS-2 cells, mineralized foci could be observed inside the primary tumor mass, as well as in the pulmonary metastases. The size of the smallest detectable metastasis was 0.5 mm. In the second scan, the mineralized foci became more pronounced. In 143B tumors, bone destruction at the proximal tibia could be visualized in detail. X-Gal stained and re-scanned lungs showed a perfect match between X-Gal staining and micro-CT-detected metastatic sites ex vivo.
Conclusions: Micro-computed tomography can be used to monitor both primary and distal OS tumor growth in vivo, and reveals detailed 3D information of micro-metastasis distribution ex vivo. Future challenges will be to increase the contrast between tumor tissue and normal tissues, e.g. by using gold-labeled antibodies directed against specific tumor markers, and thus to be able to identify and monitor even smaller metastases over time.

FM9

Stimulation of β-TCP ceramic resorption through incorporation of RANKL – an in vitro study

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Introduction: β-tricalcium phosphate (β-TCP) ceramics have been approved for the repair of osseous defects. However, in large bone defects, the substitution of β-TCP ceramics by authentic bone is inadequate to provide sufficient long-term mechanical stability. We aimed to develop composites of β-TCP ceramics and Receptor Activator of Nuklear Factor β B Ligand (RANKL) to enhance formation and activity of resorbing osteoclasts thereby stimulating cell-mediated material resorption.
Materials and Methods: β-TCP ceramics were coated with RANKL (5 µg/ml, 25 µg/ml); RANKL was superficially adsorbed (passive short-term release) or incorporated into a crystalline layer of calcium phosphate (cell-mediated long-term release). Murine osteoclasts precursors seeded onto the ceramics were stimulated with CSF-1 (30 ng/ml). On days 12 and 15, the formation of osteoclasts was controlled with TRAP staining and quantified with by TRAP activity. The expression of the osteoclast markers cathepsin K and osteocalcin receptor was measured with real-time PCR. Uncoated ceramics served as negative (+30 ng/ml CSF-1) and positive controls (+30 ng/ml CSF-1/+100 ng/ml RANKL). The release of simultaneously incorporated tritium labeled bovine serum albumin [3H-BSA] served to determine the resorptive activity of osteoclasts.
Results: If adsorbed to β-TCP ceramics, RANKL did not induce the formation of osteoclasts on the surface of the materials. Incorporation of RANKL into β-TCP ceramics resulted in positive TRAP staining and an increased TRAP activity, which was similar to that observed in positive controls (neg. contr. 0.62 ± 0.0 OD; pos. contr. 1.28 ± 0.26 OD; RANKL 1.36 ± 0.14 OD, p
Conclusion: Our Study shows that RANKL incorporated into β-TCP ceramics induces the formation of active, resorbing osteoclasts. The differentiation of osteoclasts is initiated due to a residual passive release of incorporated RANKL. Once formed, osteoclasts mediate the release of RANKL thereby perpetuing their differentiation and activation which results in a stimulation of cell-mediated material resorption in vitro. In vivo, the expression of osteoclast-derived factors may contribute to a coordinated sequence of material resorption and bone formation.

FM10

Comparison of variability during stair ascending and descending with different step heights in patients with a total knee arthroplasty and healthy subjects

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Introduction: For patients with total knee arthroplasty (TKA) ascending and descending stairs is a very demanding task in comparison to level walking. Subtle gait changes can be attributed to the investigation of gait variability. The higher requirements for the musculoskeletal system while climbing stairs leads to the assumption that the variability increases with higher step heights. Therefore the aim of the study was to compare the variability of selected parameters during stair ascending and descending with different step heights between patients with a TKA and healthy subjects.
Methods: 15 patients with good outcome with TKA (LCS® Complete™) and 17 healthy age- and weight-matched subjects were included in the study. Selected parameters of sagittal and frontal motion and joint moments of the knee from three repetitions of stair ascending and descending were measured with a motion analysis system and two force plates from the bottom combined with the stairs. Coefficients of variation (CV) for stair ascending and descending with different heights (17 cm, 21 cm) were calculated for both groups. The Bonferroni procedure was used to guarantee the overall significance level.
Results: Two-year results after TKA show that patients with good outcome produce variability during stair ascent and descent which is comparable to healthy individuals with the exception of one difference. The patients significantly decreased variability in maximal knee flexion during stance phase at stair ascending (21 cm) compared to the healthy subjects (CV = 1.3 % vs. 2.2 %, p = 0.043). For stair descending there are no differences between 17 cm and 21 cm and between both groups.
Conclusion: TKA patients with good outcome had no problems ascending and descending stairs with different step heights. In maximum knee flexion during stance phase they unexpectedly showed a more consistent gait pattern during stair ascent at 21 cm step height compared to healthy subjects. We explained this finding to be related to a need of higher requirements of control of the knee in form of a purposeful eccentrically control of the quadriceps by ascending from a higher step.

FM11

Age-related decline of the performance of the musculoskeletal system: illustrated by sprint running

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Introduction: A gradual decline of performance of the musculoskeletal system with age is an inevitable physiological process. An ideal possibility to objectify this age related decline is the motion of sprint running. Sprinting is a complex and demanding physical activity, which require significant speed, strength, endurance, flexibility and coordination of the whole body. This study looks for age-related modification of the sprint stride kinematics at maximum velocity and aims to identify the decline of strength, endurance, flexibility and coordination in a chronological order.
Methods: All finals of the 60 m sprint of the different five-year age categories (every 5 years, from 35 to 80 years) at the European Veterans Athletics Championships in Ghent (Belgium 2011) were recorded using a high-speed camera (at 1000 frames/sec). The stride kinematics of each of the 154 finalist (80 male and 74 female) was analyzed with ProAnalyst, a motion analysis tool for the automated measuring of moving objects with video without the use of special markers. The general and specific performance descriptors of sprint runners were measured and the results of the different age groups were compared.
Results: The decline of performance observed was 0.1 sec for 60m per five-year age category between 35 and 55 years and 0.4 sec between 55 and 75 years. The stride rate remains constant till the age of 75 years. Stride length shortens, ground contact time increases, air time decreases and upper leg rotational speed during extension and lower leg rotational speed during flexion decrease with age. The decrease of the range of motion of the upper leg was slight however the decrease of the range of motion the lower leg was clearly distinguishable.
Conclusion: Up to the age of 75 years a deterioration of the kinematics of the sprint stride at maximal velocity is not evident. The performance decreases gradually with a clear decline at 40, 55 and 75 years. The principal reason for the first decline up to the age of 40 is a reduction of dynamic strength, up to the age of 55 years an additional deterioration of synchronization between the two legs sets in and up to the age of 75 years a loss of flexibility occurs.

FM12

Influence of increased load wearing on human posture and muscle activation of trunk and lower limb

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Introduction: Disorders of the musculosceletal system, e.g. back pain, are often caused by the wearing of heavy loads. The present biomechanical study analyses the influence of military equipment (e.g. shoe, helmet, backpack, rifle) on muscular activity and posture of soldiers by means of different static and dynamic measurements. Furthermore, compensatory mechanisms in case of increased load wearing should be identified.
Methods: 37 airforce soldiers participated at the study on a voluntary basis. An EMG analysis was taken as the subjects walked on a treadmill at a constant speed of 3.2 km/h and were consecutively dressed with different military equipment. Bilateral dynamic surface EMGs were taken of muscles of the trunk and the lower extremities. Range of motion of hip, knee and ankle joint was detected by video analysis and an electronic goniometer. Standardisized photography was used to measure body axis and posture in the frontal and saggital plane. Furthermore, a static and dynamic pedobarography was carried out.
Results: Load wearing of soldier's equipment caused specific changes in surfaceEMG of the trunk and lower extremities in consequence of different muscular activation. For instance, change in the way of carrying the rifle led to an increase of 50% in activation of the M. pectoralis major. Furthermore, the vertical force and consecutively the pressure on the plantar surface of the foot increased with the higher weight of equipment. Thereby, a dependency on the load wearing, e.g. position of the rifle taking, was given, i.e. differences in stability of longitudinal and transversal arch of flattened and normal feet (contact area increase) were observed. Although a ventral inclination (5°) could be seen during loading, center of mass did not change in the saggital view as a result of muscular compensation. Weight of worn equipment had no significant influence on range of motion of the knee joint.

Conclusions: Wearing of heavy loads can influence strain related disorders of the musculosceletal system. In particular, back pain and injuries and functional problems of soldier´s footand ankle can occur as a result of an unbalanced weight distribution. This study should help to improve the equipment of soldiers to reduce overuse caused pain. In order to reduce increased muscle activation and to avoid harmful compensatory mechanisms and unfavourable posture adequate wearing systems for the equipment should be used.

FM13

New radiation free targeting device for intramedullary nails. A cadaver study

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Objectives: The purpose of this study was to assess the effectiveness of a novel radiation-independent aiming device for distal locking of intramedullary nails in a human cadaver model.
Methods: A new targeting system was used in 25 intact human cadaver femora for the distal locking procedure after insertion of an intramedullary nail. The number of successful screw placements and the time needed for this locking procedure were recorded. The accuracy of the aiming process was evaluated by computed tomography.
Results: The duration of the distal locking process was 8.0 ± 1.8 minutes (mean 6 SD; range, 4–11 minutes). None of the screw placements required fluoroscopic guidance. Computed tomography revealed high accuracy of the locking process. The incidence angle (a) of the locking screws through the distal locking holes of the nail was 86.8 ± 5.0 (mean 6 SD; range, 80–96). Targeting failed in 1 static locking screw because of a material defect in the drilling sleeve.
Conclusions: This cadaver study indicated that an aiming arm–based targeting device is highly reliable and accurate. The promising results suggest that it will help to decrease radiation exposure compared with the traditional “free-hand technique.”

FM14

2-months development of the mechanical properties of absorbable sutures used in orthopedic surgery

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Introduction: In orthopedic surgery, there are frequently situations in which surgical sutures have to bear high mechanical load, such as in tendon repair.Not only the sudden break of the suture but also excessive elongation of the loop can compromise a successful tissue healing.The aim of this study was to assess how the tensile strength and elasticity of absorbable suture material used in orthopedics develop during material degradation over a time period of two months.
Material and Methods: Five different absorbable (Vicryl, PDS, Vicryl rapide, Monocryl, Maxon) and one non-absorbable (Ethibond) suture materials of USP#2 (0.5mm) were tested.These 6 materials were knotted to a loop and incubated in an approved standard testing solution (37.0 °C; pH 7.4).Data was analyzed concerning load to failure, creep and hysteresis over a time period of two months.
Results: Vicryl was the strongest fiber on day 0 (195N) but he lost his tensile strength in the followed weeks (14N on day 42).Between day 14 and 28 PDS (171N) and Maxon (182N) sustained the highest loads. At the end of the two months, as expected, the non-absorbable Ethibond was the strongest fiber (140N).Monocryl didn’t resist the preload of 1N after 28 days, the Vicryl rapid even after 14 days.50% of the initial supported load was reached for Vicryl rapide and Monocryl on day 14, day 28 for Vicryl, day 56 for PDS, day 42 for Maxon and never for Ethibond. All the fibers showed an overall decrease of the elongation of the loop (creep) during the two months period.Maxon (6.3 mm) and Vicryl rapid (5.9 mm) featured the longest elongation of the loop ($p = 0.001$). The most pronounced hysteresis ($p = 0.001$) was measured in Vicryl and Maxon.All the fibers showed a slight reduction of the hysteresis over time.Remarkably, the Vicryl and the Maxon had the steepest reduction of the hysteresis in the first 42 days.
Discussion: Interestingly, there is no data available on how long strong (USP #2) absorbable suture materials preserve their mechanical properties.Monocryl and Vicryl rapid lost their tensile strength very fast and are suitable for fast healing repairs.Vicryl, PDS and Maxon sustained even higher loads to failure than Ethibond during the first 14 days.In our test setting PDS maintained the mechanical properties longest during the first 42 days.Elasticity however, in part represented by the here tested hysteresis of the material, seems to be lost in all absorbable sutures over time and should not be relied on by the surgeons.

FM15

Late implant removal after posterior correction of thoracic AIS with pedicle screw instrumentation – A matched case control study with 10 year follow-up

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Introduction: Late implant removal is occasionally necessary after instrumented posterior correction of adolescent idiopathic scoliosis (AIS) due to late implant infection or implant associated pain. Progression of deformity after implant removal is possible and its clinical relevance is not yet known due to lack of studies with a comparable control group.
Methods: 50 patients with AIS and pedicle screw instrumentation for posterior correction that were followed for at least 10 years, of whom 7 patients needed implant removal (IR) after 3.4 (range 1.1–7.9) years due to late implant associated infection. These patients were matched to another 7 patients without any complications (control) by curve type (IR = control: 1 Lenke 1A, 2 Lenke 1B, 2 Lenke 2C, 1 Lenke 2B and 1 Lenke 3C), Risser stage (IR: 3.2 ± 0.9, control: 3 ± 1.4), age (IR = control: 15 ± 2 years) and gender (all female). Radiological measurements were done preoperatively, at 6 weeks, 2 years and 10 years postoperatively. All patients completed the SRS-24 questionnaire at 10 year follow-up.
Results: Although the curve magnitude of the main thoracic curve was similar preoperatively (IR: 57 ± 6°, control 57 ± 10°) and corrected equally (IR: 18 ± 4°, control 20 ± 7°), the deformity progressed in the IR group by tendency at 2 years (25 ± 11° vs control 17 ± 6°) and became statistically different at 10 years (IR: 31 ± 10°, control 19 ± 6°, $p < 0.05$). There was no significant difference in the total SRS Score between the groups (IR: 99 ± 13, control: 90 ± 17, $p > 0.05$) at 10 years.
Conclusion: Late implant removal after posterior correction of thoracic AIS with pedicle screw instrumentation results in a significant loss of correction of 10–15° at 10 y follow-up, but without clinical relevance as measured by the SRS-24 questionnaire.

FM16

Posterior correction of thoracic AIS with pedicle screw instrumentation. Clinical and radiological Results of 50 patients with a 10 year follow-up

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Introduction: Pedicle screw instrumentation has become standard of care for posterior correction of adolescent idiopathic scoliosis (AIS). There has however been very little report on long term results. We report clinical, radiological and pulmonary function results of 50 patients with minimal 10y follow-up.
Methods: 50 patients (44 female, 6 male, mean age at surgery 15.3 years) with 42 Lenke 1 (A = 19, B = 10, C = 13), 6 Lenke 2 and 2 Lenke 3 curves (Risser 0–3 (n = 26), >3 (n = 24)) were operated for AIS from posterior with pedicle screw alone instrumentation. The data was prospectively collected preoperatively, at 6 weeks, 2 years and 10 years postoperatively. COBB angle, sagittal and coronar balance, fusion levels, adjacent disc angle and lowest fused vertebral tilt were documented at all time-points. The overall outcome as well as the outcome of different curve types were analyzed statistically.
Results: Overall the main thoracic curves was corrected from 57 ± 12° to 21 ± 09° ($p < 0.05$). There was no significant change after 2 years (23 ± 10°) or 10 years (26 ± 10°). This effect was seen in all curve types. While the coronar balance restored during the follow-up period by tendency, there was a significant restoration of overall sagittal balance from preoperative 7.3 mm to –3.8 mm ($p < 0.05$). The adjacent disc angle decreased from 6 ± 3° to –2 ± 4° postoperatively and remained stable at 10 years. The lowest fused vertebral tilt decreased from 22 ± 7 mm preoperatively to 5 ± 5 mm postoperatively and 7 ± 5 mm at 10 years. The % FVC remained unchanged at 75% at all timepoints. The SRS score did not change from 94 ± 15 at 2y postop to 98 ± 15 at 10 y postop.
Conclusion: Posterior correction of thoracic AIS with pedicle screw instrumentation achieves a stable long-term correction with a good patient satisfaction.

FM17

Vertebral body stenting versus kyphoplasty in treatment of osteoporotic vertebral compression fractures

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Objective: Vertebral body stenting (VBS) was developed to impede resintering of the vertebral body encountered in ballon kyphoplasty (BKP) in the treatment of vertebral compression fractures (VCFs). Purpose of the present study was to clarify whether BKP or VBS show relevant peri- and postoperative differences.

Methods: In a two-armed randomized controlled trial patients with a total of 100 osteoporotic VCFs were included and allocated to either BKP or VBS treatment. Kyphotic correction was determined on pre- and postoperative radiographs. The occurrence of intraoperative complications, maximum balloon pressures and total radiation time were documented.
Results: Mean reduction of kyphosis (kyphotic correction angle) was 4.5 ± 3.6° for BKP and 4.7 ± 4.2° for VBS (p = .975). Mean pressures in VBS were 350 ± 72 psi and 233 ± 81 psi in BKP (p < .001). There were no significant differences in radiation time. None of the patients underwent revision surgery, postoperative neurologic sequelae were not observed. Cement leakage occurred in 25% of the patients without significant differences between the two intervention arms (p = .220). Intraoperative material-related complications were observed in 1/50 levels in BKP and in 8/50 levels in VBS.
Conclusions: No beneficial effect of vertebral body stenting (VBS) over balloon kyphoplasty (BKP) was found among patients with painful osteoporotic vertebral fractures in regard of kyphotic correction, cement leakage, radiation time and the occurrence of neurologic sequelae. VBS was associated with significantly higher pressures during balloon inflation and remarkably more material-related complications.
Keywords: vertebroplasty; balloon kyphoplasty; vertebral body stent; osteoporotic vertebral compression fracture; spine.

FM18

Five-years results of cervical disc prostheses in the SWISSspine registry

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Introduction: The Swiss federal office of public health required a mandatory nationwide HTA-registry for cervical total disc arthroplasty (TDA), amongst other technologies, to decide about reimbursement of these interventions. The group of 10 surgeons with the highest primary case load, contributing about 50% of the registry datapool, was selected for detailed long-term followup. The goal of the SWISSspine registry is to generate evidence about the safety and efficiency of these medtech innovations.
Methods: Within the registry 166 cases treated between 3.2005 and 6.2010 who were eligible for 5 year followups were analyzed. Followup rates for 3–6-months, 1 year, 2 years and 5 years were 90%, 90%, 71% and 72% respectively. Surgeon administered outcome instruments were primary intervention, implant and follow-up forms; patient self-reported measures were EQ-5D, COSS (cervical NASS), and a comorbidity questionnaire.Outcome measures were neck and arm pain levels, medication, quality of life, work status, intraoperative and postoperative complication and revision rates. Additionally, segmental mobility (implant mobile, immobile or ossified) and osteophytes were analyzed at the 5-year followup.
Results: There was significant, clinically relevant and lasting reduction of neck (preop/postop 64/23 points) and arm pain (preop/postop 68/18) on VAS and a consequently decreased analgesics consumption at 5 years after surgery. Similarly, quality of life significantly improved from preop 0.37 to postop 0.82 points on EQ-5D scale. No intraoperative and 9 early postoperative complications as well as 9 complications at followup occurred. 8 re-interventions during the same hospital stay and 7 revisions were documented. During all followups 16 (9.6%) patients complained about 18 new events like headache (n = 7), fibromyalgia (n = 2), symptomatic stenosis (n = 2), depression (n = 1), pseudoarthrosis (n = 1), slanted neck posture (n = 1) and cervical distorsion (n = 2). At 5-year followup, osteophytes were diagnosed in 23.8% of all segments. 91.7% of all treated segments were mobile, 5.8% were immobile and 2.5% were ossified.
Conclusions: Cervical TDA appeared as safe and efficacious in long-term pain alleviation, consequent reduction of pain killer consumption and in improvement of quality of life. The improvement is stable over a five years postoperative period. The vast majority of the treated segments remain mobile after 5-years, although a quarter of the patients showed osteophytes.

FM19

MRI-changes of the multifidus muscle in lumbar radicular compression. Relation to severity and duration of compression and need for surgical decompression

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Introduction: It was the aim of this study to investigate whether atrophy of the respective multifidus muscle in MRI is related to the severity of nerve root compression and/or the duration of clinical symptoms. Furthermore we assessed whether multifidus asymmetry had any correlation with the ultimate decision for surgical lumbar nerve decompression.
Methods: MRI scans of 79 patients with symptomatic single level, unilateral, lumbar radiculopathy were retrospectively reviewed for this study. The cross sectional area (CSA) of the multifidus muscle and the perpendicular distance of the multifidus to the lamina (MLD) were measured on the affected side at the respective level, on axial cuts, as well as on the contralateral side by two experienced radiologists. The ratios of CSA and MLD between the affected and contralateral sides were calculated and correlated to the severity of nerve root compression, duration of symptoms and decision for surgical decompression.
Results: There were 67 recessal and 12 foraminal symptomatic nerve root compressions. Neither the MLD ratio (severe 1.19 ± 0.55 vs. less severe nerve compression: 1.12 ± 0.30, p = 0.664) nor the CSA ratio (severe 1 ± 0.16 vs. less severe 0.98 ± 0.13, p = 0.577) nor the duration of symptoms significantly correlated with the degree of nerve compression. A MLD >1.5 was highly predictive for need of surgical decompression (OR 27, Specificity 92%, PPV 73%).
Conclusions: The extent of atrophy of the multifidus muscle on the affected side in comparison with the contralateral side does neither correlate with the severity nor the duration of nerve root compression in the lumbar spine, but severe asymmetry with substantial multifidus atrophy is highly predictive for the decision to surgical decompression.

FM20

Neurophysiological changes during interspinous distraction in lumbar spinal stenosis

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Background: Interspinous devices have been introduced as a means of treating lumbar spinal stenosis (LSS) in selected patients on the assumption that some degree of distraction will indirectly decompress the spinal canal explaining thus the improvement of symptoms. We aimed to measure the neurophysiological effects of interspinous distraction during spine surgery for LSS and compare them to those obtained following surgical decompression.
Methods: Twenty two patients with lumbar spinal stenosis undergoing decompressive surgery by a single surgeon were enrolled in this study. From those 8 underwent single level decompression the remaining undergoing multilevel decompression. A total of 133 stenotic levels were analysed. Intra-operative motor evoked potentials (MEPs) were acquired prior any distraction of a particular level (baseline), during calibrated distraction at 6, 8, 10, 12, 14 and 16 mm, and finally after bilateral decompression. Hand MEPs served as reference. Relative changes of the area under curve of MEP's (adjusted to reference) compared to baseline were used as the primary outcome measure for each individual distraction increment as well as for the final decompression. Results were analysed with respect to disc height, number of affected levels and LSS radiological severity score based on the morphological grading.
Results: Both decompression and distraction results were related to radiological severity score, the former being most effective in high scores and the latter in low scores. Single level stenosis showed improvement of MEPs of similar magnitude to full decompression during the 8 mm distraction process (p = 0.13). In contrast 10,12,14 and 16 mm distraction were less effective in this setting (p <0.05). Multiple level decompression was more effective in a statistically significant manner than any amount of distraction. Results did not depend on disc height.
Discussion: We found that interspinous distraction in particular of 8 mm was sufficient to replicate electrophysiological improvements obtained during full decompression in spinal stenosis even of severe grade in single level stenosis patients. This did not appear to be the case in patients with multilevel disease. There appears therefore to be some neuro-physiological basis behind the reported clinical improvement of interspinous distraction which contrary to the accepted criteria was also present in severe stenosis cases providing this was limited to one level pathology. This is to our knowledge the first study that analyses the pathophysiological basis of interspinous devices aimed at treating LSS.

FM21

TcMEPS monitoring during spinal osteotomies for saggital imbalance

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Background: Kyphostic deformities with sagittal imbalance of the spine can be treated with spinal osteotomies. Those procedures are known to have a high incidence of neurological complications in particular at the thoracic level. Evoked motor potentials have been widely used in helping avoiding major neurological deficits post operatively. Previous reports have shown that a significant proportion of such cases present with important Tc MEP decreases during surgery with some of them being predictive of post operative deficits. The aim of our study was to look at the TcMEP changes in our series of patients and correlate them with clinical findings.
Patients and methods: Seventeen patients were operated in a 2 year period, presenting with kyphosis of congenital, degenerative or post traumatic origin. Shortening subtraction osteotomies were performed in 9 patients at lumbar level (L1 to L4) and 8 at thoracic level (T1 to T12).
Results: Intraoperatively all patients showed significant TcMEP changes. In particular a loss superior to 80% in at least one muscle group was observed in 4/8 patients in the thoracic group and 4/9 patients in the lumbar group. No surgical maneuver was undertaken as a result of this loss in an effort to improve motor responses other than verifying the stability of the construct and the extent of the decompression. Only 3 patients developed post operative deficits, all of them being of radicular origin (two T1 level and one L3 level) recovering fully at 3 months post surgery. No relation was found between intraoperative blood pressure and TcMEP changes. In our series, severity of TcMEP did not correlate with post operative deficits.
Discussion: TcMEP loss during major spinal surgery is of particular concern for physicians involved in this type of procedures. Although nearly all patients experienced loss of TcMEPs of some degree, only 3 patients developed symptoms but those were relatively minor and transient. Even though every effort should be taken to improve motor responses by verifying the extend of the decompression and stability of the spine as well as maintaining blood pressure, it may be that such dramatic TcMEP changes need not to alert physicians since they do not appear to have a lasting clinical effect. Total loss of TcMEP (not witnessed in our series) might require more drastic approach with possible reversal of the correction and wake up test.

FM22

Gait analysis under real-life conditions in patients presenting with lumbar spinal stenosis

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Introduction: The diagnosis of lumbar spinal stenosis (LSS) is based on patient history, clinical picture, and radiological findings. Although walking limitation is the cardinal sign of LSS, reports on its relation to symptom severity are contradictory. In addition, most studies looked at just a few walking cycles in a laboratory setting. Our primary aim was to quantify the gait parameters of LSS patients monitored under long time real life condition using ambulatory devices, in patients with LSS undergoing either conservative or surgical treatment. Our secondary aim was to identify differences between surgical and non surgical candidates on the basis of their gait parameters.
Patients and Methods: Twenty eight patients (average age 71.4y, SD 10.4y), referred to a spinal surgeon with symptoms attributed to radiological stenosis of varying degrees and with neurogenic claudication were included. Symptom and radiological stenosis (morphological grade) severity was greater in 15 patients who subsequently underwent decompressive surgery (surgical group). Walking parameters were monitored during 8 hours daily over a period of five consecutive days, prior to any treatment (non-surgical, or surgical), using 2 miniature gyroscopes on thigh and shank. Periods >10s were analyzed with regards to walking speed, cadence, stride length and walking distance as well as gait variability. Walking distance was calculated and compared for the three longest periods recorded in each subject. Gait variability was expressed as coefficient of variability (CV) of the three longest recorded walking periods of each baseline measurement Statistical differences were analysed using t-test.
Results: A total of 3757 walking episodes >10sec were analysed. Average values for cadence speed, and stride length were 99 ± 6.5 steps/min, 3.1 ± 0.8 km/h, and 1 ± 0.2 m respectively in non-surgical group and 97 ± 10.6 steps/min, 2.9 ± 0.6 km/h, and 1 ± 0.2 m in surgical group. The average values of CV for speed, cadence and stride length were 0.12, 0.07 and 0.09 respectively in the non-surgical group and 0.14, 0.06 and 0.12 in the surgical group, representing a smaller gait variability in the non surgical. There was a trend towards longer walking distances, for the three longest monitored walking periods, in the non surgical group (239 ± 304m vs 110 m ± 111, p = 0.01)
Conclusion: We found better walking capacities and less gait variability in the non surgical group. Although gait parameters might depend on a variety of factors, severity of symptoms and stenosis appear to have a measurable impact as observed in our two groups of patients. To our knowledge no previous study looked at physical activity over such a prolonged period in several subjects in the context of LSS. Future research into the reversibility of the aforementioned differences following treatment is underway.

FM23

Age-dependent normal values for bony, cartilaginous and labral coverage in the pediatric hip measured on MRI

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Introduction: Residual dysplasia of the pediatric hip after treatment of developmental dysplasia of the hip is a common problem in clinical practice. Age-dependent normal values of the acetabular index as an important value of acetabular coverage are well known. Some hips that are clearly dysplastic according to these normal values do show a surprising maturation with normal coverage in the course. It was hypothesized that hips that present a normal cartilaginous coverage on MRI might develop favorable. However, normal values for cartilaginous and labral coverage on MRI are not known. The aim of our study was to establish age-related normal values of bony, cartilaginous and labral coverage of the pediatric hip on MRI.
Methods: MR-images of hips were identified from the electronical archive. They had to meet the following inclusion criteria: no former treatment for developmental dysplasia of the hip, no hip pathology that might influence acetabular coverage or its measurement (no bone disorders such as epiphyseal dysplasia, Perthes disease, slipped capital femoral epiphysis or septic arthritis) and a contemporary Xray of the pelvis with an acetabular index below the 90. percentile of the age-related normal values according to Tönnis. MR images of 115 hips in 73 children were analysed and the bony, cartilaginous and labral acetabular index (AI bone/cartilage/labrum) was measured by two different observers in order to determine interobserver variability. The measurements were made on the coronal plane just posterior to where the triradiate cartilage between pubic and ischial bone was still visible. Percentile graphs were established from the Student's t-distribution of the measurements grouped by 2 years of age.
Results: Interobserver variability for the measurement of the AI bone was excellent (Intraclass correlation coefficient ICC 0.90). For the AI cartilage and labrum the ICC was somewhat lower (0.78) but interobserver variability was still rated as good. Percentile graphs of the AI bone, cartilage and labrum are presented. Although AI decreased during childhood, AI cartilage stayed relatively constant with the 50.percentile around 5° and a 90. Percentile around 10°.
Conclusion: We present percentile graphs of age-related normal values. Although bony coverage increases during childhood cartilaginous coverage seems to stay constant. We think that this knowledge is a valuable adjunct in decision making when to indicate secondary surgery for residual dysplasia.

FM24

Periacetabular triple innominate osteotomy for improved containment of hips with poor prognosis after Legg-Calvé-Perthes-Waldenstroem (LCPW)

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Introduction: Patients with LCPW who develop hip contracture and decentration of the femoral head usually have a poor prognosis. In 1992 GUE has begun to use periacetabular triple osteotomies in selected patients with lateralization of the femoral head and secondary dysplastic development of the acetabulum to reconstitute containment of the femoral head within the acetabulum. Functional arthrograms were performed before surgery to exclude severe hinge abduction, which is considered a contraindication.
Patients and Methods: 14 patients (16 hips) with CLPW and lateral extrusion of the femoral head and secondary dysplastic development of the acetabulum have been treated by triple innominate osteotomy (TIO) for lateralization and dysplastic acetabular development with a subinguinal adductor approach. Age at triple osteotomy ranged from 4 to 11 years (avg. 6.8y). Besides standard radiographs the indication was based on dynamic standard radiographic or MRI arthrograms. The more recent cases were pre- and postoperatively studied by quantitative CT. The TIO was performed at 9 to 30 months (avg. 18 months) after the first symptoms.
Results: All hips at follow-up (5 to 17 years, avg. 9 years after surgery) have developed concentrically and in most cases sphericity was

regained or improved. All patients at present are painfree and follow the same activities as their peers.
Conclusions: Triple innominate osteotomy is a procedure with high potential to improve the prognosis for hips with a spontaneous poor development after LCPW, if appropriately indicated.

FM25

San Diego Pelvic Osteotomy through a minimal lateral incision, results in two diffferents centers

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Background: Most clinicians agree that surgical treatment is indicated for progressive hip subluxation in patients with cerebral palsy (CP).
Introduction: The purpose of this study is to evaluate the outcome of severe CP patients (Gross Motor Function Classification System [GMFCS] levels IV and V) with hip subluxation or dislocation treated by simultaneous percutaneous pelvic osteotomy (PPO) and intertrochanteric varus shortening osteotomy (VDRSO). We review a larger cohort of patients than the one presented in 2005 at the SSO and the results at two different centers.
Methods: Eligible patients included those with a diagnosis of spastic quadriplegia or CP GMFCS levels IV or V with unilateral or bilateral hip subluxation or dislocation and surgical treatment of the deformity by simultaneous soft tissue release, VDRSO, and PPO. From 2002 onwards, all severe CP patients at our institution were treated using this technique.
Results: Twenty-four patients and 30 hips (15 male, 9 female) met the inclusion criteria. At the time of chart and radiograph review, the average age of patients was 9.4 years (range: 5 to 16.5) and the mean follow-up was 35.9 months (range: 6 to 96). Six patients (25%) underwent bilateral PPO, VDRSO, and soft tissue release; 13 patients (54%) had unilateral PPO and bilateral soft tissue release and VDRSO; 5 patients (21%) had unilateral PPO, VDRSO, and soft tissue release. PPO was always performed through a skin incision of 2 to 3 cm. The mean preoperative migration percentage of Reimer was 67.1% (range: 42 to 100) and 7.7% (range: 0 to 70) at last follow-up. The mean preoperative acetabular angle was 31.8° (range: 22 to 48) and 15.7° (range: 5 to 27) at last follow-up. Five cases presented complications: 1 redislocation, 1 bone graft dislodgement, and 3 with avascular necrosis of the femoral head.
Conclusions: A combined approach of soft tissue release, VDRSO, and PPO is an effective, reliable, and minimally invasive method for the treatment of spastic dislocated hips in severe CP patients (GMFCS levels IV and V). Even hips with relative incongruity, closed triradiate cartilage, and some deformity of the femoral head can be successfully treated with this combined approach. This less invasive surgical approach appears to be a valid alternative and implies less muscle scraping and blood loss, and a shorter operating time with an outcome similar to standard techniques reported in the literature.

FM26

Outcome of the Stanisavljevic procedure for patello-femoral instability

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Introduction: Congenital dislocation of the patella and recurrent symptomatic subluxation/dislocation in adolescents are very difficult pathologies to treat successfully. Stanko Stanisavljevic described an extensive release procedure in 1976 essentially involving medialising of the entire lateral quadriceps and medial soft tissue stabilisation. There are no significant series reporting the success of this method. This procedure has been performed regularly in our institution over several years and we report our findings.
Method: 40 knees in 32 children and adolescents with symptomatic recurrent or congenital dislocation of patella underwent this procedure after failing conservative treatment. Mean age 14 years (4–22). Mean follow up 8.3 years (4–20). Additional stabilisation procedures at same operation: 10 knees with Elmslie-Trillat, one with supracondylar osteotomy of femur; All were immobilised in a long leg cast for 6 weeks postoperatively. All patients were followed up in our clinic.
Results: 18 knees in 16 patients (45%) reported their knees as improved or much improved without further dislocations, subluxations or other symptoms. 16 knees in 12 patients (40%) underwent revision due to redislocation of the patella, usually Trochleaplasty and / or additional soft tissue procedure such as Insall. 3 knees in 3 patients (7,5%) still had dislocations or subluxations, but didn't want a revision. 3 knees in 3 patients in the failed group also complained of pain and discomfort during daily activity. Symptoms first developed after a mean of 19 months (2-60) postoperatively. Only 2 patients returned to sport at the 12 month follow up.
Discussion: The Stanisavljevic procedure produces a mediocre success rate in patello-femoral instability with our long term follow up series showing a failure rate up to 55%. We recommend more specific procedures dealing with the specific anatomical deformity such as trochleaplasty in order to produce superior success rates.

FM27

Flexible intramedullary nailing: relationship between nail and medullary canal diameter

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Introduction: Postoperative axial deviations and delayed unions are possible complications after flexible intramedullary nailing (FIN). The goals of this study were to determine if a correlation exists between occurrence of the above complications and the ratio of the diameter between nail and medullary canal (ND/MCD -ratio), and to define a threshold to be respected in order to obtain good results.
Methods: 81 consecutive diaphyseal fractures treated by means of FIN were evaluated. The ND/MCD -ratio were determined by two independent observers. Axial deviations were defined as more than 5° angulation during any time of the post operative period. Absence of bone union at three months was considered as delayed union. Statistical analysis was made for interobserver variability of MCD, dependency beween occurrence of complications and ND/MCD-ratio and eventual confounding variables (age, weight, gender, fracture location).
Results: Of 81 fractures, 14 presented with an axial deviation and 3 with a delayed union. Interobserver variability of MCD diameter was excellent (Intra-class-correlation: 0.96). Occurrence of complications was significantly associated with ND/MCD-ratio ($p = 0.0002$) but not with any of the examined confounding variables. ROC analysis showed absence of complications with a ND/MCD-ratio above 35% with a sensitivity of 100% and specificity of 89%. Above 35% ND/MCD-ratio no complication occurred.
Conclusion: In FIN a nail diameter superior than 35% of the medullary canal diameter should be chosen to avoid complications, besides respecting the technical principles. Measuring the medullary canal diameter in order to chose correct nail size is reproducible between different observers. In adolescents with a medullary canal diameter of more than 10mm in femur or tibia fractures, other methods of osteosynthesis the FIN should be considered.

FM28

Obese children sustain significantly more both bones forearm fractures when compared to non-obese children

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Introduction: Obesity in children is associated with an increased risk for fracture. The causes remain unclear and may be related to increased bone weakness during periods of intense growth or different kinetics (increased forces when falling). Comparing obese and non-obese children with extremity fractures has not been extensively studied.
Aims: Identify the characteristics of upper extremity long bone fractures in obese and non-obese children, measure their physical activity, grade the kinetics of trauma, evaluate the treatment modalities. The hypothesis was that when compared to non-obese, obese children sustain significantly more severe fractures, such as displaced, complex, multiple, or open and that they were treated more often under general anesthesia.
Methods: 6 months prospective collection of data on obese (BMI >95 percentile) and non-obese children presenting to the emergency room with an upper extremity long bone fracture. Children's activity prior to trauma was assessed with a questionnaire. Mechanism of injury was classified between direct, slow or high motion trauma. Fractures characteristics were defined using the validated pediatric classification (AO). Treatment modalities were compared.
Results: The estimated prevalence of obesity in children with upper extremity long bone fracture was 28%. 46 obese children aged 2 to 13 years (mean 9.28 y.) and 119 non-obese children aged 2 to 16 years (Mean 9.32 y.) were included in the study. There was no significant difference in the level of activity of the children in both groups (2.64 and 2.55 respectively). The mechanism of injury included a higher percentage of high motion trauma in obese children (57% versus 45%, $p = 0.19$). The risk for sustaining both bones forearm fracture was twice as high in obese children (RR = 1.97, CI 95% 1.16 to 3.34, $p = 0.012$). Obese children required a higher number of manipulations

under general anesthesia (24% versus 13%, RR 1.27, CI 95% 0.94–1.76, p = 0.092).
Conclusions: The prevalence of obesity in children with upper extremity long bone fracture was higher than in the general pediatric population. There was no statistical difference between both groups in the reported level of activity prior to injury, in the kinetics and in the treatment modalities. Obese children had a significantly higher risk for a combined radius and ulna fracture.

FM29

Evaluation of the Ponseti Method in Idiopathic Clubfeet

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Introduction: Treatment for clubfeet is time demanding and requires a sophisticated collaboration in order to achieve a good outcome. Numerous substantiated studies underlined a satisfying outcome of the Ponseti method1 as the primary therapy of idiopathic clubfeet provided, that an early onset is warranted in the absence of a high-grade rigidity2-9. The aim was to review our treatment with the Ponseti method regarding the present literature.
Methods: Fourteen patients with 19 idiopathic clubfeet have been analysed retrospectively,concerning the start and duration of plastering, the frequency of plaster changes, the need for percutaneous tenotomy of the Achilles tendon or further surgery, the start of physiotherapy and the definite change to a brace ("Kopenhagener Schiene") for night and naps.
Results: Looking at the median concerning **patients/feet** the results were the following: Start of plastering **6/6** (1-88) days after birth. Number of plasters **17/17** (3-26) in all patients. Treatment time in plaster **168/168** (47-301) days. Start of physiotherapy **7/7** (-6-21) days after start of plastering. Change to brace **196/196** (47-575) days after start of plastering. **58% of patients/64% of feet** needed tenotomy once but no further interventions. Time to surgery **111/113** (76-132) days after start of plastering. Pretenotomy plasters **12/11** (3-24). Posttenotomy plasters **4/4** (2-11).
Conclusion: Compared to recent studies with a similar frequency of plaster changes and a similar collective of patients our treatment time in plaster was much longer (e.g. 42 days5). The tenotomy-rate varies in a wide range between 3. Present studies tend to report higher tenotomy-rates then we had (70–75%2, 87.5%6, 100%3). Furthermore the higher tenotomy-rates tend to correlate with a dramatically decreased number of plasters (e.g. pretenotomy plasters 53, total number of plasters 63, 56). An earlier3 tenotomy with a wider indication might reduce length of treatment and the number of plasters. Studies including an accelerated Ponseti regime showed similar numbers of plasters even if the plasters are changed 2–3 times a week6. Further prospective studies will be required to confirm these findings.
References: 1 Ponseti 1972, 2 Wallander 2010, 3 Halanski 2010, 4 Jowett 2011, 5 Harnett 2011, 6 Xu 2011, 7 Janicki 2011, 8 Van Bosse 2011, 9 Ganger 2012

FM30

Prevalence of vitamin D insufficiency in Swiss teenagers with appendicular fractures: a prospective study about 100 cases

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Background: In elderly subjects, low vitamin D status elevates parathyroid hormone (PTH) concentrations, which, in turn, increases bone turnover and bone loss, contributes to mineralization defects, and increases risk of hip and other fractures. The significance of subclinical vitamin D deficiency in the pathogenesis of fractures in children and adolescents remains currently unclear. We aimed to determine the prevalence of vitamin D insufficiency and its effect on bone mineral values in a collective of Swiss Caucasian children with first episode of appendicular fracture.
Methods: Hundred teenagers with first episode of appendicular fracture (50 upper limb fractures & 50 lower limb fractures) and 50 healthy controls were recruited into a cross-sectional study. BMC and BMD values were measured by dual-energy x-ray absorptiometry, and serum 25 hydroxyvitamin D was assessed by using high-performance liquid chromatography coupled with tandem mass spectrometry. BMD and BMC values were adjusted for age and gender and were exprimed as Z-scores.
Results: Of the 100 injured teenagers in the study, 12% haddeficient-vitamin D levels (< 20 ng/mL; No significant groups' effect was found for any of serum 25(OH) D, L2-L4 BMD Z score and L2-L4 BMC Z score variables (p = 0.216). No significant difference was found between healthy controls and lower limb fractures groups for the calcaneal BMD Z score variables (p = 0.278). DXA scan results were consistent for both, injured teenagers and healthy controls, with normal bone density for chronologic age. At finally, the last result that emerged from this study was the lack of influences of serum 25 (OH) D levels on bone mineral values (BMD/BMC indices).
Conclusions: A significant proportion of Swiss Caucasian teenagers with or without fractures in our study are vitamin D insufficient. However, this study failed to show an influence of low vitamin D status on bone mineral density and/or content at lumbar spine, and heel. The present results reinforce nevertheless the concept that there are probably many confounders (sexual maturity, race, genetics, diet, season) to determining the real role of vitamin D status in bone accretion during growth. Further research is therefore needed to determine the real relationship of vitamin D status on bone accretion.

FM31

Pediatric Orthopedic Work in "resource deprived countries". Transfer of knowledge by active Tuition in Tanzania. Example: Blount's disease

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During the last 10 years a paediatric orthopaedic service was developed in Tanzania. The interest of the presenter has been to expand his expertise in orthopaedic problems rarely encountered in in his University Environment in Europe besides transfer of knowledge to improve orthopaedic service for children in ,resource deprived (formerly called "developmental") countries.
Example Blount's disease: Langenskiöld has taught us most about diagnosis and managment of Blount's disease. Therefore we choose this problem as an example of our activities to introduce adaptation of treatment to means locally available while pursuing the goal of full correction. Blount's disease is extremely frequent in central Africa and usually only treated when severe deformity has developed. The causes are unknown, but the presenter is convinced that nutritional deficiencies including pre-clinical rickets are likely to play a major role.
Standard Surgical Treatment is "high tibial acute osteotomy" (HTO) and retentin in plaster of paris. This does not correct the tibial plateau deformity, which should be addressed especially in young children with potential for remodelling of the joint surfaces.
"New" Treatment: In the presenters european setup elevation of the medial tibial plateau is performed by an osteotomy guided into the tibial eminence and plate fixation with or without bone graft with simultaneous epiphysiodes of the lateral tibial hemiphysis and the proximal fibular physis. In **Tanzania** we also use this osteotomy, but fixation is performed with Schanz screws and correction to achieve a neutral Mikulicz line is gradually achieved by external fixation.

FM32

A comparative analysis of fatty infiltration and muscle atrophy in patients with chronic rotator cuff tears and suprascapular neuropathy

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Introduction: The negative impact of fatty infiltration (FI) and muscle atrophy (MA) on the functional outcome of rotator cuff disorders has clearly been shown in several previous studies. However, relatively little is known of the mechanisms that lead to these changes, and more importantly, how to reverse them once they have occurred. It has been our observation on routine MRI scans, that the macroscopic pattern of FI and MA differs between patients with chronic rotator cuff tears and those with a suprascapular neuropathy. This suggests that the pathophysiology leading to the changes seen in the muscle may be different. Therefore, it was the aim of this study to compare the macroscopic appearances, as seen on MRI, that occur with chronic rotator cuff tears and denervation secondary to lesions affecting the suprascapular nerve.
Methods: Two groups of patients were retrospectively identified – Group 1 (20 shoulders): patients with a chronic tear of the supraspinatus and/or infraspinatus with no evidence of a suprascapular neuropathy on electromyographic (EMG) study; Group 2 (17 shoulders): patients with the diagnosis of suprascapular neuropathy with a positive EMG study. All patients had obtained a MR arthrogram of the affected shoulder and the supraspinatus and infraspinatus muscles were analyzed for their degree of FI and MA. Morphological assessment was performed specifically looking at the characteristics of the muscle border, pattern of fatty infiltration and the extent of its involvement.
Results: Our analysis demonstrated that there are morphological differences seen on MRI between chronic rotator cuff tears and those affected by a suprascapular neuropathy, especially with respect to the muscle border, the degree of perineural fat and overall distribution of fatty infiltration from proximal to distal. In addition we were able to

identify particular morphological patterns of fatty infiltration that were highly specific in terms of indicating a chronic rotator cuff tear or a muscle affected by suprascapular neuropathy.
Conclusion: While several studies have demonstrated the changes that appear in the rotator cuff with chronic tendon tears, no studies, to our knowledge, have described the radiological changes that occur with suprascapular neuropathy. We believe that the findings of this study have the potential to provide a basis for further research, in terms of diagnosis and qualitative description, assessment of severity and evaluation of treatment.

FM33

Correlation of the Involved Compartments of Massive Rotator Cuff Tear and Loss of Active Shoulder Range of Motion

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Introduction: The loss of active elevation following RCT is well known as pseudoparalysis, but its risk factor is unclear. The purpose of this study was to clarify the clinical symptoms of patients with massive RCT with regards to which tendons were involved, to assess the risk factor of the loss of the active range of shoulder motion, and to consider the management of massive RCT.
Methods: We divided the rotator cuff into 5 compartments: supraspinatus (SSN), superior subscapularis (SSC sup.), inferior subscapularis (SSC inf.), infraspinatus (ISN), and teres minor (TM). Ninety-eight patients (50 men and 48 women, mean age: 68 years) with RCT involving 2 or 3 compartments with muscular fatty infiltration (Stage 3 or 4 regarding Goutallier's classification) were included prospectively. We included only the severe fatty infiltration. Regarding the involved tendons, we separated the patients into 5 groups: type A (SSN + SSC sup., 8 cases), B (SSN + SSC sup. + SSC inf., 19 cases), C (SSN + SSC sup. + ISN, 21 cases), D (SSN + ISN, 35 cases), and E (SSN + ISN + TM, 15 cases). The active range of shoulder motion was assessed in each group and Tukey's multiple comparison post-hoc tests were performed on the 5 groups to identify the differences.
Results: The range of active anterior elevation significantly decreased in types B and C patients. Seventy-nine percent of type B, 48% of type C, and 33% of type E patients could not elevate their own arm actively beyond 90º. External rotation was significantly decreased in types C, D, and E, and the values for type E were significantly lower than those of types C and D. Internal rotation decreased significantly in types B and C.
Discussion and Conclusion: This study is the first report that refers to the correlation between the tendons involved with massive rotator cuff tear and its clinical symptoms. Our study revealed that the loss of active anterior elevation is related to dysfunction in 3 compartments involving SSC. The loss of active external rotation is related to dysfunction of ISN and TM and the loss of active internal rotation is related to dysfunction of SSC. Due to its anatomical position, SSC could play an important role for anterior elevation. The validated classification will be useful for more detailed analyses of patients with massive RCT.

FM34

Quantitative Analysis of Supraspinatus Tendon and Muscle Retraction Before and After Rotator Cuff Repair

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Introduction: The structural failure rate of rotator cuff repair can exceed 50%. Important predicting factors are the preoperative degree of myotendinous retraction and fatty muscle infiltration. It was the purpose of the study to evaluate the prognostic value of the preoperatively remaining length of the supraspinatus (SSP) muscle and the tendon.
Methods: In 33 cases of complete SSP tendon ruptures subjected to arthroscopic or open repair, MRI scans taken preoperatively and after a mean follow-up of 24 months were studied. The exact position of the lateral extension of the SSP muscle and tendon were evaluated and correlated with the preoperative Goutallier stage and the repair failure rate.
Results: The mean lengthening of the muscle and tendon end was -3mm and 4mm in the failed (n = 19) and 14 mm and 8 mm in successful (n = 14) cases, respectively. If patients had a preoperative Goutallier stage 2–3 and tendon length of less than 15 mm, failure rate was 92%, but only 33% if the tendon length was greater than 15 mm. With Goutallier stage 0–1, the corresponding failure rates were 57% and 25%, respectively. A preoperative tendon length of less than 15 mm alone predicts failure with a sensitivity of 79% and a specificity of 71%, with an odds ratio of 9.4. With a Goutallier stage 2 or 3 and, the odds for repair failure of tendons shorter than 15 mm was 22 fold as compared with the situation if the Goutallier stage is less advanced (0 and 1) with an odds ratio of 4.
Conclusion: We may conclude that with successful or failing repairs, the visible tendon length will be increased. The combination of Goutallier grading and measurement of the free tendon length may be a powerful predictor for the reparability of a tendon tear.

FM35

Shape of the Deltoid Muscle in Chronic Rotator Cuff Tears

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The most obvious influence on glenohumeral motion in presence of a large cuff tear has the deltoid muscle. It›s unimpaired innervation and function is a prerequisite when considering a reverse total shoulder arthroplasty (RTSA) as treatment of chronic rotator cuff deficient shoulders. We hypothesized however that the shape of the deltoid muscle in chronic rotator cuff tears may be affected by the loss of activity and, conversely, may contribute to the development of pseudoparalysis. Therefore, we set out to analyze the size and proportions of the deltoid muscle on MRI in patients with intact shoulders or with chronic symptoms of rotator cuff tears. Included were 116 patients (45 women, 71 men) with a mean age of 60 years (range: 30–84), suffering of a rotator cuff tear, who were treated in our institution either with direct arthroscopic repair, latissimus dorsi transfer, or implantation of a reversed shoulder prosthesis. All had no previous shoulder surgery and a MR-arthrography as well as a Constant score within 90 days prior to surgery. The degree of fatty infiltration (Goutallier stages), atrophy (tangent sign) and selective retraction of the tendon end and myotendinous junction of the supraspinatus muscle, as well as the thickness of the anterior, lateral and posterior portion and the area of seven anatomic defined segments of the deltoid muscle were measured by independent readout of two observers on MR-arthrographies. Our developed method measuring delta area and thickness turned out to be reproducible with excellent interobserver correlations (R = 0.814–0.924). The analysis of influencing factors on active abduction revealed a significant influence of rotator cuff tendon and muscle retraction (p: 0.0078 and 0.0029), as well as stage of fatty muscle infiltration (p <0.0001). However, we were unable to detect a relation of the deltoid muscle shape with the degree of active glenohumeral abduction (p: 0.245). Furthermore, long-standing rotator cuff tears with massive retraction and fatty infiltration of the cuff muscles did not appear to influence the deltoid shape, i.e. did not lead to muscle atrophy. Our data support that in chronic rotator cuff tears, there seems to be no disadvantage to exhaust conservative treatment and to delay implantation of RTSA, as the shape of delta muscle seems only be influenced by natural aging (p <0.0001), but to be independent of reduced shoulder motion.

FM36

Arthroscopic Rotator Cuff Repair Of Massive Rotator Cuff Tears With Pseudoparalysis

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Introduction: Massive rotator cuff tears (RCT) can lead to pseudoparalysis, or loss of active forward flexion (FF) above shoulder level with preservation of passive FF. Recently reverse total shoulder arthroplasty (RTSA) has gained in popularity for this condition. However, an arthroscopic rotator cuff repair (ARCR) with advanced mobilization techniques may provide a less morbid option if function can be predictably restored. The purpose of this study was to evaluate the ability to reverse pseudoparalysis with an ARCR.
Methods: We performed a retrospective review of an 11 year period of patients with a primary or recurrent massive RCT (complete 2-tendon or >5 cm tears) and preoperative pseudoparalysis which was treated with an ARCR. The cohort was divided into two groups: primary ARCR (group I) and revision ARCR (group II). In group I, 39 patients with a mean age of 62 years at the time of surgery were available for follow-up at a mean of 75 months. In group II, 14 patients with a mean age of 63 years at the time of surgery were available for follow-up at a mean of 72 months.
Results: In group I, active FF improved from 49 degrees preoperatively to 155 degrees postoperatively (p < .001) and pseudoparalysis was reversed in 89.7% of patients. The mean UCLA score improved from 13 preoperatively to 29 postoperatively (p < .001), and the mean ASES score improved from 38 to 83 (p < .001). In group II, active FF improved from 43 degrees preoperatively to 109 degrees postoperatively (p < .001) and pseudoparalysis was reversed in 42.9% of patients. The mean UCLA score improved from 12 preoperatively to 21 postoperatively (p < .001), and the mean ASES score improved from 40 to 57 (p = .033).

Conclusion: ARCR of massive RCTs using advanced mobilization techniques can lead to reversal of preoperative pseudoparalysis in a substantial number of patients who have not had previous surgery.

FM37

Long-term Outcome of Arthroscopic Subscapularis Tendon Repairs

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Purpose: Several authors have reported good results at short- to intermediate-term following arthroscopic repair of subscapularis tendon tears. While these results are encouraging, the long-term functional outcome of this technique is unknown. The purpose of this study was to evaluate the long-term outcome of arthroscopic repair of subscapularis tendon tears.
Methods: A retrospective review was performed of subscapularis tendon tears repaired with an arthroscopic technique from 1999 to 2003. Revision repairs and open repairs were excluded. The minimum follow-up was 7 years. Postoperative functional outcome was determined by University of California at Los Angeles (UCLA) and American Shoulder and Elbow Surgeons (ASES) scores.
Results: Seventy-nine patients with an average age of 60.8 years at the time of surgery were available for follow-up at a mean of 104.7 months. Compared to preoperative values, UCLA mean scores improved from 16.5 to 30.1 and mean ASES scores improved from 40.8 to 88.5 ($p < .001$). According to the UCLA score results were categorized as good or excellent in 83.3%, fair in 10.1%, and poor in 7.6% of cases. Return to normal sports or activities was observed in 92.4% of cases and 92.4% of patients were satisfied.
Conclusions: Arthroscopic repair of subscapularis tendon tears can lead to good or excellent results in the majority of cases. This study reinforces previous reports demonstrating improvement in functional outcome following arthroscopic of a subscapularis tendon tear and shows that this improvement in maintained long-term.

FM38

Bosworth screw fixation of acute instable clavicular fractures: Long-term results in 25 patients

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Fractures of the distal third of the clavicle are common, accounting for 15–28% of all fractures of the calvicle. The incidence of delayed union and pseudarthrosis formation respectively is relatively high in type II fractures classified after Neer. Therefore, a reduction and internal fixation is of great importance. The fixation with a Bosworth Screw achieves a high percentage of union and a low percentage of complications, however concerns exist about screw loosening. To evaluate the results and long-term effects in the use of the Bosworth screw fixation, we performed a retrospective analysis in 25 consecutive patients with an acute type II fracture of the lateral clavicle. No intraoperative complications or postoperative infections were encountered. In 23 patients (79%) the screw could be removed after consolidation of the fracture after an average of 8.6 weeks. In seven patients (29%), screw loosening was detected and in four of them (16%) a reoperation was necessary due to a significant loss of reduction. Except for one patient who died a couple of months after surgery due to other health issues, all patients could be followed-up with a mean of 10 years (range, 5–18y). At this time all the patients had an united fracture. The clinical examination showed good to excellent results with a Constant Score of 96/100 and an Oxford Shoulder Score of 47/48 points. One patient (4%) showed signs of slight acromioclavicular osteoarthrosis. With ease of application through a small incision, a low rate of acromioclavicular joint arthrosis, the Bosworth technique is an effective surgical method in providing a very satisfactory clinical long-term outcome. The relatively high screw loosening rate in our study could be due to the fact that during the postoperative rehabilitation the elevation was only limited to 90°. It is therefore proposed to limit the elevation to 60° postoperatively.

FM39

Medial Comminution as Prognostic Factor after Angular Stable Plate Fixation of Proximal Humeral Fractures

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Introduction: The decision between open fixation and arthroplasty is often difficult in the treatment of proximal humeral fractures. Applicable radiographic prognostic factors would be useful. The purpose of the present study was to investigate the influence of medial comminution on the clinical and radiologic outcome of patients after angular stable plate fixation of these fractures.
Methods: The presence of medial comminution and fracture morphology were documented on preoperative radiographs in patients with proximal humeral fractures that were treated by angular stable plate fixation. Medial comminution was defined by the presence at least one intermediate fragment in the area of the medial curvature below the anatomical neck of the proximal humerus. Follow-up for at least 24 months with radiologic assessment and functional outcome measurements including Constant Score, Subjective Shoulder Value (SSV), Disabilities of the Arm, Shoulder and Hand score (DASH), visual analogue scale (VAS), and SF-36 was performed.
Results: Follow-up examination (50.8 ± 20.6 months) was possible in 74 patients (46 female, 28 male, age 63.0 ± 15.9 years). Mean absolute Constant score (CS abs) and CS adapted to age and gender (CS adap) were 72.4 ± 14.5 and 85.2 ± 17.3%. DASH, SSV, and VAS were 15.7 ± 17.3, 80.3 ± 19.6%, and 2.1 ± 2.2. Non-union was present in 1.3%, cut-out in 5.4% and implant failure in 1.3%. Avascular necrosis was seen in 12.2%, in three cases the diagnosis was made more than 24 months after the initial trauma. In the presence of medial comminution the clinical outcome (CS abs, CS adap, SSV, several parameters of SF-36) was significantly impaired, the odds ratio for these patients to have an absolute CS <65 was 4.4 (95% CI: 1.4 to 13.7).
Conclusion: Angular stable plate fixation of proximal humeral fractures achieves good clinical mid-term results. Medial comminution is a relevant and easy-to-detect prognostic factor for the functional and subjective outcome in these fractures.

FM40

Biomechanical Effects of Lateral Offset Center of Rotation in Reverse Shoulder Arthroplasty

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Introduction: Lateralizing the center of rotation (COR) in reverse total shoulder arthroplasty (rTSA) reduces the incidence of scapular notching and improves external range of motion (ROM). The purpose of the present biomechanical study was to determine the effect of lateralizing the glenohumeral COR on: 1) glenohumeral abduction ROM in the scapular plane 2) external rotation ROM 3) deltoid abduction force 4) joint stability
Methods: Six fresh frozen, unpaired upper extremities (63.7 ± 5.3 years, BW 73.6 ± 19.2 kg) had the scapula embedded in a rectangular block of two-part polymer resin. CT scans of the block verified the orientation of the scapula to ensure consistent anatomic alignment. A biomechanical shoulder simulator was used for testing specimens before and after rTSA (Tornier Aequalis). Custom spacers shifted the COR laterally from baseline rTSA by 5, 10, and 15 mm. Outcome measures of resting abduction and external rotation ROM, and abduction and dislocation (lateral and anterior) forces were recorded.
Results: Resting abduction increased 20º vs. native shoulders but was unaffected by COR lateralization. External rotation decreased after rTSA and was unaffected by COR lateralization. The deltoid force required for abduction significantly decreased 25% from native to baseline rTSA. COR lateralization progressively increased the abduction force, reducing the mechanical advantage. Lateral dislocation required significantly less force than anterior dislocation after rTSA, and both dislocation forces increased with lateralization of the COR.
Conclusion: COR lateralization had no influence on ROM (abduction or external rotation) but significantly increased abduction and dislocation forces. This suggests the lower incidence of scapular notching may not related to the amount of adduction deficit after lateral offset rTSA but may arise from limited impingement of the humeral component on the lateral scapula due to a change in joint geometry. Lateralization provided the benefit of increased joint stability, but at the cost of increasing deltoid abduction forces.

FM41

The Standard Axillary Radiograph of the Shoulder May Falsely Indicate a Posterior Clavicular Subluxation

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Background: It has been clinically observed that in the standard axillary shoulder view of intact shoulders, the clavicle may appear to be grossly posteriorly subluxated in the acromioclavicular joint. The situation becomes more difficult if there is a superior dislocation of the ac-joint, where a simultaneous posterior direction is regarded as an indication for surgical stabilization. The purpose of this study was therefore to quantify this suspected projection phenomenon to find how the axillary view is performed best to assess the ac-joint congruency.

Methods: 15 cadaver shoulders (10 formalin fixated and 5 fresh frozen) were used in this study. In each of the first ten healthy formalin fixated shoulders we performed 23 different fluoroscopic radiographs. From the standard position of the axillary view we rotated in the sagittal plane in steps of 15 ° anterior and posterior until 45 °. Then we rotated in the coronal plane 15 ° lateral and medial and performed all sagittal views again. The distance from the tip of the acromion to the distal clavicle was measured to assess the "optimal" view, which was defined to be the one with the least apparent dorsal translation. With the other five shoulders we simulated different ac-pathologies (5 mm superior, 5 mm dorsal and 5 mm superodorsal translations of the distal clavicle) and performed again fluoroscopic radiographs in different angles, including the established "optimal" axillary view in order to compare the standard view with the optimal view.
Results: In the standard axillary view we found an average posterior translation of 1.7 mm (stdv 2.8) and in the optimal view, which was done 15° dorsal and 15° lateral to the standard axillary view, we measured a mean posterior translation of 0.9 mm (stdv 2.8). In all the 5 shoulders with a dorsal and the superodorsal translated distal clavicle the standard axillary view showed a dorsal translation with a mean of 11 (range 5.5 to 19) mm and the optimal axillary view, which was in each shoulder different, showed a mean of 8 (range 4 to 13.5) mm.
Conclusion: An apparent dorsal subluxation of the ac-joint in a standard axillary shoulder view may be regarded as normal in asymptomatic ac-joints. Conversely, in case of a true dorsal translation of the ac-joint the standard axillary view has a 100% sensitivity in revealing the dorsal translation.

FM42

Electromyography and Nerve Conduction Velocity for the Evaluation of the Infraspinatus Muscle and the Suprascapular Nerve in Professional Beach Volleyball Players

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Background / Introduction: Beach Volleyball is an overhead sport with a high prevalence of infraspinatus muscle atrophy of the hitting-shoulder.
Hypothesis: Infraspinatus atrophy seems to be due to a repetitive traction injury of the supraspcapular nerve. Early pathological findings might be assessed with surface electromyography (EMG) and nerve conduction velocity (NCV) measurements.
Material and Methods: Fully competitive professional beach volleyball players were assessed with a structured interview, shoulder examination, strength measurements (external rotation and elevation) and neuro-physiologically (surface EMG and NCV of the infraspinatus and supraspinatus muscles and the suprascapular nerve, respectively) during the Beach-Volleyball-Grand-Slam tournament 2010 in Klagenfurt, Austria.
Results: 35 men with an average age of 28 years were examined. Visible infraspinatus atrophy was found in 12 players (34%), whereby 8 (23%) had a slight and 4 (11%) had a severe atrophy. External rotation and elevation strength was significant lower on the hitting shoulder. EMG revealed a higher activation pattern in the infraspinatus muscle of the hitting arm in players with no or slight atrophy, but an impressively lower activation pattern in players with severe atrophy. NCV measurements showed a significant higher latency and lower amplitude in the hitting shoulder.
Discussion: Professional beach volleyball players have a high frequency of infraspinatus atrophy (34%) and significantly reduced shoulder strength of the hitting shoulder. These findings are not associated with demographic factors. EMG and NCV measurements suggest a suprascapular nerve involvement caused by repetitive strain injuries of the nerve. External rotation strength measurements and NCV measurements can early detect a side-to-side difference, while EMG may show compensation mechanisms for progressive damaging of the suprascapular nerve and as a result loss of infraspinatus muscle strength.
Conclusion and Clinical Relevance: Infraspinatus atrophy in high-level beach volleyball players is most likely caused by a repetitive traction injury of the suprascapular nerve and is early detectable by NCV measurements.

FM43

Does subacromial injection of a local anesthetic influence strength in healthy shoulders? – A double blinded, placebo-controlled study

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Introduction: The effect of the injection of local anesthetic into the subacromial space on the strength of a normal shoulder is unknown although it could affect strength by impairing suprascapular or axillary nerve function. We hypothesized that subacromial injection of a local anesthetic can decrease abduction and/or external rotation strength and thereby mislead the clinician.
Methods: A double blind, randomized, placebo-controlled design served to compare the effect of subacromial injection of lidocaine on shoulder strength in 10 healthy male volunteers. For each treated shoulder, the controlateral shoulder served as the placebo control. Abduction and external rotation strength measurements and electromyographic assessment were performed before and after subacromial injection. Ultrasonography was used to verify the integrity of the rotator cuff and to document the distribution pattern of the injected local anesthetic.
Results: The injection was subacromial in 90%. There was no significant difference in pain or electromyographic parameters between shoulders with lidocaine injection and those with injection of 0.9% saline ($p > 0.05$). Placebo injection into the subacromial space decreased strength significantly compared with the pre-injection state in the Whipple position (95 ± 17N to 84 ± 20N, $p = 0.012$) while a similar decrease observed in the Lidocain group did not reach significance (97 ± 15N to 87 ± 14N, $p = 0.092$). In 90° abduction in the scapular plane, there was no significant decrease in strength in either group.
Conclusion: Subacromial injection reaches the subacromial bursa in most cases (90%) without radiographic control. The injection of a local anesthetic into the subacromial bursa has no relevant effect on shoulder strength and does not falsify the clinical assessment of strength.

FM44

Predictive values of indirect detection of Kingella kingae osteoarticular infections in young children by PCR assays on throat's swab: toward a novel diagnostic method

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Background: K. kingae is currently considered as the major bacterial cause of OAI in children less than 48 months. However, diagnosis of K. kingae OAI remains challenging because clinical and biologic signs at admission may remain normal, and because this fastidious microorganism is difficult to isolate on solid medium. Although pathogenesis of K. kingae invasive infections remains unclear, there is evidence that K. kingae first colonizes the oropharynx before penetrating the bloodstream and invading distant organs. We hypothesized that K. kingae should be present in oropharyngeal flora in children with K. kingae OAI and should be detectable by a PCR assay targeting K. kingae's RTX toxin gene on oropharayngeal swabs. If so, this simple and non-invasive test could become a helpful diagnostic tool for this disease. Thus, the purpose of this study was to investigate if an oropharyngeal swab PCR assay could predict osteoarticular infections (OAI) due to K. kingae in young children.
Methods: One hundred eleven consecutive children aged 6 to 48 months, presenting atraumatic osteoarticular complaints were prospectively enrolled. All had a clinical evaluation, radiological investigations, and blood samples. Blood and oropharayngeal specimens were tested with a PCR assay specific for K. kingae. Cases of OAI were defined as any patient with a bone, joint or blood isolate of pathogenic bacteria, or magnetic resonance imaging consistent with infection in the absence of positive culture. Cases of K. kingella OAI were defined when blood, bone or synovial fluid samples were positive for the organism by culture or PCR.
Results: Among 142 children, 39 met the OAI case definition. Among these 39 OAI cases, 30 (76.9%) had K. kingae OAI, two (5.1%) had other organisms, and ten (25.6%) had no microbiologic diagnosis. All 30 oropharyngeal swabs from K. kingae case patients, and 8 (7.9%) swabs from 74 other patients, were positive. The sensitivity, specificity, positive predictive value, and negative predictive value of the oropharayngeal swab PCR assay for K. kingae were 100% [82.1;95.8], 90.5% [88.4;100], 78.9% [62.7;90.4], and 100% [95.3;100] , respectively.
Conclusions: Detection of K. kingae DNA in the oropharayngeal swab of children with clinical findings of OAI is highly predictive of K. kingae mediated OAI. If these findings are replicated in other settings, detection of K. kingae by PCR assays on oropharayngeal swabs could radically improve recognition of OAI.

FM45

Postraumatic septic arthritis: caveat Gram-negative pathogens

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Objective: Trauma-related septic arthritis is a rare and serious infection. Little is known about its microbiologic spectrum, clinical pattern and outcome.
Method: Review of the literature from 1945 to 2010 with an emphasis on post-traumatic cases.
Results: We retrieved 14 large-scale epidemiological surveys without detailed stratification regarding the origin of septic arthritis (3340 episodes) and 131 case reports. Post-traumatic septic arthritis is witnessed predominantly in young healthy males (75%; median age, 31 years) and involves the knee in 54% of cases. Four distinct origins differ in pathogenesis and microbiology: bites; thorn punctures; and trauma sustained in terrestrial or aquatic environments. Overall, causative microorganisms in post-traumatic arthritis are predominantly Gram-negative (51%), in contrast to primary native joint arthritis where Staphylococcus aureus prevails. Variability for the choice of antimicrobial agents is larger than in primary native arthritis, but the duration of antibiotic therapy and surgical therapy remain similar. Mortality equals zero and microbiological cure is achieved in 96% of cases. Severe functional mechanical sequelae, such as ankylosis or amputation, occur in 19% of cases.
Conclusion: Post-traumatic septic arthritis has a different clinical and microbiological pattern than primary native joint arthritis. In the case of empirical antibiotic treatment, a broader spectrum covering Gram-negative rods is more appropriate than simple anti-Gram-positive therapy.

FM46

Delayed diagnosis of Propionibacterium Prosthetic Joint Infection

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Although perioperative prophylaxis and improvement of surgical environment have reduced the risk of intraoperative infection, the frequency and importance of delayed anaerobic prosthetic joint infection (PJI) remains underestimated. We performed a cohort study, evaluating patients with prosthetic joint infection involving propionibacterium spp. We retrospectively analyzed data of all patients who were treated for confirmed propionibacterium spp infection (defined as growth of the same microorganism in ≥2 tissue/synovia specimens or blood cultures) in our institution after total joint arthroplasty between 2000 and 2011. Evaluation of clinical, microbiological and radiological data as well as demographic information was accomplished. Additional information regarding surgical (re)-intervention and follow-up was available. We were able to include 12 patients with shoulder (n = 4), hip (n = 6) and knee (n = 2) PJI, primary reasons for arthroplasty were osteoarthritis (n = 9), trauma (n = 2) and dysplasia (n = 1), 25% were women. Mean age at time of diagnosis of infection was 65.6 years (range, 45–86y) with a median time from implantation to diagnosis of 66.4 months (range, 2-189 m). The main symptom was pain (n = 9), persistent fistula (n = 4), fever (n = 4), local symptoms (swelling and/or redness) (n = 3), radiological loosening was present in 5 cases. Type of infection was classified as early (24 months) (n = 6). The causative organism was propionibacterium spp (n = 10), co-infection (n = 2) with coagulase-negativ staphylococcus. Organisms were detected in perioperative biopsie (n = 5), sonication (n = 4), preoperative joint puncture (n = 3). 1-stage exchange was performed in 4 patients, 2-stage exchange with spacer implantation in 5, definitive spacer implantation in 2 cases and conservative treatment in 1 case. Duration of hospitalization was 46 days (range, 0–246 d). After a mean follow-up of 14 months (2–35 m) only one patient needed treatment for new infection with another organism (staphylococcus epidermidis). Most propionibacterium infections were diagnosed as delayed or late PJI (75%) with consistent pain as primary clinical parameter followed by persistent fistula and unspecific clinical/radiological signs of infection. Correct and early diagnosis of propionibacterium infection remains challenging. Consequently, patients with persistent postoperative pain should be carefully screened for PJI with propionibacterium.

FM47

Listeria monocytogenes infection of a reverse shoulder arthroplasty – A case report

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Introduction: *L. monocytogenes* is a rare and mostly opportunistic foodborne pathogen which usually causes a systemic infection with no or mild gastrointestinal symptoms in immunocompetent patients. It is also known to have a high affinity to foreign bodies such as prosthetic joints in immunocompromised patients. Most cases of prosthetic joint affection are described in the hip and the knee joint. We report an unusual case of an infection with *L. monocygotenes* in a shoulder prosthesis.
Case report: A 72-year-old female initially presented with a derailed diabetes mellitus type 2 after previously being treated with systemic steroids for 3 days for her right shoulder pain. Medical history showed no other immunocompromising disease. During her hospitalization, she developed fever and was first treated with ceftriaxone for an urinary tract infection. Blood cultures then showed a bacteremia with *L. monocygotenes,* which explained the lack of improvement. When the right shoulder pain exacerbated, we suspected an affection of the right shoulder total prosthesis. The patient already had a long history of complications with her right shoulder prosthesis. We decided to treat this infection operatively with debridement and inlay exchange and adjustment of the i.v. antibiotic therapy to amoxicillin with an aminoglycoside (gentamicin). Cultures obtained from the debrided periprosthetic tissue and fluid confirmed L. monocytogenes. 5 days later, another tissue sample during a second look operation proved to be negative for microbes. With improvement of the patients symptoms and decrease of inflammatory parameters, we changed to peroral antibiotic treatment with amoxicillin for another 5 months and discharged the patient in a good condition. No further complications were observed. One year after the infection the patient is free of symptoms and back to the previous range of motion.
Conclusions: A prosthetic joint infection with *L. monocytogenes* is a rare condition which should be considered in the differential diagnosis of joint infections. In our case, the detected bacteremia, which is often missing referring to the literature, conducted us to the right diagnosis – together with the clinical symptoms and the intraoperatively taken positive tissue samples. We postulate that, without implant removal a less radical operative treatment in terms of an excessive debridement and inlay exchange combined with an adequate long term antibiotic therapy can achieve adequate results.

FM48

In vitro activity of gentamicin-loaded resorbable beads against Staphylococcus epidermidis

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Keywords: Bone infection, gentamicin-loaded resorbable beads, microcalorimetry.
Background: Synthetic resorbable bone graft substitutes loaded with gentamicin are used for treatment of posttraumatic, postoperative and hematogenous osteomyelitis. Local release of gentamicin may enhance the treatment of bone infection. Therefore, we investigated the activity of gentamicin-loaded beads against Staphylococcus epidermidis by microcalorimetry.
Methods: S. epidermidis strain RP62A, susceptible to gentamicin, and biconvex rounded cylindrical beads (250 mg) consisting of calcium sulphate dehydrate, calcium carbonate, and hydrogenated triglyceride (Herafill, Heraeus Medical, Hanau, Germany) were used. The beads contained 1% (equivalent to 2.5 mg) gentamicin in the form of gentamicin sulphate. Each bead was incubated in 3 ml tryptic soy broth (TSB) in a microcalorimetry ampoule containing 105 S. epidermidis/ml prepared from an exponential growth bacterial culture. The bacterial heat production was used to determine the inhibition of bacterial growth. Growth medium with S. epidermidis without beads (no antibiotics) was used as positive control. All experiments were performed in quadruplicate.
Results: S. epidermidis cultures without gentamicin-loaded beads produced heat flow peaks between 180 and 210 microwatts after 12–15 hours of incubation, corresponding to the exponential growth of S. epidermidis in nutrient-rich medium (TSB). In contrast, S. epidermidis cultures with gentamicin-loaded beads completely suppressed heat production during 24 hours, demonstrating their antibiotic activity.
Conclusion: Gentamicin-loaded beads effectively inhibited growth of S. epidermidis under described in vitro conditions. Further in vitro studies should investigate the activity of other local antibiotics and other microorganisms. Finally, clinical studies are needed to demonstrate the improved treatment by using gentamicin-loaded beads in bone infections.

FM49

Biofilm formation on percutaneous K-wires – Influence of material properties on relapse rates after correction of toe deformities

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Toe-deformities are a common problem in orthopaedic foot surgery. Various operative procedures described include a temporary fixation by percutaneous K-wires (KW). Relapse rates of deformities are reported as high as 5–10% and are mostly related to scare contractures. Recent studies have shown that extensive postoperative scare formation might be related to biofilm centred clinicaly inapparent low grade infection on the surface of medical devices. Aim of the study was (i) to evaluate if recurrence of toe deformities is related to an unrecognized low-grade infection related to extensive biofilm formation on the surface of percutaneous KW and (ii) if biofilm formation can be diminished by the use of titanium (ti) wires instead of stainless steel (ss). Between 08/10 and 03/11 we prospectively included 143 toe deformities temporarily fixed with KW. The study was designed as a randomised controlled trial and randomisation was intended 2:1 (ss vs. ti). KW were harvested in the outpatient clinic. Removed KW were shortened with a sterile punch to approximately 2cm (measured from the tip of the wire) and harvested in sterile tubes. Biofilm was analysed with an established sonication procedure. Clinical data (relapse of deformity, pain, swelling and ability to wear normal shoes) was assessed after 6 months. Overall 89 ss and 54 ti KW in 62 patients (50 female) were implanted in the study period. The main diagnosis was hammer toe (n = 75) and claw-toe deformity (n = 30). Mean time to KW removal was 42 days (SD 10). 25 KW (14 ss and 11 ti) were excluded due to obvious contamination during removal or violation of the laboratory protocol. Quantitative biofilm analysis showed an increased biofilm formation (>500 cfu/ml) on the surface of the ss wires (47% vs. 23.3%, p = .031). For the clinical follow-up 7 samples needed to be excluded: 4 (all ss) underwent revision before 6 month follow-up and 3 (2 ss/1 ti) due to a purulent infection. After 6 months follow-up we found a lower relapse rate (13% vs. 32%, p = 0.015) and less pain (21% vs. 43%, p = 0.009) in the ti group. There was no correlation between biofilm formation and relapse of the deformity (r = 0.033/p = 0.721) but between relapse and pain (r = 0.341/p). Titanium wires showed less biofilm formation, relapse of deformity and pain as compared to stainless steel wires. We therefore recommend the use of titanium instead of stainless steel wires for the transfixation of toe deformities.

FM50

Treatment of active unicameral bone cysts with injection of chronOS Inject® in children and adolescents

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Introduction: The risk of a fracture and the probability of spontaneous healing in unicameral bone cysts are mainly depending on the activity of the cyst and can be quantified with the Cyst-Index. Our study presents the results after treatment of bone cysts in the active stage with percutaneous aspiration, hydrogen peroxide lavage and injection of chronOS Inject®.
Methods: From 2006 until 2011 21 patients (13.2 ± 3 years) with 21 cysts (5 proximal femura, 11 humeri, 5 calcanei) were treated 27 times. Depending on the size and location of the cyst at the femur, an internal fixation was performed prior to the injection. There were 13 preceding fractures. At follow-up radiological healing (modified Neer classification), activity level, refracture, reinjection and complications were examined. The mean follow-up time was 40 ± 19.6 months.
Results: After 1.5 months 95% returned to unrestricted activity. 1 refracture in a femur occurred because of insufficient biomechanical stability. Partial or complete radiological response was observed in 81% after 13 ± 3.4 months. 5 patients (28%) required a repeat injection after 21 ± 4.6 months. 3 of this patients showed healing after 12 ± 0.3 months, 1 patient required a second injection with healing after 13 months. 2 (7%) wound infections occurred.
Conclusion: ChronOS Inject® provides stability and prevents refractures at the upper extremity and the foot. At the proximal femur additional stabilisation is mandatory. This procedure has the potential to enhance healing of active unicameral bone cysts. However it doesn't exclude recurrence, therefore radiological follow-up is mandatory. ChronOS Inject® is a useful option for the treatment in active unicameral bone cysts.

FM51

CT marking of resection margins prior to resection of malignant bone tumors

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For most musculo-skeletal sarcomas complete resection with uncontaminated margins R0 resection) is still the most important part of treatment.The precision of osteotomies controlled under standard X-ray or image intensifier control is influenced by parallax and the limitation in 3-dimensional analysis of oblique planes.
Objectives: Mobile CT scanners to provide real time 3D images during surgery are not yet readily available. We use to place marks (K-wires or ancres) in Standard CT-scanners immediately or the day before surgery.
Case example: 17 year old girl, osteosarcoma of the proximal fibula involving the tibio-fibular joint. Following the neoadjuvant chemotherapy the day before the definitive tumor resection 3 K-wires were placed unter CT-control to guide the osteotomies of the tibia (1st above the tibio-fibular joint, 2nd oblique proximally, 3rd oblique distally into the tibia). The resection then was performed letting the K-wires guide the saw blade avert from the tumor. The tibial plateau was supported by an allograft. Examination of the tumor revealed uncontaminated margins and the patient presently one year after surgery is diseasefree.
Results: Using different CT-assisted modes in performing tumor resection (placing markers in the CT as guides for resection or using CT navigation) allow to perform resections with a precision in the range of mm.
Conclusion: In situations where intraoperative determination of planes, axes or points maybe difficult and real time CT is not available pre-operative marks under CT-control should be used.

FM52

The Combined Fibula-Allograft Reconstruction for the Joint sparing Reconstruction of the Distal Femur

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Introduction: The implantation of a tumor megaprosthesis is mainly used for the reconstruction after the resection of osteosarcomas of the distal femur. With improved imaging, the extent of the tumor can precisely be delineated, and often, a closer margin can be chosen. Consequently, it is not always necessary to resect the entire distal femur, but sparing the epiphysis and thereby preserving the knee function. The reconstruction of such defect is a challenge. We represent herein our experience on four patients having undergone a reconstruction using the combination of an allograft and vascularized fibula.
Results/Case Series: After tumor resection, the remaining epiphysis (at least 1 cm) contains all the knee ligaments and thereby may provide a fully functional knee. The distal osteotomy is performed either through the epiphysis, the metaphysis or through the growth plate itself. A LISS plate is placed from laterally to restore the anatomic position of the epiphysis, and an allograft is placed with the correct length to anatomically restore the defect. The ipsilateral fibula is harvested and placed medially onto the allograft and spanning the osteotomies. Its pedicle is anastomosed either with the genicular descendens vessels, or directly to the femoral vessels. We have operated on four patients with this technique, with a mean age of 14 years. At the follow-up of 12 months, all osteotomy sites healed. There was full knee extension as well as flexion, with a normal gait not necessitating any assistive devices. No revision surgery was mandatory so far.
Conclusions: The combination of allograft and vascularized fibula for the intercalary reconstruction of the distal femur sparing the epiphysis provides a durable construct with good functional outcome. The addition of a vascularized fibula enhances the healing of the allograft-host junctions.

FM53

The first non-invasive joint-sparing growing prosthesis world-wide for an Osteosarcoma of the proximal tibia

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Introduction: Malignant bone sarcomas of the growing skeleton represent a particular challenge. Amputation is very mutilating, and rotationplasty although functionally a good alternative, is not opted for because of its disfiguring aspect. A growing prosthesis may represent an alternative, particularly when there is considerable growth left. Further, sparing the joint may offer great functional advantages whereas – in contrast to resecting the joint- a closer margin must be accepted. We herein represent the world-wide first non-invasive joint sparing growing prosthesis which was implanted in a 10 year old child.

Results/Case Report: A 10 year old male represented with pain in the proximal tibia after a fall. A non-displaced pathological fracture at the proximal tibia was seen, and a biopsy revealed an osteosarcoma. The boy underwent neoadjuvant chemotherapy according to the EURAMOS protocol, and then resection of the proximal tibia sparing the epiphysis was performed. A custom made growing prosthesis (Stanmore Implants) was manufactured. This uncemented HA-coated growing prosthesis has a plateau which receives the remaining epiphysis (of ca 1 cm thickness) and which allows the fixation of the tibial plateau with screws. The extensor mechanism was reconstructed using a medial gastrocnemius flap together with a split skin graft. The soft tissues healed uneventfully, and adjuvant chemotherapy was resumed 3 weeks postoperatively. Six months later, the prosthesis was non-invasively lengthened using an external magnet. The patient has full extension and walks without walking aids.
Conclusions: A non-invasive joint sparing growing prosthesis represents a valuable alternative for young children with bone sarcomas. Although technically certainly challenging, it leads to good function, and the non-invasive growing can be performed on an outpatient basis. However, the costs are high.

FM54

Functional Outcome of Patients with Inferior Scapulectomy

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Introduction: Scapulectomies are rarely performed because there are only few indications. Depending on the extent and location of a bone tumor, partial scapulectomies can be performed. When the tumor is located within the inferior scapula, this part can be resected while maintaining the superior part and particularly the glenoid. Herein, we report on three patients and the functional outcome after the resection of a chondrosaroma of the inferior scapula.
Results/Case Series: Three patients with a mean age of 45 years were diagnosed with a chondrosarcoma involving the inferior scapula. All did involve the teres muscles as well as the infraspinatus and parts of the subscapularis muscles, but not the scapular spine. All patients underwent a posterior approach, and parts of the respective muscles were en bloc resected with the tumor and the inferior scapula. All resections were R0. The bone defect was not reconstructed, the muscles were adapted as good as possible in their anatomic positions. Passive mobilisation was used for six weeks. All wounds healed uneventfully. At a mean follow-up of 12 months, MSTS and TESS scores were obtained and revealed a normal shoulder function with complete and symmetric ROM.
Conclusions: In contrast to partial resections of the scapula involving the glenoid, patients with inferior scapular resections usually have a very good or normal shoulder function subsequent to surgery.

FM55

Transabdominal Rectus Flap for Sacrectomy

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Introduction: Musculoskeletal tumors represent the main indications for a sacrectomy. Depending on the dorsal extension of the tumor locally, and the thin soft tissue coverage of the sacrum dorsally, the surgeon is often forced to resect a large enough skin and subcutis such that wound healing problems may result because of increased tension on the soft tissues when primarily closed. We present herein a patient for whom we used a transabdominal recuts flap which was placed – after the resection of the sacrum – dorsally, with uneventful wound healing.
Results/Case Report: A 48-year old female patient fell onto her buttock with consecutive pain. Conservative initial pain management followed. Because pain increased over 6 months, imaging was performed and a huge mass originating from the sacrum (proximally S2/3) and extending within the left gluteal muscle down to its insertion at the dorsal femur was shown. An ultrasound-guided biopsy revealed a chordoma. We used a combined antero-posterior approach, first getting the rectum as well as the L5 nerve root on the left side off the tumor as well as ligating a huge vena sacralis mediana. Before closing, we harvested a pedicled rectus abdominis flap which was placed in the depth of the pelvis. The patient was then turned, an extensile approach was chosen to remove the muscular tumor extension en bloc woth the sacrum. The sacrectomy was performed at S2. After R0 removal of the specimen, the pedicled rectus abdominis flap was developed from posteriorly, and fixed to cover the defect. There was uneventful wound healing. Because histology revealed one positive lymph node as well as vascular invasion, we opted to proceed with postoperative adjuvant proton therapy.
Conclusions: In case of large tumor extension dorsal of the sacrum with much soft tissue involved, the placement of a transabdominal pedicled rectus flap is a very helpful option to achieve full soft tissue coverage. It additionally offers the advantage to free the tumor intrapelvically from other organs, as well as safe control of the vessles.

FM56

3D assisted planning and performance of corrective osteotomy at the distal radius

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Introduction: Malunions of the distal radius may lead to pain, reduced range of motion, instability and joint degeneration justifying corrective osteotomy. The procedure is challenging due to the minuteness of the bone and the aimed accurateness of 1–2 mm for extraarticular and <1 mm for intraarticular malunions. To improve planning and precision of the intervention 3D visualisation and intraoperative guiding devices were developed. We present these new technologies on the basis of a case series.
Methods: CT based 3D reconstructions of the malunited bone and the intact opposite bone were used to plan and perform the osteotomy virtually. For extraarticular corrections the amount of displacement (6 degrees of freedom) of the fragments was calculated and the values transferred to a novel drilling-guide accordingly to the plate. The holes were performed with the guide in the planned later fragments before the osteotmy. After the osteotomy the fragments could easy be screwed to the plate with the predrilled holes in the correct position. Intraarticular osteotomies were performed in an outside-in technique without arthrotomy. Multiple drill-holes which were connected to complete the osteotomy planes were performed by individualised drilling-guides (rapid prototyping) using the juxtaarticular bone surface for exact positioning. The reposition was controlled either by a second guide or direct step measurements. 12 patients (6 extraarticular, 6 intraarticular; 2 combined) were treated according this method. Accurracy was controlled and calculated with postop CT scans and 3D analysis.
Results: All interventions were performed as planned. The accuracy (difference with pre-op virtual planning) was 1.8° for rotational and 0.9mm for translational extraarticular correction. All steps of the intraarticular malunions were corrected to considerably less than 1mm and general joint congruency was restored. In all patients pain was reduced and range of motion increased. One patient needed a decortication and cancellous bone graft due to delayed union.
Conclusion: 3D assisted corrective osteotomy with drilling guides is a precise and reliable method and is the only possible method on the palmar side of the distal radius. The time required for the planning is 1-3h but intervention time is reduced.

FM57

The radio-volar double plating technique for comminuted distal fractures of the radius

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Subject: A2 Presentation: A 1628 letters Presentation of a study published by Jacobi, M et al. in the "journal of orthopedic surgery and research" 2010. The results of this study have never been presented at a congress yet. Erling, C; Jacobi, M; Wahl P; Kohut G
Introduction: A possible difficulty in intra-articular fracture of the distal radius is the displacement tendency of the radial styloid process due to the tension of the brachioradialis tendon.
Methods: Ten patients treated within one year for complex distal radius fractures by double-plating technique with a radial buttress plate and volar locking plate, through a single volar approach, were followed prospectively during 24 months. Outcome measures included radiographic follow-up, range of motion, grip strength and score follow-up (VAS, Gartland-Werley score and patient-rated wrist evaluation).
Results: Ten patients with intraarticular distal radius fractures with dislocation of the radial styloid process were treated with this technique. This resulted after 24 months in good clinical outcome (mean visual analog scale 0.9; almost symmetric range of motion; mean Gartland-Werley score 2 ± 3; mean patient-rated wrist evaluation 3.2 ± 2.4). Radiologic evaluation according to the Dresdner Score revealed anatomic reduction without secondary dislocation during the follow-up and uneventful consolidation.
Conclusions: The described technique strongly facilitates anatomic reduction and stable fixation of intra-articular distal radius fractures with dislocation of the radial styloid process and leads to satisfactory clinical and radiographic outcome.

FM58

Dorsal tilt of the distal radius and wrist ligamentous function

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Introduction: On subjecting the wrist to axial load the lunate tends to rotate in extension while the scaphoid rotates in flexion. It has been demonstrated that a unidirectional coupling exists through the SL ligaments which constrain this counteracting, relative movement. The more the hand is flexed, and the scaphoid with it, the greater is the tension in the SL ligaments. We therefore hypothesise that a dorsal tilt of the radius might possibly induce abnormal constraint in the SL ligaments that could finally lead to instability of the wrist. Malunion after distal radius fracture is frequent and the consequences of malunion still controversial. The validity of the hypothesis raised, has now been tested with respect to instability.
Material and Method: Three fresh human cadaver forearm specimens, including the elbow and the distal third of the humerus, were used. Final dissection proved that they were free of any wrist pathology. Distal radial malunion was simulated with dorsal tilts of 0°, 20° and 50°. Stability was compared in these three different positions of dorsal tilt and also without tilt, but in 0°, 20° and 50° of wrist flexion.
Results: With increasing wrist flexion, or dorsal tilt of the radius, the torque/angle graphs showed less intracarpal movement for a given torque, indicating increased restriction (higher stiffness).
Conclusion: Permanent overload of the ligaments occurs with wrist flexion or dorsal tilt. Thus, it might be expected that progressive deterioration (creep) of the involved ligaments could possibly occur, a potential cause of progressive instability and/or rupture.

FM59

Trapeziometacarpal joint replacement with an uncemented prosthesis: prospective clinical results under vitamin C prophylaxis

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Introduction: In trapeziometacarpal surgery the complication rate is high and complex regional pain syndrome (CRPS) type I may occur. We prospectively investigated our clinical results after a fully standardized treatment with a total joint prosthesis under vitamin C prophylaxis.
Methods: In patients with basal thumb arthritis stage II or III according to Dell and no benefit from conservative treatment, the joint was replaced by an uncemented semi-constrained hydroxy-apatite coated prosthesis (Roseland, Depuy International Ltd. Leeds, England). First web opening and visual analogue scale (VAS) scores for pain, activities of daily living (ADL) and satisfaction were taken perioperatively. Two days prior to surgery 500 mg ascorbic acid was started during 50 days as prevention for CRPS. Post-operative treatment was functional.
Results: In 47 patients 56 joint replacements were performed. The group consisted of 37 females and 10 males with a mean age of 61.1 years. Operations were performed in day care under regional (plexus) anesthesia and two times under general anesthesia. There was a significant improvement in function (first web opening increased with 15 degrees) and VAS scores for pain, ADL and satisfaction ($p = 0.000$). Patient satisfaction was strongly associated with the amount of pain reduction. According to the IASP and Veldman criteria no CRPS was found. Complications occurred 7 times (12.5%), without any infections. Five revisions had to be performed (8.9%) for 2 dislocations of the cup, a fractured trapezium, an aseptic loosening of the cup and for instability. As a salvage procedure a resection arthroplasty gave fairly good results in these patients (due to the intention to treat policy, these results have been used in the statistical analysis). Minor complications were a tenosynovitis of the thumb and an entrapment of the dorsal sensory branch of the radial nerve, which was released.
Conclusion: Patients should be aware of the high complication and revision rate before they decide to undergo surgery. In case of failure, a salvage procedure can be performed. Torrededia (2006) used the same implant and reported 5 cases of CRPS after 38 implantations (13% CRPS). In our prospective cohort no CRPS occurred after 500 mg vitamin C daily (relative risk 0.87, confidence interval 0.77–0.98, $p = 0.009$). The NNT is 7. We advise vitamin C as prophylaxis against CRPS in this kind of hand surgery.

FM60

Patient's preoperative pharmaceutical medications: effect on complication and mortality rates after primary total hip replacement

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Introduction: Influence of co-morbidities on complication rates and patient's outcome after surgery is well recognized. Due to economic pressure ("DRG") instruments predicting and quantifying this influence might be of interest. We wondered if a simple count of a patient's preoperative pharmaceutical medications would give valuable information.
Methods: Preoperative pharmaceutical medications of a consecutive series of 668 patients undergoing elective unilateral primary total hip arthroplasty were retrospectively analysed. According to the number of preoperative medications patients were allocated into group A (no medication), B (1-2), C (3-5), D (6-8) and E (>9). Length of hospital stay, local and systemic postoperative complications as well as mortality rates within the first postoperative year was analysed.
Results: Mean patient's age was 63 years (range: 18–94). 53% were females. A clear relationship between preoperative medications and hospital stay (4.3 days for group A, 8.7 days for group E) was noticed. Sixty (9%) local and 19 (2.8%) systemic complications occurred during hospital stay and another 60 (9%) local or systemic complications were detected during the first postoperative year. During hospital stay, a clear relationship between preoperative medications and local (A: 7%, B: 7%, C: 9%, D: 14%, E: 15%) or systemic (A: 1%, B: 2%, C: 2%, D: 6%, E: 10%) complications was documented. For homologous blood transfusions (A: 0.02, B: 0.16, C: 0.3, D: 0.73, E: 0.72 units per patient) the relation was similar. During the first postoperative year a clear connection between preoperative medications and complications (A: 5%, B: 4%, C: 12%, D: 15%, E: 21%) as well as mortality rates (A: 0%, B: 1%, C: 2%, D: 4%, E: 5%) was observed. Among different preoperative medications, anticoagulants and platelet aggregation inhibiting drugs (even if stopped before intervention) showed to have a prominent effect on postoperative complications (62.5% if in combination) and one-year mortality (12.5% if in combination).
Conclusion: In the present investigation the number of a patient's preoperative pharmaceutical medications showed to correlate with hospital stay, local and systemic complications and the first year mortality rate.

FM61

Quality control and critical incident reporting in orthopaedics – a must for every orthopaedic surgeon!

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Objective: Quality control and critical incident reporting is increasingly recognized in orthopaedics. Definition and quantification of complications in orthopaedics is a mandatory part of our daily clinical practice. It clearly leads to significant improvement of healthcare quality. Hence, we aim to describe an easy, systematic and standardized method to assess surgical and medical complications in our department. In addition, a pathway for the implementation of a similar critical incident reporting system in other departments will be provided.
Methods: This critical incident reporting system and quality control was introduced in our department 5 years ago. There was a 3 years introduction period to adapt the clinical pathway to the indivual hospital characteristics. For the critical incident reporting all patients are screened for the occurrence of any complications by the attending resident or by the consultant. The secretary writing the follow up report then checks the forms again. If the form is not filled out correctly, it is sent back to the attending surgeon. The complications are classified in a seven grade classification. Grade 1 included complications without extension of the stay. Grade 2 and Grad 3 complications required respectively a mild and a severe extension of the stay. Grade 4 complications needed minor surgical procedure, while grade 5 required a major surgical procedure. Patients with grade 6 had several surgical or interventional procedures done due to the complications. Grade 7 indicated death of the patient. For the study the total number and rate of complications was analysed for 2006. The complications were graded as described above. The revision rate was also noted.
Results: Total rate of complications was 13%, the revision rate was 2.2% (grade 4, 5 and 6). The mortality rate was 0.25% (grade 7).
Conclusions: The suggested method of critical incident reporting and quality control is clinically feasible and allows the surgeons to critically evalute their rate of complications and revision surgery, which is mandatory in particular in the era of DRG cost reimbursement.

FM62

Advancing patient-reported outcome assessment in orthopaedics: Development of a computer-adaptive version of the Forgotten Joint Score (FJS-CAT)

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Introduction: Patient-reported outcome (PRO) instruments are widely used in orthopaedic outcome research. Traditional PRO measures use the same set of questions for each patient. Current research activities in patient-reported outcome methodology include the development of computer-adaptive test (CAT) instruments. CAT uses individually tailored sets of questions for each patient. The recently published Forgotten Joint Score(J Arthroplasty, 2012) is a measure of patients' joint awareness during daily activities, a new aspect of patient outcome.
Objective: The aim of this study was to develop a computer-adaptive test version of the Forgotten Joint Score (FJS) and administer the FJS-CAT to a sample of 60 patients.
Methods: We analysed FJS-12 data from the St. Gallen Knee Register to generate the item bank for CAT. To determine unidimensionality of the items we performed a principal component factor analysis and determined root mean square error (RMSE) to assess model fit for an item response theory (IRT) model. We performed IRT analyses and CAT simulation. The new FJS-CAT instrument was administered to a pilot sample of 60 patients after hip and knee arthroplasty on a touch tablet PC.
Results: FJS data from 580 patients after THA and TKA was available for analysis. All of the 12 FJS items showed very good unidimensionatity (Cronbach's Alpha 0.96, Factor 1-2 Eigenvalue ratio 9.83) and could be fitted to an IRT Rating Scale Model (RMSE 0.06). Measurement precision in terms of standard error of the FJS-12 score was 0.43 (logit units). Within CAT simulation the measurement error for a 3-item CAT was 0.61, for a 5- item CAT 0.52 and for a 7-item CAT 0.48. This means that a four-fold increase of the number of questions increased measurement precision by a factor of 1.4.
Conclusion: CAT reduces the number of questions administered to an individual patient without relevant loss of measurement precision. From a patient's view point CAT is beneficial as it omits irrelevant or redundant items and is time saving.

FM63

Reconstruction of big acetabular defects with a combination of bone cement in layers and an antiprotrusio cage according to Burch Schneider

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Introduction: Revision of big acetabular defects with a Burch-Schneider antiprotrusio cage (BS) and a big quantity of cement ends in early loosening and migration of the implant, most probably because of overheating and necrosis of bone. Reconstruction with BS and protection of the adjacent bone with allo-/autografts was usually successful. Due to restricted availability of allografts we replace the bone grafts by a thin layer of cement kept in place with armament screws. In a second step the BS is inserted and the PE cup gets fixed with the cement needed to fill the remaining defect.
Material and methods: 1. In an experiment layers of Palacos® of a thickness of 3.3, 6.7, 10 and 13.5 mm were prefabricated. A second layer of Palacos of 17mm thickness is placed on the first. At the border between the old and the new cement the temperature rises up to 80°. It only reaches 45°, 31°,29° resp.29º on the bone side of the prefabricated layer, not being dangerous to the bone. A relatively thin cement layer protects bone effectively from overheating. 2. Between 2006–2010 patients with 13 big acetabular defects were referred in the age of 70y (60–79). The cranial defect measured Ø 3.5 cm(1 1/2 - 6). Protrusion was found in 8 cases, no ventral wall in 10, a transacetabular non-union in 4.Two-step cementing was used in all cases. In some cases prefabricated cement pellets were added to the first cement to reduce warmth. BS always was placed after the first cementing. In massive protrusion the central defect was bridged initially by a prefabricated layer of cement. Transacetabular non-union was fixed with a dorsal plate. As complications we noticed 2 sciatic palsies, still in recovery and 1 crossed cerebral embolia, which recovered completely. Postoperatively all patients with exception of the non-unions cases did full weight bearing.
Results: The follow up is 23 (7–45) months. At the 3 month controls patients hat no or only slight pain. Limping was reduced but nearly in all cases still present. 3/4 of the patients did not use crutches anymore. All X-ray controls showed stable components without loosening lines, even in the cases of non-union. In all protrusion cases a rebuild of a medial bone wall was observed.
Conclusion: In big acetabular defects 2-step cementing in combination with BS results in primary stability allowing immediate weight bearing. Bone damage by overheating can be inhibited. The long-lasting results are still to be observed.

FM64

Refined classification of acetabular deficiencies using CT-based quantification of the amount of bone loss: overview of 30 Paprosky type IIIA-B cases

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Introduction: Orthopaedic classification systems serve three main functions, i.e. to facilitate communication among physicians, to provide a framework for research and education, and to help guiding decisions regarding treatment. The most commonly used classification systems for bone loss associated with acetabular revision are the AAOS [1] and Paprosky system [2]. In general, classification of acetabular deficiencies is performed based on Xrays or CT scans. Although the amount of bone loss is rarely measured quantitatively, objective and quantitative data on the degree and location of bone loss could facilitate correct and consistent classification. Recently, a computerized tool was presented to quantitatively asses bone loss [3]: TrABL (Total radial Acetabular Bone Loss). This study aims to demonstrate on an extended patient population that TrABL combined with standard classification systems provides more detailed, quantitative information on bone defects.
Methods: Data obtained from 30 patients with severe acetabular defects, classified Paprosky type IIIA and IIIB, was reviewed. Starting from the CT scan of a defective acetabulum, the TrABL tool automatically assessed the total amount of original acetabular bone that was missing, seen from the hip's original centre of rotation. Six anatomical regions were defined for which the degree of bone loss was expressed: anterosuperior, anteroinferior, inferior, posteroinferior, posterosuperior and medial. The ratios obtained for all defects were analysed statistically.
Results: Review of the patients' data indicated that no two defects were alike, even within one traditional type. In comparison to general classification schemes, TrABL provided more quantitative, 3D information on the degree of bone loss. Statistical analysis showed that total bone loss was highest in the posterosuperior region (63% ± 27%). Bone loss was lowest inferiorly. No statistical differences were found between the anterosuperior, anteroinferior, posteroinferior, and medial regions. The majority of the defects suffered at least 25% bone loss in more than half of the regions. All defects had at least one region with the same degree of bone loss.
Conclusion: Classification of acetabular deficiencies into existing systems is refined by the quantitative data provided by TrABL.
[1] D'Antonio et al. Clin Orthop Relat Res. 1999. [2] Paprosky et al. J Arthroplasty. 1994. [3] Gelaude et al. Adv Orthop. 2011.

FM65

Dynamics of femoral bone remodelling after cemented Muller total hip arthroplasty. A radiographic 20-year follow-up of 20 hips

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Introduction: The aim of our study was to investigate the dynamics of cortical thinning around the cemented Muller straight stem at different time periods during long term follow-up.
Patients and Methods: Out of 132 consecutive osteoarthritic patients operated with a cemented Muller straight stem, all with more than 15 years follow-up and no signs of loosening were included. Thethicknesses in THA femoral cortices were measured medially and laterally at 6 levels, from the first postoperative, 5, 10 years and the last follow-up x-rays.
Results: Cortical thinning was measured in 20 THA hips (19 patients) followed for 20 ± 2 years. 60% of cortical thinning occurred within the first 5 postoperative years. This was significantly greater when compared with cortical thinning between 5 and 10 years (13%) and between 10 years and the last follow-up (27%). Greater cortical thinning was observed proximally (Level 1 and 2) than distally (Level 5 and 6) within the first 5 postoperative years ($p = 0.005$), but not at later periods.
Conclusion: Bone remodelling of the proximal THA femora seems to be mainly caused by the insertion of the implant-within the first 5 years, occuring more proximal for the cemented Müller stem. Later periprosthetic cortical thinning in stable implants is due to natural ageing and not related to implant type or fixation concept.

FM66

Leg length discrepancy after total hip arthroplasty revision and influence on patient satisfaction and functional outcome

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Introduction: Leg length discrepancy (LLD) can be the reason for substantial patient dissatisfaction after primary total hip arthroplasty (THA). The influence of LLD on patient satisfaction after revision THA is less well-known. The objective of our study was to assess the radiological LLD before and after a THA revision and to analyse the influence of LLD on patient satisfaction and functional outcome at 5 years postoperative.
Methods: We performed a retrospective cohort study, including all patients who had undergone a THA revision between 2000 and 2006 at our institution. LLD was measured on pre- and postoperative anteroposterior pelvic X-rays. Clinical outcomes were evaluated at 5 years postoperative with use of the Harris Hip Score (HHS). Patient satisfaction was assessed with a visual analogue scale (VAS, 1 = completely dissatisfied, 10 = very satisfied).
Results: Among the 122 eligible patients, 84 patients had pre- and postoperative anteroposterior pelvic X-rays available for measurements. The mean LLD was –5.9 mm (±9.3) preoperatively and –1.4 mm (±10.1) postoperatively. Preoperatively, a LLD >1 cm (shortening or lengthening) was found in 33 patients (39.3%) compared to 27 patients (32.1%) after revision. Overall, shortening of the operated limb occurred after revision in 49 patients (58.3%). At 5 years, 53 patients were clinically assessed with the HHS and VAS score. The mean HHS was 78.6 (±18.3), the mean HHS pain item 36.3 (±8.9), and the mean VAS 7.5 (±2.3). Comparing the patients with a LLD of >1 cm (=19 patients) to those without LLD, the mean HHS was 78.1 vs. 78.9 (p = 0.889), the mean HHS pain item 35.2 vs. 37.0 (p = 0.474), and mean patient satisfaction was 7.1 vs. 7.7 (p = 0.314).
Conclusion: We found that LLD after THA revision only slightly influenced patient satisfaction, but not functional outcome.

FM67

Primary Total Hip Replacement in Patients with tears of the hip abductor insertion: Does rotator cuff tear repair improve outcome? Short term results

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Introduction: Total hip replacement through the direct anterior approach has gained increased popularity. Using this approach, preexistent and potentially symptomatic tears of the hip abductor insertion remain unrecognized and may result in inferior outcomes. We wondered if it is worthwhile to repair preexisting tears of the hip abductor insertion by using a transgluteal approach. We therefore retrospectively compared short term outcomes of THRs in patients with preoperative documented hip rotator cuff tears using either a transgluteal or direct anterior approach.
Methods: From a consecutive series of 24 patients with documented rotator cuff tears of the hip by MRT, 11 got THR through the direct anterior approach without repair and 13 through the transgluteal approach with repair to the hip abductor tendon tear. Decision upon the approach for THR was dependent on the surgeon's preference. Grading of abductor tendon tears (partial versus complete, anterior portion versus anterior and lateral portion, fatty muscle infiltration) was performed on preoperative MRT by an independent musculoskeletal radiologist. The Harris Hip Score (HHS) and the WOMAC score were used as outcome parameters after a minimum follow-up of one year. Additionally Trendelenburg sign, hip abductor strength (polio grades) and trochanteric tenderness was assessed.
Results: In terms of preoperative HHS, WOMAC, age, gender, BMI and MRT-grading of abductor tendons and muscles no significant differences were found between the two groups (p = 0.2–0.9). In all cases tears were mild, involving not more than the anterior and lateral portion of the insertion, without retraction. After a mean follow-up of 13 months (12–24 months) the HHS was 88 versus 82 (p = 0.36) and the WOMAC 2.0 versus 3.0 (p = 0.27) after the direct anterior and the transgluteal approach, respectively. Whereas in terms of hip abductor strength (p = 0.21) and trochanteric tenderness (p = 0.8) no difference was found between the two groups, a tendency of less frequent Trendelenburg signs were recorded for the direct anterior approach without repair of tendons (p = 0.07).
Conclusion: With the reservation that a small, non randomized comparison with very short term follow-up was undertaken, our results do not indicate that a transgluteal approach allowing repair of mild tears of the hip abductor tendons results in superior subjective and clinical outcomes when compared to an direct anterior approach ignoring the abductor insertion.

FM68

Comparison of pre-operative continuation and discontinuation of aspirin in patients undergoing elective hip and knee arthroplasty

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Background: Discontinuation of aspirin while reducing bleeding risk may increase the risk of perioperative cardiovascular events. However, data on this clinically important issue are scarce.
Methods: We retrospectively assessed the impact of pre-operative continuation or discontinuation of aspirin on regional complications, bleeding risk, and cardiovascular outcome in a cohort of 739 consecutive patients undergoing elective hip (n = 396) and knee arthroplasty (n = 343).
Results: 465 patients did not receive antithrombotic or full-dose anticoagulatory medication, 71 received vitamin K antagonists, 14 received clopidogrel and 14 combinations of more than two antihrombotic/anticoagulatory medications. 175 patients were on aspirin. 139 discontinued aspirin at least 10 days before surgery and 36 continued aspirin intake. Compared to those discontinuing aspirin, patients who continued aspirin more frequently showed knee swelling after one week (35.1 vs. 81.3%; p = 0.001). However, knee flexion and extension at hospital discharge did not differ significantly between the two groups. Local bleeding complications, perioperative blood loss, the amount of substituted blood products and the postoperative drop in hemoglobin were comparable in the two groups. There was a slight statistical trend towards an increased risk of cardiovascular complications in patients who discontinued aspirin (6.5% vs. 0.0%; p = 0.117).
Conclusion: Continuation of aspirin is associated with a transitory increase in knee swelling. However, it neither compromises orthopedic outcome at one year follow-up nor does it increase the risk of relevant perioperative bleeding complications. It may be associated with a favorable perioperative cardiovascular outcome. These data support perioperative continuation of aspirin intake in patients undergoing knee or hip arthroplasty.

FM69

Synovial fluid leptin level and joint pain in end-stage osteoarthritis: A potential explanation for increased pain in women and in obese patients

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Introduction: There is increasing evidence that the adipokine leptin may be the key mediator between obesity and osteoarthritis (OA). Synovial leptin levels are increased in OA, particularly in women and in obese patients. Furthermore, in these two patients groups higher pain levels before joint replacement have been described. A possible link between obesity, adipokines and pain severity has been suggested in studies on weight loss. Weight reduction resulted in decreased joint pain in OA patients and in decreased blood leptin levels. Finally, studies in rodents suggested that spinal leptin might be involved in the pathogenesis of neuropathic pain.
Objectives: We hypothesized that synovial fluid (SF) leptin concentrations correlate with pain severity, and thus mediate the association between increased joint pain and (1) female gender and (2) obesity
Methods: Cross-sectional study including all patients with primary hip and knee OA undergoing total joint arthroplasty between January and December 2010. On the day of intervention, SF and serum were sampled and leptin concentrations were assessed using an ELISA kit. The main outcome was severity of joint pain measured preoperatively with WOMAC score and VAS pain scale.
Results: 250 patients were included, 134 patients underwent total hip and 116 total knee arthroplasties. Mean age was 72 (±9) years, 62% were women. Mean SF leptin levels were 22.5 ng/ml in women and 5.3 ng/ml in men (p <0.001). SF leptin levels strongly correlated with BMI (r = 0.518) and serum leptin levels (r = 0.910). SF leptin concentrations >19.6 ng/ml (highest quartile) were significantly associated with increased pain levels on both WOMAC and VAS pain scale. The association remained unchanged after adjusting for presence of contra-lateral arthritic joints and diabetes (WOMAC adjusted mean difference -10.8 (95% CI: –16.5; –5.1) and VAS pain adjusted mean difference 0.7 (95% CI: 0.1; 1.3)). Significant associations between increased joint pain and (1) female gender and (2) BMI observed in univariate analyses disappeared after adjusting for SF leptin concentrations, suggesting that these associations are mediated by leptin levels.

Conclusion: Joint pain is strongly associated with SF leptin concentrations. Increased pain observed in women and in obese patients may be related to high leptin levels. However, due to the cross-sectional study design a causal relation between leptin and joint pain cannot be ascertained.

FM70

Statins may reduce femoral osteolysis in patients with total hip arthroplasty

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Background: Periprosthetic osteolysis threatening the survival of implants is the main long-term complication after total hip arthroplasty (THA). Statins are frequently taken by elderly patients. In experimental studies their use has been associated with reduction of osteoclastic activity and subsequent periprosthetic osteolysis as well as with promotion of bone formation around implants. Our objective was to evaluate the influence of statin use on the development of femoral osteolysis within five years after THA.
Methods: We conducted a nested case-control (case-cohort) study with 100% sampling including all THAs presenting with femoral osteolysis at the five year visit (cases) and compared them with those without osteolysis at five years (controls). Cases and controls were identified from a cohort of primary THAs operated between January 2001 and December 2005 with the same uncemented cup and the same 28 mm head size. Periprosthetic osteolysis was assessed on standardised radiographs by a surgeon blinded to the patient's exposure status.
Results: 735 primary THAs were included, mean age 68 years, 54% in women. Five years after surgery osteolysis had developed around the femoral component of 40 THAs (5.4%). Ever-use of statins was much less frequent among cases (5 of 40, 12.5%) than among controls (199 of 695, 28.6%). The crude risk ratio of femoral osteolysis among statin users was 0.36 (95% CI 0.14; 0.92). After adjusting for age, sex, patient activity level, body mass index, diagnosis, type of bearing surface, and type of stem in a multiple logistic regression analysis, the adjusted risk ratio was 0.38 (95% CI 0.15; 0.99).
Conclusion: Statin use was associated with a substantially reduced risk of developing femoral osteolysis five years after primary THA. Statins may be useful for reducing the risk of implant failure following THA.

FM71

Use of the Hohmann brace does not prevent recurrent dislocation after primary THA

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Introduction: Two thirds of first dislocations after primary total hip arthroplasty (THA) can be treated conservatively after successful closed reduction, in the absence of component malposition1. Use of an abduction brace such as the Hohmann brace is precognized by many orthopaedics surgeons but evidence about its usefulness is sparse. DeWal et al.2 in 2004 reported no efficacy of such a brace in preventing re-dislocation after THA using mostly a posterior approach (38/42 patients). Our objective was to investigate whether the use of an abduction brace was associated with reduction of (1) recurrent dislocation and (2) revision surgery in patients with a first episode of dislocation after primary THA operated upon with different approaches.
Methods: We conducted a retrospective cohort study. Between 3/1996 and 6/2011, we identified 92 patients with hip dislocation after THA, close reduction under general anaesthesia followed by a conservative treatment with a minimum f/u of 6 months. 68 patients had a Hohmann brace for a mean of 10.7 weeks and 24 patients had no contention at all. There were 52 men and 40 women. Mean age at dislocation was 71 years. A transgluteal approach was used in 78 patients, a posterior in 9, an anterior in 4 and a trochanter flip in 1 patient. Primary outcome was recurrent dislocation; secondary outcome was revision for recurrent dislocation. The results were adjusted with the propensity score method for diagnosis (primary or secondary osteoarthritis, fracture), gender, age, previous surgery, ASA score, BMI, year of intervention, cup size, cup inclination, neck length, surgical approach and participation in preoperative patient education.
Results: Within the Hohmann group the incidence of re-dislocation was 39.7% (27/68 patients) compared to 33.3% (8/24) in the other group. Incidence of revision was 22.1% (15/68) compared to 16.7% (4/24). Logistic regression for recurrent dislocation showed an unadjusted odds ratio of 1.3 (95% CI 0.5–3.5), p = 0.581. When adjusted the odds ratio was 0.7 (95% CI 0.2–2.0), p = 0.478. The unadjusted odds ratio for revision THA was 1.4 (95% CI 0.4–4.8), p = 0.576 and the adjusted 1.0 (95% CI 0.3–3.7), p = 0.991.
Conclusion: Use of the Hohmann brace did not substantially reduce the risk of recurrent dislocation or revision surgery for instability after primary THA.
1. Daly PJ, Morrey BF. J Bone Joint Surg. 74A: 1334, 1992. 2. Dewal H, et al. J Arthroplasty. 2004 Sep;19(6):733–8.

FM72

Risk factors for dislocation following primary total hip arthroplasty

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Introduction: Dislocation occurs in 1–5% of patients after primary THA and is the second cause of revision after aseptic loosening. The risk is highest during the first postoperative 6 months. While implant- and surgery-related risk factors have been extensively reported, there is less data concerning patient-related risk factors.
Objective: To determine which patients' characteristics are associated with an increased incidence of dislocation during the first 6 months after primary THA while simultaneously taking into account implant- and surgery-related factors.
Methods: We included all primary THA patients operated between 1998 and 2010, using a lateral approach and 28 mm head. The data were prospectively collected using the Geneva Hip Arthroplasty Registry, and we analyzed the impact of gender, age, BMI, co-morbidities, ASA score, neurologic disorders, primary versus secondary OA, prior surgery, SF-12 physical and mental health status, activity level, and participation in a preoperative education program. Risk factors were evaluated using uni- and multi-variate logistic regression. Implant- and surgery-related factors as cup inclination, surgical approach, head size, cup size and surgeon experience were controlled for by either restriction or adjustment if necessary.
Results: Overall, 3,264 primary THAs were included (mean age 70 years (±11), 58% women). Among them 60 dislocations (1.8%) occurred during the first 6 months post-operative. The risk ratio was higher for men than women, for patients with BMI ≥30, >2 co-morbidities, an ASA score 3–4, and prior hip surgery as well as for patients who had not participated in the preoperative education program. In the multivariate analysis all but the ASA score remained significant predictors of dislocation.
Conclusion: Our study reports the largest number of patient-related risk factors for dislocation to date. These results may help surgeons in identifying high risk patients, thus selecting the best strategy which should include preoperative patient education.

FM73

Outcomes of cable vs. wire fixation five years after total hip arthroplasty

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Introduction: Cables and wires are currently used for fixation of greater trochanter or femoral fractures and osteotomies in complex primary and revision hip arthroplasty. Better results have been reported with cables regarding greater trochanter consolidation and breakage resistance. However, cables have been associated with increased osteolysis and subsequent aseptic loosening. No recent study has compared the results of cable versus wire fixation. Our objective was to evaluate 5-year clinical and radiographic outcomes and complication rates of a cable system, and compare them to results of wire fixation.
Methods: Prospective cohort study including all primary and revision THAs performed between 3/1996 and 12/2005 with cable or wire fixation of fractures or osteotomies. Clinical and radiographic evaluation performed 5 years postoperative.
Results: Cables were used in 51 THAs and wires in 126 THAs. Three patients with cables developed a foreign-body reaction. After five years radiographs of 33 THAs with cables and 91 with wires showed an implant breakage of 36% and 46%, respectively. With cable fixation a significantly higher risk was found of non-union (36 vs. 21%; RR 1.7 (95% CI 1.0; 3.2)), osteolysis around the fixation (52 vs. 11%; RR 4.7 (95% CI 2.4; 9.2)) and femoral and acetabular osteolysis. Cable breakage increased the risk of osteolysis to 86%. Clinical results did not substantially differ between the two groups.
Conclusion: 5 years after THA we found a significantly higher risk of non-union and osteolysis with the cable system. In the presence of cable breakage almost 90% had developed osteolysis.

FM74

Effect of tranexamic acid in total hip arthroplasty with a minimal invasive anterior approach

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Introduction: Tranexamic acid reduces the intra- and post-operative blood loss after standard total hip arthroplasty and decreases the proportion of patients requiring allogeneic blood transfusion as a consequence. But there are no data on its effect in minimal invasive surgery of THA.
Objectives: Aim of this retrospective study was to evaluate the effect of tranexamic acid on patients receiving a THA with a minimal invasive anterior approach. Additionally we wanted to investigate risk factors for a blood transfusion.
Methods: We introduced tranexamic acid for elective primary THA for osteoarthritis with a minimal invasive anterior approach in a highly standardized peri-operative protocol. Power analysis was performed and resulted in 64 patients in each group. We compared 65 patients treated with tranexamic acid 1 gram pre-operatively and 1 gram intra-articular during the operation with 64 patients treated without any tranexamic acid avoiding any other difference in the operation procedure or rehabilitation. We compared the age, sex, ASA score, intra-operative blood loss, difference between pre- and post-operative haemoglobin, blood transfusion rate, hospitalisation duration and complications between the two groups. Multivariate analysis was performed to determine the risk factors for blood transfusion.
Results: There was no significant difference concerning age, sex, ASA score, intra-operative blood loss, hospitalisation duration and complications. The difference between the pre- and post-operative haemoglobin in the group without tranexamic acid was 4.25 g/dl and in the group with tranexamic acid 3.22 g/dl ($p < 0.001$). The need for blood transfusion was 19 out of 64 (30%) in the group without tranexamic acid versus 2 out of 65 (3%) in the group with tranexamic acid ($p < 0.001$). Risk factors for blood transfusion were the treatment without tranexamic acid (Beta = 0.062, 95% CI: 0.011 to 0.333, $p = 0.001$) and the pre-operative haemoglobin (Beta = 0.475, 95% CI: 0.295 to 0.766, $p = 0.002$).
Conclusion: Tranexamic acid in total hip arthroplasty with a minimal invasive anterior approach reduces the difference between the pre- and post-operative haemoglobin and the total blood loss respectively. Patients with tranexamic acid have a lower risk for an allogeneic blood transfusion. We found no disadvantage in the use of tranexamic acid and thus continue doing minimal invasive surgery of total hip replacement with it.

FM75

Long-term results (minimum 10-year follow-up) using acetabular reinforcement cups (Ganz Cup/Burch-Schneider Cage) in cases of revision

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Introduction: Acetabular reinforcement cups (Ganz cup) and reinforcement cages (Burch-Schneider cage) are commonly used for reconstruction of bone defects in revision hip arthroplasty or in primaries on occasions. In our hospital we investigated the long-term results of implantation of acetabular cups used for revision.
Material and methods: Between September 1999 and November 2002, 60 acetabular cups (41 Ganz acetabular reinforcement rings, 19 Burch-Schneider cages) in 59 patients (male: 34, female: 25) had been implanted due to aseptic loosening (37), septic loosening (2), re-implantation after Girdlestone arthroplasty (9), dislocation of the cup after primary total hip replacement (2), fractures (9) and mal-positioning after total hip arthroplasty (1). Minimum follow-up was 10 years with a maximum of 12 years. The mean age of our patients was 82 years (range: 59 to 103). The mean age of the patients at the time of surgery was 72 years with a minimum of 47 and a maximum of 92 years. Main outcome measure was survival of the reinforcement cup/cage.
Results: At our last follow-up 5 (8%) acetabular cups had been revised due to septic loosening leaving a Girdlestone arthroplasty, 5 (8%) patients had acetabular cup revisions due to aseptic loosening of the reinforcement cup/cage. 1 (2%) patient had a cage revision of unknown reason at another hospital. 5 (8%) patients were lost to follow-up. 44 (73%) patients had no revision. Further complications were reported in 4 (7%) patients having dislocations followed by closed reduction and 2 (3%) having revisions of the cemented inlay leaving the cup/cage in place. 27 of 59 (46%) patients had died at the 10-year follow-up.
Conclusion: Acetabular reinforcement cups/cages (Ganz cup and Burch-Schneider cage) in cases of revision provide excellent long-term results with a 10-year survival rate of 73% (44 of 60). The dislocation rate of 7% using an anterior approach in case of revision is acceptable.

FM76

First results of the HA-coated SL-PLUS® MIA stem in MIS-THR after 3 years. Clinical and radiological outcomes of 492 cases

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Introduction: The use of cementless straight stems in minimally invasive total hip replacement is a safe and established procedure. Steadily growing numbers of implantations in young and more active patients increase the requirements for surgical technique, implants and rehabilitation. The aim of our study was to verify how far the HA-coated SL-PLUS® MIA stem fulfill these demands.
Methods: From January 2008 to December 2011 we implanted 1.304 HA- coated SL- PLUS® MIA stems. Each operation was performed in supine position via anterolateral MIS-approach followed by immediate postoperative full weight bearing mobilization. In the present study 492 patients were examined after 1–3 years postoperatively. At the time of operation the mean age was 70,3 years (female/male = 311/181). The clinical (HHS) and radiological follow-ups were performed after 6 weeks, 3, 6, 12, 24 and 36 months. The radiological evaluation was performed by using digital image analysis (a/p, axial and faux profile images) focused on the osseointegration of the implant in all Gruen zones (subsidence, radiolucent lines and cortical hypertrophy).
Results: The mean Harris Hip Score increased from 46,2 preop. to 92,3 after six weeks and 98,2 after one year postoperatively. A small number of stem subsidence was observed in the first 6 weeks postoperatively. No subsidence was measured in 91,1% (448 cases), in the range of 2–4 mm in 8,1% (40 cases) and from 5 mm up in 0,8% (3 cases). Radiolucent lines in the area of the trochanteric wing were observed in only 3 cases. Minor and moderate cortical hypertrophies were observed in 3% of cases in the metaphyseal region.
Conclusion: In our view the first results fulfill the demands for MIS-THR, especially in combination with immediate postoperative full weight bearing mobilization. Nearly no occurrence of radiolucent lines and a small number of subsidences may result through the osteoconductive HA-coating. Due to this effect the primary stability during the period of ingrowth is improved.

FM77

Distal anchoring cementless modular revision hip stem: Survivorship and outcome

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Introduction: Due to its modularity, separating stable implant anchoring from leg length, torsion and offset issues, diaphyseal anchoring modular revision hip stems gained wide popularity in complex revision hip arthroplasty. Using the Revitan™/PFM™ revision stem since 2000, a retrospective review of a consecutive series was conducted in order to document implant survivorship and clinical and radiological results.
Material and Methods: Between January 2000 and 2009 160 Revitan™/PFM™ systems were implanted in 156 patients (77 female). The median age at surgery was 69 (28-93) years. Indications were revision for aseptic loosening in 55, recurrent dislocation in 1, implant fracture in 1, malpositioning in 1, periprosthetic fracture in 41, periprosthetic infection in 50, primary total hip replacements after femoral mal-union in 3 and primary total hip replacements in osteoarthritis in 8 patients. After a minimum follow-up time of 2 years, all patients were contacted by phone with structured interview and invited for a clinical and radiological follow-up visit.
Results: 38 patients died before contacting for study a mean of 3.5 years after surgery. None of them had implant revision. From the remaining 118 patients all were interviewed by phone. Forty did not consent for clinical and radiological examination. X-ray after a minimum follow-up of 2 years of these patients was available in 31 and analyzed. The remaining 78 patients were analyzed clinically and radiologically after a median follow-up time of 6 (2-11) years. Kaplan-Meier implant survivorship analysis for any reason revealed 99% (CI: 97–100%) survival at 2 years and 91% (CI: 85–97%) at 5 years. Implant revisions were due to aseptic loosening in 6, infection in 5, periprosthetic fracture in 2 and implant fracture in 1. Analysis of 121 follow-up x-rays showed no stem subsidence (<5 mm) in 100 and stem subsidence (>5 mm) of a mean of 16 mm (6–30) in 21 implants. The median HHS at latest follow-up was 82 (23–100).
Conclusion: The investigated distal anchoring cementless modular revision hip stem shows an implant survivorship comparable to the expected cumulative 5-year revisions rates of first revisions reported by registries.

FM78

Total Hip Replacement in Patients with History of Illicit Injecting Drug use

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Introduction: Since the risk to cause and spread infection with colonized strains is known to be multiplied by injection or inhalation of drugs, total hip arthroplasty (THA) in patients with a history of illicit drug use (IDU) is a concern. Our aim was to evaluate implant revision rates in patients with a history of IDU undergoing THA.
Material and methods: A retrospective consecutive single series of patients undergoing THA between January 1999 and December 2009 with history of IDU but declared and confirmed abstinence by patients and their respective healthcare professionals was followed until death, implant revision or for a minimum of 24 months.
Results: From 24 patients (27 THA) one (2 THA) left for a foreign country and could not be traced, three (4 THA) died after a mean of 24 months (range: 6–73) unrelated to surgery after an uneventful course. From the remaining 20 patients (21 THA), 11 patients (11 THA) had an uneventful course, without any clinical signs of infection and perfect radiological appearance of the THA after a mean of 69 months (range: 24–123). From the remaining 9 patients 8 THA were revised and 2 THA are awaiting revision. Reason for revision was deep sepsis in 8 and periprosthetic fracture in 2 patients, from which one complicated with a postoperative deep infection. Cumulative ten year implant revision rates were 49% (CI: 39–61%) for any reason and 43% (CI: 31–55%) for septic reason. Five patients admitted recurrence of IDU after THA. Abstinence of less than one year was more often associated with IDU recurrence and both increased the risk of septic implant failure ($p = 0.023$, $p = 0.061$).
Conclusion: A history of IDU is a major risk factor for septic failure. Even after declared IDU abstinence, a 20% admitted recurrence rate occurs and is associated with an even increased risk of septic implant failure.

FM79

Risk Factors for aseptic loosening of Muller type straight stems – A register-based analysis of 828 consecutive cases with a minimum follow-up of 16 years

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Even small design variables of the femoral stem may influence the outcome of a hip arthroplasty. We performed a risk factor analysis for aseptic loosening with special emphasis on design modifications of cemented Müller-type straight stems. We investigated 828 total hip replacements carried out with 4 different versions of cemented Müller-type straight stems. These replacements were carried out at our institution, and patients were followed prospectively in the in-house register. All stems were operated in the same setup, using Sulfix-6 bone cement and a second-generation cementing technique. Demographic and design-specific characteristics were analysed using an adjusted Cox regression model. The 4 versions showed marked differences in 15-year stem survival with aseptic loosening as the endpoint: 93.9% (MSS CoNiCrMo), 83.0% (SL CoNiCrMo), 81.4% (MSS Ti-6Al-7Nb) and 64.3% (SL Ti-6Al-7Nb). The Cox regression analysis showed a relative risk (RR) of 3.811 for aseptic loosening for stems made out of Ti-6Al-7Nb. The RR for aseptic loosening of the SL design was 2.129. Overall, the risk ratio for aseptic loosening of the stem increased to 7.486 (95% CI: 3.758–14.912) when comparing the most and the least successful designs (MSS CoNiCrMo vs. SL Ti-6Al-7Nb). Cemented Müller-type straight stems should be made out of a material with high flexural strength (e.g. CoNiCrMo). The surface finish should be polished (Ra <0.4 µm), and high offset should be avoided. These technical aspects in combination with modern cementing techniques, should improve the survival of Müller-type straight stems. This may also hold true for all types of cemented stems.

FM80

Influence of resection geometry on fracture risk in treatment of femoroacetabular impingement

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Introduction: Surgical resection of the femoral head- neck junction is a well accepted treatment in symptomatic patients with cam type femoroacetabular impingement (FAI). Nonetheless a potential complication hereof is a femoral neck fracture.We investigated the influence of resection width and length for various depths on postoperative fracture risk in daily life activities, using a validated finite element (FE) model.
Methods: A linear elastic, isotropic FE- model was used for biomechanical analysis.The femur anatomy was obtained from the publicly available Standardised Femur (Version 2.1). We compared radiographs of seven patients, who had suffered from a femoral neck fracture after surgical treatment of FAI in our institution for descriptive validation. Additionally a twofold quantitative validation of the FE results against experimental data from literature was performed. Round shaped resections were made to simulate surgery, whereat defect width along femoral neck and length along the femoral head circumference were varied for defect depth of 10%, 20% and 30% of the femoral head radius . The forces leading to a fracture in the model were compared with literature data of in vivo loads measured during daily life activities with telemetric hip implants.
Results: In the descriptive validation, the fracture location predicted by the FE models corresponded to the location seen in the X-rays. In both quantitative validations, simulated values were within reported experimental data. In FE- analysis stumbling was critical for nearly all types of resection. The average decreasement of peak force per millimeter was 38.43 N/mm for widening, 64.85 N/mm for lengthening and 162.5 N/mm for deepening of the resection.
Conclusions: Peak loads are very sensitive to resection depth, and more sensitive to resection length than resection width.

FM81

LCPD: Reduced Range of Motion due to Extra- and Intra-Articular Impingement

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Background: Performing joint-preserving surgery in hips after LCPD implies the understanding of the complex pathomorphology. Noninvasive three-dimensional computer analysis allows a better understanding of the individual pathomorphology by calculating range of motion (ROM) and locations of impingement zones.
Questions/purposes: We asked if the ROM, the localization of impingement zones, and the incidence of additional extra-articular impingement between hips with LCPD and normal hips or hips with femoroacetabular impingement (FAI) differs.
Methods: We used a CT-based virtual dynamic motion analysis based on a motion algorithm to simulate the individual motion for 13 hips with LCPD, 22 hips with FAI, and 27 normal hips. We then determined the motion and impingement pattern of each hip for the anterior (flexion, adduction, internal rotation) and the posterior impingement test (extension, adduction, external rotation).
Results: Hips with LCPD had a decreased amplitude for all hip motions (flexion, extension, abduction, adduction, internal and external rotation) compared to FAI or normal. The location for impingement zones in hips with LCPD differed for the anterior- and posterior impingement on the acetabulum and femur compared to the FAI and normal group. The incidence of both intra- and extra-articular impingement was increased in comparison to the normal and FAI group.
Conclusions: Hips with LCPD show a decreased range of motion due to a higher incidence of intra- and extraarticular FAI. These findings need to be taken into consideration when performing joint-preserving surgery after LCPD.

FM82

Pelvic Morphology Differs in Dysplasia and Acetabular Retroversion

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Background: Developmental dysplasia of the hip (DDH) and acetabular retroversion represent two opposite acetabular pathomorphologies. There are indicators that they are associated with alterations in pelvic morphology. However, there are no reports that compare pelvimetric measurements in these two opposing diagnoses.
Questions: First, what are the differences between dysplastic hips and retroverted hips for each key measurement variable? Second, what is the predictive value of each variable to detect acetabular retroversion?
Patients and Methods: AP pelvis radiographs for 51 dysplastic and 51 retroverted hips were compared based on four key measurement variables: 1) pelvic width index, 2) anterior inferior iliac spine sign, 3) ilioischial angle, and 4) obturator index. We then calculated the sensitivity, specificity, and area under the ROC curves for each variable.
Results: We found a higher pelvic width index, higher prevalence of anterior inferior iliac spine sign, higher ilioischial angle, and lower obturator index in acetabular retroversion. The predictive value of our variables was excellent for the pelvic width index and ilioischial angle,

fair for the anterior inferior iliac spine sign, and poor for the obturator index.
Conclusions: Pelvic morphology is strongly associated with acetabular pathomorphology. In DDH the entire innominate bone is internally rotated while it is externally rotated in acetabular retroversion. We present pelvimetric parameters as indirect indicators of acetabular retroversion. These can be used in cases where the acetabular rim is not clearly visible.

FM83

Impact of femoral torsion on femoroacetaular impingment

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Introduction: several morphological aberrations can result in femoroacetabular impingement (FAI). Femoral torsion is one of them. We aimed to investigate 1) the effect of femoral torsion on FAI, 2) the amount of osteochondroplasty needed to compensate for decreased femoral torsion.
Material and Methods: A 3-D rigid hip model from the free University of Brussels resulting from a whole body scan of an average person was used. Using Geomagic software the quality of bone surfaces was improved. The refined parts were imported into the CAD-software SolidWorks. A coordinate system was build with three cuboids. Within this coordinate system, the femur was moved until contact occurred with the acetabular rim or pelvis, respectively. Femoral torsion was varied by simulating a subtrochanteric rotational osteotomy in 5° increments from –15° to +40° of femoral torsion. With reference of a femoral torsion of +12° alterations of range of motion due to altered femoral torsion were compensated by simulated head-neck osteochondroplasty and its extend measured.
Results: Hip flexion was not influence when varying femoral torsion from 0° to 50°. Varying femoral torsion from 0° to –15° relevantly reduced flexion by 45°. IIn order to compensate for decreased femoral torsion of either 0° or –15°, atypical distal femoral neck resection (depth, width, length) of 2, 6, 19 mm or 5, 13, 32 mm was necessary. Hip internal rotation in 90° of flexion was not influence when varying femoral torsion from 10° to 50°. Varying femoral torsion from +10° to –15° exponentially reduced hip internal rotation by 36°. In order to compensate for decreased femoral torsion of either 0° or –15°, atypical distal femoral neck resection (depth, width, length) of 2, 4, 10 mm or 4, 8, 25 mm was necessary. Femoral antetorsion >30° limits hip extension and adduction by posterior FAI and Ischiofemoral impingement.
Conclusion: In this model decreased femoral antetorsion up to 0° does not relevantly influence hip range of motion in flexion and internal rotation. True femoral retrotorsion (<0°) relevantly impairs hip range of motion in flexion and internal rotation. Compensation by extensive osteochondroplasty would result in creating a groove in the periphery of the femoral neck.

FM84

Mild, untreated SCFE in childhood as a risk factor for the development of cam type FAI

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Etiological factors for the development of the cam deformity of the proximal femur remain unclear. Goodman et al have described a post slip morphology leading to osteoarthritis. We hypothesized that mild, untreated slipped capital femoral epiphysis (SCFE) in childhood causes a cam type deformity subsequently leading to femoro-acetabular impingement (FAI). We retrospectively analyzed 289 Arthro-MRI of the hip of patients presenting with FAI symptoms between 01/2006 and 03/2010. The mean age was 25 years (SD 6.1). Forty MRI with isolated pincer type FAI were excluded leaving 249 hips for analyses. A SCFE-like morphology was defined according to Goodman et al: loss (increase) of normal concavity of the anterosuperior (posteroinferior) femoral head neck junction = lack of anterosuperior (increase of posteroinferior) head neck offset; location of the fovea posterior to the neck axis = positive fovea sign; posterior tilt of the epiphysis = increased tilt angle. In addition, the α-angle was determined. The results obtained from these measurements were compared to 30 MRI of normal, asymptomatic hips, 20 MRI of hips with symptomatic FAI after in situ pinned SCFE, and 30 MRI of hips with FAI symptoms and an extended epiphysis morphology according to Siebenrock. Of all 289 analyzed MRI, 23 hips (9%) showed a SCFE-like morphology. The majority (180 hips (72%)) had features of an extended epiphysis. The anterosuperior to posteroinferior offset ratio was smaller in the SCFE-like group (5.6) and the in situ pinned SCFE group (2.5) compared to normal hips (56) and hips with an extended epiphysis (27) (p Our analyses show that 9% of hips with symptoms of cam type FAI present with a SCFE-like pathomorphology. The morphological features are similar to the group with symptomatic FAI after in situ pinning for SCFE. The SCFE-like pathomorphology most likely results from mild, untreated SCFE which subsequently leads to symptomatic cam type FAI and progression of osteoarthritis in adulthood.

FM85

Effective costs of a femoral head bone allograft. Is it worthwhile to run an own bone bank?

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Introduction: Allograft bone is widely used in orthopaedics and expensive. It is commercially available from companies processing allografts in order to eliminate risks of disease transmission or can be stored from femoral head of patients undergoing primary total hip replacement in an own bone bank after screening donors for transmissible diseases. We wondered if in terms of costs it is worthwhile to run an own bone bank in our institution.
Material and Methods: A retrospective review of the complete dataset of our own bone bank over the last 4 years was performed. All cost relevant parameters such as registration and approval by the government, infrastructural overheads (freezers, power consumption), personnel (administration, handling, controlling), storage material and laboratory analysis (swab, donor screening) were evaluated and total costs calculated. The rate of secondary rejected bone allografts was recorded. The cumulative costs were divided by the effectively implanted allografts.
Results: In a 4 year period 290 femoral heads were harvested. 25% of them were spitted and stored as half femoral head allografts. Costs totalled CHF 255700. Rejection rate was 101 of 290 (35%). The calculated effective cost per whole femoral head allograft was CHF 1’790 and for a half femoral head allograft CHF 895. Provided the whole process could be optimized by adapting storage capacity and avoiding secondary donor exclusion after laboratory screening, effective cost per half and per whole femoral head allograft could maximally be reduced to CHF 450 and CHF 800, respectively.
Discussion and conclusion: Without shipping costs and consumer taxes, half and whole femoral head allografts are commercially available for CHF 1’390-1’683 and CHF 2’225, respectively. Taking into account costs only (ignoring other issues such as quality of graft materials, receiver safety) it was worthwhile to run an own bone bank in our institution.

FM86

Double locking plate fixation of Denis II/III type sacral fractures in unstable pelvic C-type fractures – results of 28 cases

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Introduction: The posterior pelvic ring is responsible for 60% of the stability. In vertical unstable AO C-type fractures with associated Denis type II/III fractures of the sacrum, dorsal pelvic ring fixation is crucial and several operative methods exist. We describe a new method with dorsal double locked compression plating technique.
Material and methods: From 2001 to 2011, 119 unstable pelvic ring fractures were treated operatively in our institution. 28 patients suffering AO C-type fractures with associated Denis type II or III type fractures meet the inclusion criteria and were managed using our dorsal double plate osteosynthesis technique. For osteosynthesis, a posterior median approach was used, allowing anatomic reduction of the sacral fracture under visual control. For fixation, two parallel locked compression plates (LCP 3.5) were used, placing the most lateral screws either sacral, sacro-iliacal or iliacal. All patients were assessed clinically and radiologically. To evaluate the functional outcome, the Iowa pelvis Score was used and the patients were contacted by phone after a minimal follow- up time of 12 months.
Results: The 28 patients with a mean age of 40 years (18–72) sustained a vertical unstable pelvic ring injury, injured mainly in traffic and ski accidents. 24 patients had unilateral and 4 patients a bilateral sacral fracture. The mean injury severity score was 18 ± 10. Associated with the injury, 8 patients showed a lumbo-sacral plexus lesion. Eighteen patients were operated in a one-stage procedure. For sacral osteosynthesis, mainly 5 and 6 holes plates were used with the most lateral screw inserted in most cases sacro-sacral or sacro-iliacal. In the perioperative period, 4 infections were observed but could be treated successfully without longterm sequelae. There was no iatrogenic nerval injury observed. Long term follow-up was available in 24 of the 28 patients. All fractures united within the follow-up period. All patients consider their functional outcome according to the Iowa pelvis Score as either good or excellent (91/100 pts).

Conclusion: Dorsal double locking plate fixation of the sacral component by open approach and direct reduction is a successful and save alternative to percutaneous iliosacral screw fixation in pelvic C-type fractures. The risk of iatrogenic nerve injury seems to be low even in Denis II type fractures. The open approach enables a good quality of reduction especially in severely displaced fractures.

FM87

The Pararectus approach for anterior intrapelvic management of acetabular fractures

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Introduction: A new anterior intrapelvic approach for treatment of displaced acetabular fractures involving predominantly the anterior column and the quadrilateral surface is introduced. To establish five "windows" for instrumentation, the extraperitoneal space is entered along the lateral border of the rectus abdominis muscle, the so-called "Pararectus" approach.
Methods: The feasibility of secure dissection and optimal instrumentation of the pelvis was assessed in five human cadavers (ten hemipelves) before its implementation in a consecutive series in twenty patients (mean age 59 years, range: 17–90; 17 male) between 12/2009 and 12/2010. The quality of reduction using CT scans and the occurrence of intraoperative complications were assessed.
Results: In cadavers, sufficient extraperitoneal access and secure instrumentation of the pelvis were accomplished. In patients, reduction of fracture displacement was statistically significant [pre- vs. postoperative (mean ± SD): step-off: 3.3 ± 2.6 mm vs. 0.1 ± 0.3 mm, p <0.001; gap: 11.5 ± 6.5 mm vs. 0.8 ± 1.3 mm, p <0.001]. Lesions to the peritoneal sac and minor vascular damage were noted in each case in two patients.
Conclusion: Multi-directional screw placement and various plate configurations were feasible in cadavers without vast retraction of the soft tissues. In the treatment of complex acetabular fractures in patients the Pararectus approach allowed for anatomic restoration with minimal access morbidity. At our department in these patients the new Pararectus approach has become the standard approach in selected cases.

FM88

Reduction of dome impaction and quadrilateral surface determines outcome in acetabular fractures treated through Stoppa approach

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Introduction: The ilioinguinal (II) approach is well established for the treatment of acetabular fractures. As an alternative modified Stoppa approach can be used to expose acetabular fractures. We describe our experience with this approach.
Methods: This retrospective study describes a series of 50 consecutive patients of two level one trauma centers (oct 2005–sept 08; 9 multiply injured patients) where a modified Stoppa approach (n = 15), or in combination with the first window of II (n = 22) or Smith-Peterson approaches (13) was used. In 5 patients an additional posterior approach was necessary. Displacement of ≤1 mm was considered an anatomic reduction. Functional outcome was measured by Merle d'Aubinge/Postel-score. The patient collective was divided according the age in two groups:
Results: The mean age in group I was 39.7, in group II 72.5 years. Of the 50 fractures, the mean time from injury to surgery was 4.5 days. Medial displacement of quadrilateral surface and dome impaction were observed in group I in 62% and 15%, and in group II in 92% and 50%. Anatomic reconstruction was achieved in 81% in group I and in 58% in group II. Eight patients had a total of nine operative complications, four required reoperation (two deep infections, one intraarticular screw, one removal of tamponade after diffuse bleeding). Two patients of the group II died within one respectively nine months after surgery. Two patients in group I and one patient in group II needed hip arthroplasty 16.7 months after reconstruction. At last clinical examination, the functional rating of 20 patients in group I and of 16 patients in group II was classified as excellent or good in 100% (11 months) respectively 69% (10 months).
Conclusion: Open reduction and internal fixation of dome impaction and quadrilateral surface through the Stoppa approach is a demanding technique. Reduction of the superomedial dome impaction eventually with bone grafting improves outcome in patients with acetabular fractures in young as well as in older osteopenic patients.

FM89

Retrospective study of telescoping and re-operation rate of the Targon FN system for fixation of femoral neck fractures

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Introduction: The Targon FN system (Aesculap) is a new device to fix femoral neck fractures providing a telescoping mechanism with angular and rotational stability. Aim was to study whether and how the Targon FN system does telescope and to investigate the mode of failure and re-operation rate.
Methods: Younger patients, little displaced fractures and old-aged patients with many co-morbidities were judged as suitable for internal fixation. Between 2008 and 2011 175 patients had a femoral neck fracture, 44 of them were operated with the Targon FN system. Quality of reduction, screw positions, re-operation rates and reasons for re-operation were analyzed. Telescoping of the screws was assessed by measuring screw length.
Results: 16/44 (36%) patients were re-operated, 9 with a THA, 4 hardware removals, one endoprothesis, one DHS and one wound revision. The reasons for re-operation were 3 poor reductions, 4 poor screw positioning and one pertrochanteric fracture due to too many drill attempts. 3 patients had an avascular ostoenecrosis and 1 had a secondary dislocation. In the average the screws telescoped 4.0 (0 to 16) mm within 3 months and 4.4 (0 to 11) mm within one year. There was no screw perforation or rotation.
Conclusion: The re-operation rate was comparable to other internal fixation systems. Poor reduction and poor screw placement were the main reasons for failure. Telescoping of the system worked in a sufficient way. Correct reduction and good positioning of the screws are mandatory for a good outcome in osteosynthesis of femoral neck fractures, independent of the fixation device.

FM90

A novel technique for the quantification of dynamic hip screw migration and telescoping on two-dimensional radiographs

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Introduction: In order to prevent serious complications after dynamic hip screw (DHS) fixation of proximal femoral fractures, surgeons must detect any cranial migration or excessive lateral sliding (telescoping) of the hip screw on postoperative two dimensional (2D) plain radiographs. However, measurements of these parameters are distorted if radiographs are taken with the hip flexed or rotated. The goal of this study was to develop and validate a novel technique to quantify DHS migration and telescoping on serial plain radiographs in consideration of the distorting effects of hip rotation and flexion.
Methods: Using ap radiographs of a Synbone® implanted DHS, the projection of specific DHS dimensions at different angles of hip flexion and rotation was empirically determined. The resulting associations between projected DHS dimensions and hip flexion and rotation were used to adjust measurements of DHS migration and telescoping on serial radiographs to the effects of hip flexion and rotation. The technique's accuracy was validated in a duplicate analysis of standardized radiographs with no DHS migration. For clinical evaluation of the technique, we identified a series of radiographs of 15 patients who either experienced uneventful fracture healing (stable group, n = 6), cranial hip screw migration (unstable group, n = 6) or hip screw cut out through the femoral head (n = 3) after DHS fixation of a proximal femoral fracture. Using our technique, cranial DHS migration and telescoping from baseline to the 6 (FU1) and 12 weeks (FU2) follow- up visits were calculated.
Results: In duplicate analysis of standardized radiographs the standard error of measurement was 0,091 and 0.066 mm for cranial screw migration and telescoping respectively. In clinical validation, cranial DHS migration was most pronounced in the cut group (11.3 ± 0.9 mm), while telescoping was most distinctive in the unstable group (9.3 ± 6.3 mm), both between baseline and FU1. The stable group was statistically significantly discerned from the unstable group regarding cranial DHS migration and telescoping at FU2 (P = 0.045 and P = 0.027, respectively).
Conclusion: The technique may reliably and accurately quantify DHS migration and telescoping as low as 2 mm. It can be used clinically to prevent screw cut out and fracture collapse and scientifically in studies quantifying implant migration in osteoporotic bone.

FM91

Percutaneous sacroiliac joint fusion using iFuse – Implantat System™: first results of a new technique

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Introduction: Multiple techniques of sacroiliac joint fusion exist. Classic treatment of sacroiliac joint fixation compromises open surgery typically with a large incision to prepare the sacroiliac joint and adding bone graft to help the joint heal. The increased dissection needs long duration of surgery and usually translates into several days of hospitalization. Furthermore, potential wound complications – especially in this area – escalates. Thus, there is need for percutaneous proceedings. The purpose of our study was to describe our early experience and describe the surgical technique of a new percutaneous sacroiliac joint fusion system.
Description of technique: Sacroiliac joint fixation is performed through a small incision about 2 cm length made along the side of the patient's bottom. Subsequent a K-wire is placed in the right position between the neuroforamina using fluoroscopy (real time x-ray) to confirm proper placement. Guided by the wire specially designed pierced instruments to prepare the bone and insert the Fusion Implants were inserted.
Results: In this first cohort of patients with persistent iliosacral pain a number of 6 patients were treated with the mentioned method. There were neither intraoperative complications nor postoperative wound infection. Five patients were almost free of pain. The remaining patient was having prolonged localized pain.
Conclusion: Minimally invasive sacroiliac joint fusion is an alternative technique to protect the surrounding tissues and minimize soft tissue exposure.The clinical results illustrate that this technique is able to achieve good goals of pain reduction and minimize perioperative complications.

FM92

Open resection of subchondral acetabular osteoid-osteoma guided by combined CT navigation and hip arthroscopy

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Background: Resection of osteoid osteomas often pose challenging surgical tasks in terms of tumor size and surgical approach. Various imaging support has been used to enhance precision of tumor location and to preserve relevant surrounding structures.
Case Description: We report the case of a 20-year-old woman with osteoid osteoma formation in subchondral acetabular location of her left hip joint. After several CT-guided core biopsies a further attempt at tumor resection using the O-arm equiped with the optical navigation system missed the osteoid osteoma again. Based on high resolution CT the osteoidosteoma was successfully overdrilled under simultaneous computer navigational guidance of the cannulated biopsy drill and arthroscopic control of acetabular cartilage integrity.
Literature review: In extraarticular location of long bones and spine resection of osteoid osteoma has been reported under image intensifier and computer navigation control. In intraarticular location with direct visibility arthroscopic resection has been frequently performed. In juxtaarticular osteochondrotic lesions of knee and ankle joints combinations of computer navigation and arthroscopy were undertaken to improve precision and reduce soft tissue trauma, yet at high technical expense.
Clinical Relevance: Resection of the small sized osteoid osteoma in subchondral location of the acetabulum in the presented case required the combination of computer navigation and arthroscopic visual control. The chosen approach proved being a successful strategy avoiding additional surgical trauma for the patient and radiation exposure for the operating staff.

FM93

Femoral Torsion: Reliability and Validity of the Trochanteric Prominence Angle Test

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Femoral torsion might influence pathologic hip conditions. Therefore, assessment of femoral torsion during clinical work-up might be important. We wondered if physical examination could reliably measure or at least screen for gross anomalies of femoral torsion.
Material and Methods: Femoral torsion of 45 volunteers by two independent observers on two occasions using the "trochanteric prominence angle test" and by a radiologist unsing magnet resonance imaging (MRI) was measured. Inter- and intra-observer reliability as well as agreement of the trochanteric promincence angle value with MRI values were assessed using Kappa statistics and Intra Class Correlation, respectively.
Results: Inter- and intra-observer reliability ranged from poor to moderate and agreement with MRI values was fair only. Considering a 5° to 10° difference of femoral torsion clinically relevant, physical examination failed to match MRI values within ±10° in more than 50%. Arbitrarily defining thresholds for pathologic femoral torsion, the "trochanteric prominence angle test" could not recognize torsions outside the >30° / <0° range and diagnosed torsions outside the >20° / <10° range with a sensitivity of 18–75% and a specificity of 58–98% only.
Conclusion: Physical assessment of femoral torsion using the "trochanteric prominence angle test" does not allow reliable measurements nor screening for gross anomalies. We therefore integrate an adapted MRI protocol allowing measurement of femoral torsion within our clinical work up.

FM94

An alternate concept for the treatment of Vancouver type B2 periprosthetic femur fractures

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Introduction: The standard for the treatment of periprosthetic fractures is to revise the stem in B2 and B3 fracture types and often involves major surgery. We present the results of an alternate concept, where in B2 type fractures the stem is retained and the fracture osteosynthesized. We theorized, that if the stem would not reintegrate with healing of the fracture, it could be revised more easily and that the treatment is faster and involves less complications in this elderly group of patients.
Methods: All patients treated for a Vancouver B2 fracture between 01/ 2008 to 10/ 2011 were included into this retrospective study. Pathological fractures were excluded. Fracture classification, intra- and postoperative complications, healing time and the use of erythrocyte concentrates (EC) were documented. Standardized x-rays were taken preoperatively and at 6 weeks intervals until healing.
Results: 25 Patients (19 F, 6 M) were included into the study. Median age was 84 years (range 58–97). 17 fractures were treated with a revision of the stem (group 1), and eight were osteosynthesized. (group 2). Group 1: Mean hospitalisation was 21 (11–42) days. There were five (30%) major local complications (2 dislocations, 1 infection and 2 C3 fractures. Revision surgery was performed in four (23%) cases (2 ORIF, 1 debridement, 1 open reduction) Six (35%) major systemic complications (pneumonia, cardiac decompensation and nephritis with death in one case) were documented. On average 3 (0-6) EC were used. Group 2: Mean duration of hospitalisation was 22.5 (13–42) days. There were three local complications (2 stem migration, 1 hematoma), and 1 delayed union. Treatment included revision of the stem in two hips (revision rate 25%) and evacuation of the hematoma. There was one (13%) systemic complication (temporary renal failure). The mean use of EC was 2 (0–6). There was no significant difference in the use of erythrocyte concentrates ($p = 0.59$) and in the duration of hospitalisation ($p = 0.71$).
Conclusion: Primary osteosynthesis and secondary stem revision if necessary is an alternate concept in the treatment of Vancouver B2 fractures. The local complication rate with respect to stem revision or re-osteosynthesis was less in group 2. However, there was a significant difference for systemic complication in favour of the alternate concept. The results show, that the current concept is an excellent option with a siginificant decrease of the perioperative Morbidity rate.

FM95

Hemiarthropasty for displaced femoral neck fractures: long term outcome in patients under 65 years

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Introduction: Hemiarthroplasty of the hip is a treatment option for displaced fractures of the femoral neck in the elderly patient. Hemiarthroplasty (HA) is supposed to be less invasive than total hip arthroplasty (THA) and is therefore preferably used in elderly patients. However, recent studies suggest superior functional results of THA compared to HA. We hypothesized that long-term functional outcome of HA in younger patients (
Methods: Thirtyone patients (nineteen female, twelve male) under the age of 65 years (mean 61.1, range 47 to 64 years) were treated with hemiarthroplasty for displaced femoral neck fracture between 1995 and 2006. They were retrospectively assessed by clinical scores (Merle d'Aubigné and WOMAC Hip Scores) and by radiographic examination. Acetabular protrusion was measured on plain radiographs of the pelvis and was staged according to Baker et al. (grade 0–3).
Results: Preliminary Data: The mean follow-up was 11.2 years (range 6.5 to 17.5 years), three patients (10%) died during follow-up. Ten

patients (30%) showed a poor Merle d'Aubigné Score, of which three had to undergo THA (10%) because of acetabular erosion (grade 3 in two patients, grade 2 in one patient). All patients showed mild migration of the femoral head (Baker grade 1) due to the cartilage erosion, whereas erosion of the bony acetabulum (Baker grade 2 and 3) was only seen in 3 patients (10%).
Conclusion: Hemiarthroplasty in patients younger than 65 years leads to unsatisfactory results. One third of the patients had to be converted to THA or had a poor functional outcome after 10 years. This may be due to the erosion of the acetabular cartilage seen in all patients, suggesting that cartilage erosion is an early event. However, erosion of the bony acetabular roof is rare (10%) in this relatively young patient group.

FM96

The Critical Shoulder Angle: A New Radiological Tool in the Assessment of Patients with Degenerative Shoulder Pathologies

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Background: The role of bony geometry for the development of degenerative disorders of the shoulder remains unclear. Some radiographic parameters have been studied as predictive factors for rotator cuff tears (RCT), but anatomical predictors for primary osteoarthritis (OA) have not been identified. We hypothesized that the combination of a wide acromion with an upward tilted glenoid fossa would be particularly prone to supraspinatus tears whereas a short lateral extension with an inferiorly inclined glenoid would lead to osteoarthritis of the glenohumeral joint. This hypothesis was tested using the so-called critical shoulder angle (CSA), a new radiographic parameter, which represents a measurement of the combination of glenoid inclination and lateral extension of the acromion.
Methods: The CSA was measured in 94 asymptomatic shoulders with normal radiographs and sonograms, in 102 shoulders with documented RCTs without OA and in 102 shoulders with primary OA and absence of RCTs.
Results: The mean CSA was 33.1 ± 2.0° in the control group, 38.0 ± 2.7° in the RCT group and 28.1 ± 3.3° in shoulders with OA. These differences were all significant (p <0.001). While patients with CSAs greater than 35° had an 85.7% chance to be part of the RCT group, those with angles below 30° belonged with a 95.2% probability to the OA group.
Conclusion: Primary OA of the glenohumeral joint is associated with significantly smaller and degenerative RCTs with significantly larger CSAs than normal, asymptomatic shoulders. These findings suggest that individual quantitative anatomy implies biomechanics, which are likely to induce specific types of degenerative joint disorders.

FM97

The effect of simulated scapular winging on glenohumeral translations

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Introduction: There is a controversy if throwers with scapular winging are subject to increased anterior glenohumeral (GH) translations with consecutive instability. Previous cadaveric and in vivo models studying this hypothesis were limited either because of inhibited scapulothoracic motion or due to inaccurate or discontinuous registration of joint kinematics. The goal of this study was to test if scapular winging leads to a significant increase of anterior GH translations in a cadaveric system with unrestraint scapulothroacic motion, reproducible motion implementation and continuous joint kinematic registration.
Methods: Six shoulders of three skinned, fresh frozen cadaveric torsos were tested in a novel seven degree of freedom testing apparatus consisting of lower and upper frame. Torsos were mounted in the lower frame with the wrist pinned to a robotic motion actuator in the upper frame. The shoulders were subjected to three trials of an abbreviated throwing motion (from maximal external rotation to the end of deceleration) before and after simulation of scapular winging with a wedge put under the inferior angle of the scapula. During each motion, the positions of three retroflective bone markers were recorded by five high speed infrared cameras to infer the position of calibrated anatomical scapular landmarks as well as the center of rotation of the GH joint for each instance in time. GH translations and scapular rotations were plotted over time to calculate the area under the curve (AUC) as a representative of the overall GH translations and scapular rotations in specific segments of the motion.
Results: Implementation of scapular winging led to a significant increase of scapular flexion and lateral rotation in all segments of the motion (P = 0.001–0.025 and P= P = 0.004–0.012, respectively). From maximal external rotation to neutral rotation, scapular winging was associated with an increase of scapular internal rotations (AUC 170 ± 21 versus 145 ± 39 degrees*seconds, P = 0029) and anterior GH translations (AUC 14.5 ± 11 versus 28.4 ± 14.9 mm*seconds, P = 0008).
Conclusions: Increase of scapular internal rotation as seen with scapular winging is associated with a significant increase of anterior GH translations in a passive cadaveric model. Thus, **r**ehabilitation of scapular winging in throwers may be improtant to prevent GH instability.

FM98

Shoulder arthroplasty revisions: modular, stem-in situ replacements versus total replacements

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Introduction: Modular shoulder arthroplasty systems were developed partly to ease the conversion of an anatomical into a reversed prosthesis by retaining the stem in situ. The goal of this study was to evaluate whether this technical advantage is realizable in the operation room, and which benefits can be expected.
Methods: Between 03/2006 and 11/2010 a total of 6 modular conversions and 19 total conversions – including the replacement of the stem component – were performed in our clinic due to secondary rotator cuff tears or insufficiency. Patients were documented pre-, peri- and 1 year postoperatively for clinical and radiographic assessment and functional scores using a set of patient questionnaires (Constant Score [CS], Q-DASH, SPADI).
Results: The group of modular conversions consisted of 6 patients (male:female 4:2, mean age 61.5 years [48–73]), which were reoperated after a mean of 3.2 years (1.7–5.1) following the primary implantation. The revisions in the group of the 19 total replacements (male:female 1:18, mean age 70.2 years [53–85]) were performed after a mean of 5.4 years (0.5–17.7). This heterogeneous group (11x hemiarthroplasty / 8x total arthroplasty, 12x cemented stem / 7x uncemented) showed a significantly higher mean duration of the surgery (181 minutes) than the group of modular conversions (129 minutes) (p <0.05). The mean amount of intraoperative blood loss and the hospitalization time were noted with a lower tendency in the group of modular conversions (500 ml vs 660 ml / 5.7 vs 7.8 days). Perioperative complications tended to occur more often at the total replacement surgeries (n = 4 [21%] versus 1 [17%]). All patients significantly improved clinically and functionally following the revisions, with comparable outcome between the groups at the 1-year follow-up (e.g. CS 57.8 ± 32.9 vs 60.7 ± 14.8).
Conclusion: Modular shoulder arthroplasties help the surgeon to easily change the prosthetic system from an anatomical to a reversed shoulder arthroplasty. Our first experience shows the conversion with the stem in situ leads to a significantly shorter surgery time, and in tendency, a lower perioperative complication rate, a lower blood loss and a shorter hospitalization time. However, there seems to be no effect on the short-term outcome.

FM99

Reverse shoulder arthroplasty with deltoid insufficiency

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Background: The indications for reverse shoulder arthroplasty (RSA) have progressively been extended. Associated insufficiency of the deltoid is not uncommon and remains, in the literature, a contraindication and precludes the use of RSA. The aim of this study was determine the mid to long-term functional outcome and patient satisfaction of RSA implanted in case of deltoid insufficiency.
Materials and methods: Patients who had a RSA with a documented preoperative deltoid insufficiency were considered potentially eligible for inclusion in this retrospective multicentric study.
Results: Between January 1999 and December 2010, 49 patients (49 shoulders) underwent RSA with a deltoid insufficiency. At a mean follow-up time of 38 ± 30 months (range, 12 to 142 months), the anterior forward elevation improved from 50° ± 38° before surgery to 121° ± 40° at final follow-up, which was statistically significant (P <0.001). The mean Constant score also improved significantly, from 24 ± 12 at baseline to 58 ± 17 at final follow-up (P <0.001). The mean SANE score was 71 ± 17 and the rate of patient satisfaction was 98%. There were nine postoperative complications (18%).

Conclusion: The results suggest that preoperative deltoid insufficiency, in certain circumstances, is not an absolute contraindication to RSA. This treatment option can yield reliable improvements in active forward elevation, and functional outcome despite a high rate of postoperative complications.

FM100

May compensatory scapular movements avoid impingements in reversed shoulder prostheses?

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Introduction: Reversed shoulder prostheses balance the deficiency of the rotator cuff muscles, by semi-constrained articular surfaces and a medial displacement of the rotation centre. However, the rotation centre medialization may induce mechanical impingements among bones and implants. Several ideas have already been proposed to reduce the impingements and improve the mobility of reverse prostheses: lateral or inferior displacement of the rotation centre, increase of the glenosphere size. The effects of these design parameters have only been evaluated on the maximal range of abduction, for simple movements. The aim of this study was to evaluate the required correction of the scapula to avoid impingements, for different glenosphere positions, sizes and to relate this mobility map to typical activities of daily living.
Methods: A geometric model of the scapula and humerus was built from CT data of a normal cadaver shoulder. Four variations of the reversed shoulder prosthesis Aequalis (Tornier, Edina, MN) were tested: standard 36-mm glenosphere (STD-RSA), 42-mm glenosphere (LRG-RSA), lateralized 36-mm glenosphere (LAT-RSA), and Bony Increased-Offset (BIO-RSA). A CAD software was used to perform the bone resection and the prosthesis implantation. We simulated 4 measured daily living activities: hand to mouth, hand to contra lateral shoulder, hand to back pocket, and combing hair. Each movement was divided in three parts: first, middle, and end. For each part, and each design, we evaluated the required compensation of the scapula to avoid impingement, if any.
Results: With the STD-RSA, impingements occurred only for rest position and back-pocket position. The LRG-RSA partly improved the mobility. The two lateralized glenospheres were free of impingements. When impingements occurred, the scapular compensation was less than 10 degrees (in any direction), which was below the standard deviation of the measurements on healthy subjects.
Conclusion: We concluded that in many situations, the movements of the scapula compensate for the loss of glenohumeral range of motion and allow to avoid impingements in reversed total shoulder prostheses.

FM101

Rim reconstruction with autogenous iliac crest for anterior glenoid deficiency: 43 instability cases followed for 5 to 19 years

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Introduction: The purpose of this study was to evaluate the long-term results of instability patients treated with iliac crest graft glenoid augmentation.
Materials and methods: Retrospective study including 48 consecutive patients (40 male, mean age 25, range 17–35) with defects ranging from 15 to 25%. 20 primary and 28 revision cases. 3 declined follow-up examination. 5 lost to >5 years follow-up. Mean follow-up 9.2 years (range 5–19). Reconstruction comprised: iliac crest graft, interposition of the labrum on the burred surface of the graft and capsular re-tensioning. We measured the Oxford Shoulder Instability Score, assessed arthrotic changes, atrophy and fatty infiltration of the subscapularis.
Results: 8/43 had residual pain, 3/43 had a subjective sensation of instability, 1/43 had a re-dislocation and required re-intervention. The mean OSIS was 18.1 points (12–50) (n = 40). 1/40 developed postoperative subscapularis insufficiency. The mean subscapularis atrophy was 6% (46% atrophy to 41% hypertrophy). 2/40 had a relevant fatty infiltration of the SSC muscle stage III to stage IV. 19/40 had mild and 1/40 had a moderate arthrosis. Arthrosis progressed by one stage in 7 of 35 shoulders. The mean residual glenoid defect was 4.0% (0–13.5) (n = 40).
Conclusion: Glenoid rim reconstruction with iliac crest graft was equally effective for patients with primary repair and for failed previous stabilization. It offered the advantage of an anatomic reconstruction with a comparatively good long-term preservation of the joint line.

FM102

Early failure of shoulder interposition arthroplasty using Graftjacket® in combination with hemiprostheses

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Introduction: Treatment of glenohumeral osteoarthritis (GOA) in the young patient is challenging. Total shoulder arthroplasty (TSA) may reliably address pain and function but at the price of early sacrifice of glenoid bone stock. Various efforts have been made to avoid the use of a prosthetic glenoid component and to prevent glenoid abrasion after humeral hemiarthroplasty (HHA). Graftjacket® (GJ®) is a human dermal collagen allograft which is used for soft tissue augmentation and also for interposition arthroplasty in young patients with GOA. We present our experience with its use in 6 patients, which is the largest case series reported up to date. Further, we compare the results to alternative treatment options like meniscus allograft and capsular interposition arthroplasty (CIA).
Methods: From 2009 to 2010, GJ® was used as a glenoidal interposition arthroplasty combined with a humeral resurfacing (5) or humeral prosthesis (1) for treatment of osteoarthritis in 6 patients with a mean age of 47 (34–57). Before availability of GJ®, 6 patients with similar diagnosis were operated with meniscus allograft (5) or capsular (1) interposition.
Results: At a mean of 10 (2–17) months after implantation of the GJ®, 3 of the 6 patients had to be revised (2 TSA). In 1 patient the GJ® was implanted arthroscopically. 2 months postoperatively open revision surgery with HHA and reimplantation of a new GJ® was performed. At time of revision the previous GJ® was totally worn out. 9 months after the first revision he had to be converted to a TSA. All 3 remaining patients have unsatisfying results at a mean F-U of 14 (6–22) months, but refuse further surgery. Of the 6 patients with meniscus allograft or CIA only one patient had a good functional result at latest F-U of 72 months. The other 5 patients all had a poor result, 1 accepting it and 4 having had revision surgery.
Conclusion: In our hands GJ® interposition arthroplasty for the treatment of GOA in the young patient failed at a very high rate. The poor results are comparable with those after meniscus allograft or capsular interposition arthroplasty. We therefore discontinued this type of operation and conclude that new treatment options for young patients with GOA are desirable.

FM103

Shoulder MRI Findings in Water Polo Players

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Background: Shoulders of throwing and swimming athletes are highly exposed joints with structural abnormalities seen on magnetic resonance imaging scans. The aim of this study was to evaluate the correlation between the clinical symptoms and the radiological findings in shoulders of water polo players.
Material and Methods: This was a comparative single centre cohort study evaluating the relevance of radiological examinations in shoulders. We selected 28 semi-professional water polo players with symptomatic and asymptomatic shoulders between the age of 18 and 35 years and a control group of volunteers also between the age of 18 and 35 years. The clinical examination was accomplished by two clinical examiners and measured with the Constant Murley Score and further clinical tests to evaluate the stability, the range of motion of the joint as well as the quality of the rotator cuff. Isometric muscle strength was measured and shoulder MRI's were evaluated by two radiologists.
Results: Our probands were divided into three groups: throwing (group 1, n = 28) and non throwing shoulders (group 2, n = 28) of the water polo players and group 3 generated by both shoulder joints of our control group (n = 30). Pathological findings as scars and tendinopathia of the subscapularis/infraspinatus muscle and the posterior labrum were more often described in group 1 than in 3. Changes in the supraspinatus muscle were found in 35.7% of the throwing shoulders. Almost the same percentage was described in group 2 and 3 (32.1% / 33.3%). All the throwing shoulders (n = 28) did show pathological findings in the MRI but 22 of them did not have any pain.
Conclusion: There is no correlation between the clinical symptoms and the MRI findings in semi-professional water polo players. We neither found typical pathologies of throwing shoulders nor typical pathologies of swimming shoulders. One reason may be the different muscle balance between swimmers and throwers. Water polo players are no typical swimmers what prevents the development of a glenohumeral instability as described in swimming shoulders. Water polo players don't have a sum of pathologies of throwers and swimmers.

FM104

The Biomechanical Effectiveness of Classic and Congruent Arc Latarjet Procedures

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Introduction: The Latarjet procedure for treatment of recurrent shoulder instability consists of fixation of the osteotomized coracoid process to the anterior glenoid rim. We compared the strain onto the glenoid, the humeral displacement and the ultimate load to failure of two differently orientatated coracoid fixations.
Methods: Eight cadaveric shoulders (four pairs) were subjected to a compressive loading using a testing machine (Instron, MA) before and after one of two Latarjet reconstructions of a simulated 25% anterior glenoid defect. For the Classic method the coracoid was fixed so that its lateral edge became part of the glenoid face, while for the Congruent it was its inferior surface. We applied 100 cycles of 1 Hz at 50, 100, 150 and 200N directed 30° anteriorly on the glenoid rim. Glenoid strain and humeral displacement were recorded and compared between intact bone and after Latarjet reconstruction. Paired t-tests were used to compare between the various testing states. Statistical significance was set at $p < 0.050$.
Results: No differences in glenoid strain were noted. There was no difference in humeral displacement between intact and Classic Latarjet ($p \geq 0.278$) while after Congruent Latarjet the mean difference in displacement increased at 150N to 3.803 ± 2.287 mm ($p = 0.045$) and at 200N to 4.922 ± 2.365 mm, ($p = 0.025$). The difference of failure load between Classic and Congruent Latarjet was significant (701.1 ± 83.4N vs. 435.9 ± 166.9N; ($p = 0.031$)).
Discussion: Humeral displacement suggests that Classic and Congruent Latarjet are comparable at lower loads but at increased loads the Classic Latarjet is stronger. This was further reinforced by the significant difference in load to failure.

FM105

Arthroscopic Biceps Tenodesis Compared to Repair of Isolated Type II SLAP Lesions in Patients Over 35 Years of Age

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Purpose: The purpose of this study was to compare arthroscopic biceps tenodesis with repair of isolated type II superior labrum anterior and posterior (SLAP) lesions in patients over the age of 35.
Methods: We identified isolated type II SLAP lesions surgically managed over a five-year period. Minimum two-year follow-up was available for 22 patients who underwent repair (Group 1), and for 15 patients who underwent a primary biceps tenodesis (Group 2). The mean age at the time of surgery was 45.2 + 5.5 years in group 1, and 52.0 + 8.0 years in group 2.
Results: In group 1, functional outcome improved from baseline to final follow-up by American Shoulder and Elbow Surgeons (ASES) (47.5 to 87.4; $p < .0001$) and University of California, Los Angeles (UCLA) scores (18.5 to 31.2; $p < .0001$). In group 2, similar findings were observed for ASES (43.4 to 89.9; $p < .0001$) and UCLA scores (19.0 to 32.7; $p < .0001$). There was no difference in functional outcome between the groups. Full range of motion recovery was delayed by nearly 3 months in group 1 compared to group 2 ($p = .0631$). Two patients in group 1 required a secondary capsular release. In group 1, 77% of patients were both satisfied and returned to normal activity, compared to 100% in group 2 ($p = .0673$).
Conclusions: In the current study, individuals over the age of 35 with an isolated type II SLAP lesion had a shorter postoperative recovery, a more predictable functional outcome, and a higher rate of satisfaction and return to activity with a biceps tenodesis compared to repair. Based on our observations, biceps tenodesis is preferable to repair for isolated type II SLAP lesions in non-overhead athletes over the age of 35.

FM106

Aseptic Loosening Rate of the Humeral Stem in the Coonrad-Morrey Total Elbow Artrhoplasty. Does Size Matter?

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Background: Aseptic implant loosening is one of the most common complications leading to revision surgery in total elbow arthroplasty. Different humeral stem lengths are available with varying designs. In general the decision of which stem length to use, depends on the surgical diagnosis or simply the surgeon preference. Often the longer stem is used for posttraumatic or revision cases while for rheumatoid patients the shorter stem is preferred. There is no data in the literature to favor one humeral stem length over the other according to the diagnosis.
Methods: We analyzed the total elbow joint database of the Coonrad-Morrey design at our institution for aseptic loosening leading to revision and compared the revision rate and the survival of the 4-inch and the 6-inch humeral stems.
Results: Overall, revision for aseptic humeral loosening is infrequent and occurred in only sixteen of 711 total elbow arthroplasties during a mean follow-up of 88 months. There was no significant difference in the revision rate between the two stem lengths (1.9 per cent for the 4-inch stems and 2.6 per cent for the 6-inch stem). Revision rate was correlated to the surgical diagnosis and was significantly higher for posttraumatic patients than for rheumatoid patients (5.1 per cent vs. 0.66 per cent, $p < 0.001$). Of interest, the mean time to revision was shorter for the 4-inch stems than it was for the 6-inch stems (37 vs. 95 months, $p = 0.034$).
Conclusion: Revision rate for aseptic loosening of the humeral stem of the Coonrad-Morrey prosthesis does not depend on the stem length but rather correlates with the surgical diagnosis.

FM107

Endoscopic decompression of the ulnar nerve in Cubitaltunnel syndrome. Results with prospective course over 6 months

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Introduction: After carpal tunnel syndrome the Cubitaltunnel syndrome (syn. sulcus ulnaris syndrome) is the second most common compressionssyndom of a peripheral nerve. The site of compression in the area of the elbow can be localized electrophysiologically mostly accurate. After failed conservative treatment decompression with / without anterior translocation of the nerve is a common method to relieve the nerve over a long distance. Using a endoscopic technique the postoperative rehabilitation time should be shorter.
Aim: In a prospective consecutive case series study with electrophysiological course, the results of endoscopic decompression of the ulnar nerve are presented in Cubitaltunnel syndrome.
Material and Methods: Between 8/2008 to 3/2010 we performed at our institution an endoscopic decompression of the ulnar nerve in 22 patients. Preoperatively a clinical and electrophysiological examination was performed in all patients. Clinical follow up were performed 6 and 12 weeks and finally a clinical and electrophysiological examination after 6 months. For the statistics for predominantly non-normally distributed data we use the Spearman coefficient, Mann-Whitney U and Wilcoxon test.
Results: The surgical procedure was performed without complications in all patients. 20 patients over 6 months could be included for the entire follow-up. As early as 6 weeks postoperatively all patients showed a slight improvement of symptoms. At final follow-up 6 months postop in 10 cases (50%) a normal sensibility in the ring- and smallfinger could be documented. The two-point discrimination averaged 4.9 (± 0.94). In 14 cases (82%) the strengh of the ulnar innervated intrinsic muscles was normal. Only in 3 cases (15%) there was no subjective improvement during the first 6 months. Satisfaction on a VAS scale from 0 (not satisfied) to 10 (very satisfied) was amounted 7.7 pts.
Summary: Endoscopic decompression of the ulnar nerve does represent a simple and complication-free procedure to relieve the nerve in the elbow area over a long distance. The recovery of the nerve takes place slowly and depends on the severity of nerve damage. Not in all cases a complete nerve recovery could be expected.

FM108

Injection-induced low-grade infection of the shoulder joint: a case series analysis

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Background: Purulent arthritis of the shoulder has been widely reported. Low-grade post-operative infections of the shoulder have also been observed. Low-grade infections of the shoulder without prior surgery have not been reported in the literature. The purpose of this study is to present our experience of 7 patients with low-grade infections of the shoulder without a history of prior surgery.
Methods: We retrospectively reviewed 7 patients, mean age of 45 years, that originally presented with diffuse shoulder pain, with or without stiffness. None had prior surgery but all had prior injections, average 5.6, into the shoulder. All patients were treated with various arthroscopic procedures. All had harvesting of 4 tissue probes

identifying low-grade infection. Pre/Post-operative pain score and range of motion, intraoperative findings, post-operative Constant score, Subjective Shoulder Value and pre/post operative radiographs were analyzed. Post-operative antibiotic therapy was recorded.
Results: All patients showed synovitis without pus or any other sign of infection. Propionibacterium acnes were identified in 5, coagulase-negative Staphylococcus in 2, and Staphylococcus saccharolyticus in 1 shoulder. One patient had a mixed infection (Propionibacterium acnes and coagulase-negative Staphylococcus). Therapy consisted of oral antibiotics for 1 to 6 months. Four patients had a satisfactory and 3 an unsatisfactory outcome
Conclusions: Diffuse shoulder pain with or without stiffness in patients without prior surgical history can be caused by low-grade infection. Treatment using oral antibiotics has unpredictable outcomes.

FM109

Post-traumatic ankle osteoarthritis: correlating radiographic features with functional outcome

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Objective: To assess (1) the reliability and construct validity of the Kellgren-Lawrence scale (KLS) in the context of post-traumatic ankle OA; (2) it's correlation to functional outcome.
Design: Cohort of 75 patients (150 ankles) surgically treated for unilateral malleolar fracture was reviewed. Functional outcome was assessed using the AOFAS hindfoot score and a visual analog pain scale. Radiographic grading of OA and determination of specific features of OA was performed by four physicians. Intra- and inter-observer reliability was determined. Minimal joint space width (minJSW) sclerosis and talar tilt angle were quantified by digital measurements. A modified KLS including talar tilting was then designed.Validity of both original and modified scales was evaluated in the subgroup of post-fracture ankles and expressed as ability (1) to identify those with clinical symptoms and (2) to distinguish between patients with different degrees of fracture severity.
Results: Inter- and intra-observer reliability of OA assessment were good (ICC 0.61 and 0.75). MinJSW significantly decreased ($p = 0.04$), and sclerosis significantly increased with KLS grades ($p = 0.06$ and 0.03). A minJSW cut-off of 2 mm allowed adequate differentiation between normal/early (0–2) and advanced (3—4) grades. Both the original and the modified KLS grades significantly increased with decreasing AOFAS ankle-hindfoot scores and pain assessment. The modified scale showed better discrimination between advanced OA grades.
Conclusions: The KLS is valid and reliable for assessment of ankle OA. Inclusion of the talar tilt angle improved the correlation with clinical paramterers. Use of the proposed adapted scale would allow for better comparison between studies.

FM110

Medial Pain Syndrome in Patients with Total Ankle Replacement

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Introduction: Total ankle replacement (TAR) is an increasingly recommended treatment for patients with end-stage ankle osteoarthritis (OA). The risk of persistent pain following TAR remains high. Pain is typically localized on the medial side. The aim of this study was to (1) establish a classification of medial pain syndrome in patients who underwent TAR and (2) describe treatment strategies as a function of the suggested classification.
Methods: We retrospectively reviewed data from 744 patients who had 778 TARs between May 2000 and December 2009. Only primary arthroplasties with a minimum of 2 years follow-up were included, resulting in 582 patients with 612 TARs. There were 319 female and 293 male patients with a mean age of 58.2 ± 12.8 years. All patients were evaluated pre- and post-operatively (mean follow-up 5.9 years, range: 2–9). In 91 patients medial pain syndrome was diagnosed. It was defined as pain localized on the medial side with an intensity of at least "3" using a visual analogue scale (0–10) in at least 3 of 6 months before the last follow-up.
Results: The following classification of the medial pain syndrome has been established in our practice. Type I: medial impingement/ contracture of medial ligaments (18%); Type II: valgus (32%); Type III: varus (23%); and Type IV: varus-valgus deformity (18%). The following treatment strategies are suggested based on this classification scheme. Type I: medial release and/or exchange of insert (smaller size) or revision TAR. Type II: medial displacement calcaneal osteotomy. Type III: supramalleolar osteotomy. Type IV reconstructive surgery including first supramalleolar osteotomy of the tibia to correct the longitudinal axis of the tibia and then the medial displacement calcaneal osteotomy to address the valgus hindfoot deformity.
Conclusions: Persistent pain in patients who undergo TAR is a common problem and has been described in up to 60% of all replaced ankles. In patients with medial pain syndrome a complex biomechanical problem is often observed, and a simple debridement of the medial gutter typically results in temporary pain relief. Based on our experience, medial pain syndrome can be assigned to one of four Types to classify the typical causes of pain, and our clinical strategies to address each Type have been presented.

FM111

The Effect of Three-Component Total Ankle Misalignment on Clinical Outcome: Pain Relief and Functional Outcome in 368 Consecutive Patients

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Introduction: Although total ankle replacement (TAR) is becoming an increasing popular treatment, the potential risk of persisting pain and reoperations following TAR is still remarkable. The sagittal malposition of the talar component belongs to the common intraoperative complication of TAR. Therefore in the present study we analyzed the influence of talar component position on the clinical results.
Methods: Our study included 368 TAR. There were 166 female and 189 male patients with a mean age of 59.4 years. All patients were evaluated pre- and postoperatively. Clinical (visual analogue scale (VAS), American Orthopaedic Foot and Ankle Society (AOFAS) hindfoot score) and radiological (anteroposterior offset ratio (AOR)) follow-up was performed. The mean time to final follow-up was 51.2 months.
Results: Due to the radiological analysis at latest follow-up all patients have been divided into three groups: ankles where the centre of the talus was found to be (1) positioned exactly on the longitudinal axis of the tibia (146 ankles), (2) anterior to the tibial axis (116 ankles, mean AOR 0.06), and (3) posterior to the tibial axis (106 ankles, mean AOR –0.07). Postoperatively, AOFAS hindfoot score and ROM significantly improved in all patients ($P < 0.001$). In the patient group with AOR = 0 the AOFAS hindfoot total score and ROM were measured at the highest level ($P < 0.001$). Although the AOFAS score and ROM were found lower in the patients with talus centre measured anterior or posterior to the longitudinal axis of tibia, we could not found a significant correlation between the value of AOR and AOFAS score or ROM inside of each group.
Conclusion: Total ankle replacement (TAR) is becoming an increasing popular treatment, the potential risk of persisting pain and reoperations following TAR is still remarkable. The sagittal malposition of the talar component belongs to the common intraoperative complications. Therefore in the present study we analyzed the influence of talar component position on the clinical results. The exact positioning of the talar component of three-component total ankle is one of requirements for mid-term successful results regarding the postoperative pain relief and functional outcome.

FM112

Bone-Implant Interface of a Three-Component Total Ankle Replacement: Histological Analysis of Five Retrieved Implants

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Introduction: Most current total ankle replacements (TAR) use a porous coating with or without hydroxyapatite (HA) for cementless fixation. Histological analysis of the bone-implant interface has been a part of extensive research. However, most long-term available data are from patients with total knee or hip replacement. Up to date, no comparable studies were performed using retrieved ankle implants. The objective of this stud was therefore to assess the osteointegration process on retrieved implants of different prosthesis generations based on histologic analysis.
Methods: HINTEGRA 3-component prosthesis used HA single coat for the 1st generation, porous CoCr (200µm) with HA double coat for the 2nd generation, and a titanium (200µm) with HA double coat for the 3rd generation. Five patients were included into this study:
1) female, 52 years, 8.6 years after TAR (1st generation), chronic pain;
2) male, 77 years, 8.5 years after TAR (1st generation), chronic pain;
3) male, 71 years, 6.8 years after TAR (2nd generation), peroneus nerve palsy; 4) female, 6.2 years after TAR (3rd generation), painful arthrofibrosis; 5) male, 59 years, 5.0 years after TAR (3rd generation), painful arthrofibrosis. Tibial and talar components were removed with bone-bloc (at least 6mm) and prepared for histological analysis with toluidine blue stain.
Results: While regular bony ingrowth to HA layer was found in all 5 cases, the HA layer was not stable in the 1st-generation which resulted in partial loosening. For the 2nd and 3rd generation implants, trabecular stress concentration was found around the 6 mm peaks and at posterior and anterior aspect of tibial and talar implants.

Conclusion: Our findings are in accordance with clinical studies of different implants showing that single HA coating results in an inferior osteointegration when compared to double coated implants. The histological distribution of trabecular bone at the interface supports earlier observations that load transfer occurs mainly through the cortical rim. We conclude that tibial component should cover the entire cortical rim and that a stem or a fin is not necessary for fixation, and that precise bone cut on talar side is important for proper bony support.

FM113

Revision Arthrodesis with the Use of Fresh Allograft and Rigid Plate Fixation

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Introduction: End-stage ankle osteoarthritis is a debilitating condition that results in substantial functional limitation and a poor quality of life. Two treatment modalities have been discussed in the literature: arthrodesis as the traditional treatment and total ankle replacement (TAR) as an alternative method. Non-union in patients with ankle arthrodesis and failure of prosthesis components in patients with TAR belong to major postoperative complication requiring new treatment strategies. Revision arthrodesis in this patient cohort is technically demanding, especially due to decreased bone quality and/or deficient bone stock. The objectives of this study were therefore: 1) to describe our treatment algorithm and surgical technique in patients with failed ankle fusion / TAR, 2) to determine intra- and perioperative complications rate, and 3) to determine the fusion rate.
Methods: 17 consecutive patients (8♂, 9♀, mean age 48 years, range 22–78) with failed TAR (n = 12) or failed ankle fusion (n = 5) were including into this prospective study. Patients with Charcot neuroarthropathy of midfoot and/or hindfoot were excluded. In all patients isolated tibiotalar fusion was performed using anterior double plating with additional two screws across the joint. In two patients additional posterior plate was used to achieve the appropriate primary stability. All patients were clinically and radiologically assessed after 3.5 (2–4.8) years. All radiographs were independently evaluated by two persons to assess the osseous healing. When not conclusive, computed tomography has been additionally performed.
Results: There were no intraoperative complications. Wound-healing occurred within two weeks after the surgery without adverse events in all but two cases. In two cases the infection resolved with intravenous antibiotics for 7 days, no operative debridement was necessary. A solid fusion at the site of arthrodesis was detected radiographically after 4, 6, and 8 months in 12, 4, and one patient, respectively. No ankles had to be revised.
Conclusion: Our surgical technique with the use of fresh allograft and anterior double plating was shown to be a reliable revision surgery method with low complication rate and high fusion rate.

FM114

A target device to improve subtalar screw placement – A cadaver study investigating effect on precision and radiation exposure

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Introduction: In subtalar arthrodesis screw placement is important to provide primary stability. In inexperienced hands this step could be time-consuming and exposes surgeons and patients to radiation. By means of a target-device these potential drawbacks and dangers could be reduced. It was hypothesized that a speficically designed target-device would reduce radiation exposure while improving screw placement when compared with the conventional "free-hand" method.
Materials and methods: Twenty matched-pairs of intact cadaveric hindfeet specimens were prepared for the study. Specimens were randomly assigned into two groups consisting of 10 specimens each. Group 1 = screw placement performed with a target-device. Group 2 = screw placement under fluoroscopic control. An experienced and fellowship-trained foot and ankle surgeon and a resident, who has never done subtalar fusions did all surgeries. Exposure to radiation was assessed by means of the dose area product given by the fluoroscope.
Results: Optimal screw positioning was achieved in both groups in 10 out of 20 specimens (group 1 n = 5; group 2 n = 5). Suboptimal screw placement was achieved in 8 cases (group 1 n = 4; group 2 n = 4). There were two failures, which occurred in fusions performed by the resident (group 1 n = 1; group 2 n = 1). Exposure to radiation was significantly reduced in group 1 when compared with group 2 (4,1cGy*cm² vs 8,1cGy*cm²; p = 0.012). No lesion of neurovascular structures due to aiming device placement occurred in group 1.
Conclusion: A target-device for screw-placement does not provide a signifcant technical advantage but reduces radiation exposure.

FM115

Primary Stability and Stiffness of Ankle Arthrodesis Techniques – Cross Screws vs. Anterior Plating

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Introduction: Ankle arthrodesis has remained gold standard in treating symptomatic end-stage osteoarthritis. Cross-screw fixation is widely applied to perform ankle fusion but with considerable failure rates. Thus, an anatomically shaped anterior double-plate system has been introduced with union rates of 100%. The current biomechanical study investigates primary stability and stiffness between screw fixation and anterior double-plating.
Methods: Twelve cadaver specimens of lower legs were used. Matching was performed directly(3 pairs) and according to the projectional BMD from previous DEXA scans (6 pairs). Specimens were randomly assigned to each fixation technique. All constructs were tested (Machine model 1456; Zwick) flexing the foot until failure (= rotation of the talus relative to the tibia) and the force documented. Using linear regression, which was fit to the force–displacement curve in the linear portion of the curve (R2 average value was 0.984, with a range from 0.948 to 0.996) stiffness was given by the slope.
Results: The mean load to failure of the anterior double plating system averaged 967N (range from 570 N to 1400 N) and 190 N (range from 100 N to 280 N) (p = 0,005) for the three-screw fixation method. Stiffness averaged 56 N/mm (range from 35 to 79 N/mm) for the anterior double-plating system whereas a mean of 10 N/mm (range from 6 to 18 N/mm) was achieved for the three-screw fixation method (p = 0,004).
Conclusion: An anterior double-plating system performs better regarding primary stability and stiffness. This data can be used to adjust postoperative rehabilitation protocols regarding ambulation and weight bearing.

FM116

Non-operative Treatment of Acute Rupture of the Achilles Tendon

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Treatment of acute rupture of the Achilles tendon is categorized into operative and non-operative treatment. Surgery is associated with a significantly lower number of re-ruptures but also an increased complication rate, whilst not leading to accelerated rehabilitation or improved functional outcome. We developed and evaluated a customized non-operative treatment algorithm. Ninety-one patients were prospectively followed up for a mean of 30.6 ± 20.1 (9.38–88.1) months. A short ankle cast in 20° equinus position was worn in a special rehabilitation boot equipped with 2 removable heel inlays for 6 weeks. Full weight-bearing was allowed immediately. After 6 weeks, the cast was removed and patients wore the boot for another 6 weeks, removing one heel inlay every two weeks with a final 2 week period of ambulation in the boot without inlay. A special physical therapy program was absolved. The mean Thermann score was 82.2 ± 13.4 (35–100) points. Subjective satisfaction was rated "very good" and "good" in 92.3% of patients. There were 5 re-ruptures, three with an adequate trauma and two without, the latter undergoing surgical repair subsequently. The complication rate was 6.6%, including each one plantar fasciitis, intratendinous seroma, pressure ulcer, transient hypaesthesia, development of CRPS syndrome, and 2 deep venous thrombosis. Our treatment algorithm promotes fast rehabilitation through immediate full weight-bearing and physical therapy. The re-rupture rate is lower, while the complication rate matches results after non-operative treatment reported in other studies. Concluding, non-operative treatment is a valuable option for acute rupture of the Achilles tendon.

FM117

SMART: Swiss Multi-Center Achilles Tendon Rupture Trial – Clinical and Radiological Outcomes at over 7.5 Years Follow Up: Muscles and Tendons Partially Recover

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Background: There is still controversy on the best treatment of Achilles tendon (AT) ruptures. Long-term follow-up with radiologic and clinical measurements are needed to assess the best treatment option.

Hypotheses: We hypothesized that open surgery would perform best in muscle atrophy and AT length (ATL) across the mainstream treatment groups.
Methods: In this retrospective, multicenter cohort study, 52 patients after unilateral AT rupture treated by open, percutaneous or conservative treatment and a healthy contralateral leg were assessed at a mean of 91.0 months follow-up. Demographic parameters, time off work, maximum calf circumference (MCC) and clinical scores (ATRS, Hannover, AOFAS) were evaluated. Muscle volume (MV) and cross-sectional area (CSA) of the triceps surae and ATL were measured on an MRI.
Results: Reduced MV was found in all groups with a higher MV in the percutaneous (675.9 ± 207.4 cm3) compared to the conservative group (729.9 ± 130.3 cm3, p=.04). Mean ATL was higher at the affected leg (198.4 ± 24.1 mm vs. 180.6 ± 25.0 mm, p <.0001) without statistical difference on subgroup analysis. Clinically measured ankle dorsiflexion showed poor correlation with ATL (R2 = .067, p = .008). MV correlated with the cross sectional area (R2 = .60, p <.0001) but showed a weak correlation with the Hannover score. MCC seems to be a good predictor of MV following the algorithm: **MV [cm³] = 35 * MCC [cm] – 566** (R2 = .42, p <.0001).
Conclusions: No significant difference between the treatment groups was found in the above parameters. Even if direct costs of conservative treatment are lower, days off work are more consistent in the operative groups, which might equalize the cost-effectiveness. CSA and MCC are easy and cost-effective measurements and a very good approximation of muscle volume of the triceps surae.

FM118

Achilles Tendon Augmentation with Flexor Hallucis Longus Transfer in the Treatment of chronic Achilles Tendon Disease

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Background: A flexor hallucis longus (FHL) tendon transfer aims to restore function and relieve pain in chronic Achilles tendon (AT) disease. The clinical and radiographic outcome of two different surgical techniques (transtendinous/-osseous) was assessed. A transosseous tendon transfer was hypothesized to perform better than a transtendinous technique.
Methods: Forty patients (42 ankles) from January 2005 – March 2009. Group 1 = transtendinous (22 pts/20 ankles); Group 2 = transosseous (18 pts/18 ankles). Retrospective analysis: AOFAS hindfoot-; VISA-A-, Foot Function Index- and SF-36 scores and MRI of the lower leg to assess muscle quality. Isokinetic plantar flexion strength measurements using a Con-Trex dynamometer.
Results: Group 1: F-up: 73 mts. Age: 52 yrs. Improved AOFAS score from 66 points to 89 points (pGroup 2: F-up: 35 mts. Age 56 yrs. The AOFAS score increased from 59 points to 85 points (pOne FHL showed hypertrophy. Isokinetic testing at 30 deg/sec in group 1 revealed significant weakness in the operated ankle averaging 54.7 N-m (75% of normal), and in group 2 58.2 N-m (77% of normal). In both groups all patients had good to excellent clinical outcome and no significant differences were found regarding the five scores, plantar flexion strength nor changes in the MRI.
Conclusion: The hypothesis has been disproved. Overall, an FHL transfer provides good-to-excellent clinical, functional and radiographic outcome in the treatment of irreparable AT disease.

FM119

Treatment of Charcot Foot Arthropathy – the more the merrier?

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Introduction: The Charcot arthropathy (CA) of the foot is a chronic destructive process affecting the osseous foot's arc in patients with sensitive neuropathy. Immobilization and total contact casting (TCC) are the treatments of choice, yet, evidence-based suggestions for the very heterogeneous affected population are missing. Purpose of the present study was to evaluate patient specific risk factors in the treatment of CA.
Methods: Patients with CA who received definite shoe wear or orthetic/prosthetic treatment between 01/2005 and 01/2012 were enrolled and analyzed retrosepctively. Demographic and clinical characteristics at time of diagnosis, treatment paths and duration, recurrence rates and complications were documented.
Results: Forty-three feet of 36 patients (mean age 59 ± 10 years; female 10, male 26) were included. Mean follow-up after initial diagnosis was 42 months (range 4–155 months). Diabetes was present in 30 patients (83.3 %), obesity in eleven (30.6%), peripheral vascular disease in eight (22.2 %) and alcohol/drug abuse in four (11.1%). The most common localizations were the Chopart and Lisfranc joints. Nine feet were directly treated by orthopaedic shoes; six feet received life-long orthotic stabilization. For the rest, duration of immobilization (rTCC/TCC) was 6 ± 5 months (range 1–27 months). Amputation was necessary in four patients, (transmetatarsal 1, Lisfranc 1, transtibial 2); three patients needed prosthetic care. Recurrence of osteoarthropathic activity occurred in nine patients (25.0%) after a mean 35 months follow-up. These patients had shorter initial immobilization (3 ± 3 months), mostly diabetes (8/9) and most did not adhere to the suggested treatment schedule (6/9). Of all feet, 75% initially presented in an advanced stadium (Eichenholz >0), in patients with a recurrence this was the case in 85.1 %. Ulceration was common (22/43 feet, 51.3%). Superimposed infection occurred in 17/43 feet (39.5%) and required surgery in six feet (14.0%). Reconstructive surgery was necessary in seven feet (16.3%).
Conclusion: The mainstay in the treatment of Charcot arthropathy is early diagnosis and immediate, long-lasting off-loading. Surgical interventions are reserved for life/limb-threatening infections or strong deformities, and only once the disease is stable. Recurrence of osteoarthropathic activity is possible even after several years. Good patient management with a close doctor-patient relationship may be the key to avoid these.

FM120

Correlation of Foot and Ankle Ability Measure with balance performance in ankle sprain patients

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Introduction: The rehabilitation of ankle sprains aims to regain good physical function. Balance training has been shown to decrease the risk of ankle instability and ankle sprain recurrence1. However, it is unclear if a good balance performance after an ankle sprain goes also along with a good physical function. Thus we investigated the relationship between balance and clinical measures of physical function.
Methods: 27 patients with an ankle sprain were included after having been 4 weeks in an air cast. All patients filled in the FAAM questionnaire, a self-reported questionnaire, which consists of an activity of daily living (ADL) and a sports related subscale. Furthermore, patients' balance performance has been assessed by the mean of an AMTI force plate. Subjects performed 6 trials of quiet standing in single-leg stance on the injured limb, (3 stable, 3 unstable conditions (on a foam)). The center of pressure (COP) excursion in ML and AP directions, and its speed were calculated. Correlation between balance parameters and FAAM subscales were calculated using Spearmans rho.
Results: COP displacement in AP direction was negatively correlated to the FAAM sport-subscale for both, the stable and unstable conditions (R = –0.45, p = 0.02; R = –0.41, p = 0.03 respectively). No significant correlation was found between COP displacement in AP direction and FAAM ADL subscale. COP displacement in ML direction was not correlated with the FAAM subscales (sport and ADL). COP speed recorded in a stable condition was correlated with the ADL subscale (R = –0.45, p = 0.02) and the sport subscale (R = –0.50, p = 0.01). For the unstable condition, no significant correlation was found between speed and FAAM subscales.
Discussion: Good balance control in AP direction is related to individual's sport related functional level. However, a good AP control does not go along with the self reported capacity to handle ADL and a good ML balance control does not mean that ankle sprain patients report a good physical function. Only COP speed is related to both FAAM subscales, at least when assessed in a stable condition. Larger COP displacement per unit of time in a stable condition (and therefore a patient who is less stable) go along with less physical function. These results indicate that COP speed is more related to physical function than ML or AP COP excursion and thus deserves further attention while assessing the effect of treatment strategies. 1McGuine et al. (2006) Am J Sports Med

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FM121

Role of Collateral Ligaments in Metatarsophalangeal Stability: A Biomechanical Cadaver Study

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Introduction: The anatomy of the lesser metatarsophalangeal joint (MTPJ) including the plantar plate and the collateral ligaments. Two distinct lesser MTPJ collateral ligaments have been identified, named the accessory and proper collateral ligaments (ACL and PCL). The

role each of the collateral structures play in maintaining joint stability is unknown. Therefore the primary objectives of this study were to determine if: 1) ACL or PCL is more important in preventing MTPJ instability, 2) ACL and PCL can be reliably repaired to improve MTPJ stability, and 3) MTPJ stability is increased with addition of suturing an interosseous (IO) tendon to the capsule in a torn ACL and PCL model.
Methods: Twenty-six fresh-frozen cadaver lesser MTPJ's were tested for instability with the amount of force necessary to translate the joint three millimeters dorsally. Specimens were tested with 1) intact collateral ligaments, 2) transected accessory collateral or proper collateral ligaments (ACL or PCL), 3) repaired ACL or PCL, 4) transected ACL and PCL, 5) repaired ACL and PCL, and 6) transferred interosseous (IO) tendon.
Results: The mean force required for three millimeters of dorsal displacement was 25 ± 13 N (range, 11 to 52N) in the 26 specimens. Transecting either the ACL alone or the ACL and PCL led to the most instability vs. transecting the PCL alone. Repairing both ligaments improved stability. The IO tendon transfer was comparable to the direct repair of the PCL but was inferior to the direct repair of the ACL.
Conclusion: Both ACL and PCL have stabilizing effect on the MTPJ. However, the ACL was more important since primary transection of the ACL led to more instability and additional transection of the PCL in an ACL deficient model did not lead to significantly more instability. Direct repairs of both structures improved the stability of the joint but not back to normal. IO tendon transfer is a possible adjunct to collateral ligament repairs, but in itself is not sufficient to restore stability.

FM122

Ankle arthrodesis for salvage of Chopart-amputations with anterior soft tissue problems

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Background: In Chopart-level amputations the heel inevitably collapses into equinus and varus. This stretches the anterior soft tissues and moves the typically anterior scar plantarly, close to or into the weigthbearing zone. As a result wound dehiscence or ulceration may occur, jeopardizing the stump's salvageability. Reduction of the hindfoot position and stabilization with an ankle arthrodesis relieves the anterior tension allowing for wound closure and undisturbed healing. Furthermore the scar is moved away from its problematic position.
Method: Between 1998 and 2009 12 patients (seven female, five male, average age 59 years) were treated with a Chopart amputation for trauma (4), tumor (2), gangrene, infection and ischemia (6). To prevent woundbreakdown of preoperatively already existing anterior soft tissue problems an ankle arthrodesis was added.
Results: Two amputees (2 infection and ischemia) had woundbreakdown anyway and required below knee amputation. Ten were successfully treated without major complications and fitted with protheses. At average follow-up of 27 months (13 – 63), the average Pro-AMPU score (pain, activity of daily living, prosthesis handling, max. 120 points) was 107 and the validated Legro Prosthesis Evaluation Questionnaire scale (prosthesis function, mobility, psychosocial experience, well-being, max. 200 points) was 147 points. Walking capacity was "physiological walker" in one patient, "household walker" in three, "limited community walker" in four, and two patients were "full community walker". Radiographically, ankle fusion was achieved in all cases.
Conclusion: Ankle arthrodesis is a valuable option to assure woundhealing in patients with Chopart-amputations and preoperatively already existing anterior soft tissue problems. It adds little to the operative procedure, and a conversion to a higher level amputation is avoided in the majority of cases.

FM123

Pediatric navicular fractures, to operate?

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Objective: The os navicolare is a keystone of the medial longitudinal arch of the foot. The fracture of this bone is rare in adults, but even more in children. So far, no epidemiological data on pediatric navicular fractures are available.
Methods: We present the case of a pediatric navicular body fracture and a review of the literature.
Case/Results: After a motor vehicle accident, a 10-year-old girl was admitted to our hospital complaining of pain and swelling along her right midfoot. Conventional radiographs showed a navicular body fracture in association with a cuboid avulsion fracture. A CT scan showed that the navicular fracture was multifragmentary with an important osteocartilagineous proximal impressed fragment, the cuboid avulsion was displaced and an additionally nondisplaced fracture of the lateral cuneiform was documented. After few days, using a dorsal approach the patient underwent an open reduction and internal fixation (ORIF) of the navicular bone with a 2.0 mm LCP plate and biological bone graft. With a lateral additional access, an osteosuture of the cuboid fracture was performed achieving an anatomical reduction. After the operation partial weight bearing for 4 weeks was allowed, after that full weight bearing was started. No complications occurred, after three months the patient is completely pain free, the X-rays shows a good alignment and a good healing at the fracture site. The removal of the implants is planned. Since there is no literature for pediatric patients, we have to refer to the principles concerning adults. Navicular injuries range from an avulsion fracture to comminuted fractures combined with injuries of other tarsal bones. In nondisplaced injuries conservative management seems to have a good outcome, whereas in case of displaced fractures ORIF is recommended to re-establish the medial column anatomy.
Conclusion: This is one of the first pediatric cases with navicular fracture reported**.** It is not clear whether conservative or operative management is the treatment of choice. Referring to the principles used for adults, conservative management could be used for nondisplaced fractures, whereas a surgical procedure should be considered for displaced fracture, in order to prevent arthritis and to avoid a shortening of the medial column of the foot.

FM124

Talar navicular fractures: new classification with correlation to clinical long term results

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Introduction: Navicular body fractures are uncommon fractures. Whereas formerly treatment often was nonoperative nowadays open reduction and fixation is mostly advocated. Some authors recommend primary arthrodesis in case of severe comminution. A new classification system is proposed that allows better anticipation of long term results.
Material and Methods: Twenty-four patients with navicular farcture were seen at the Inselspital Berne at a mean follow-up of 67.5 month (range 11–157). There were 14 men and 10 women, the age ranged from 17 to 61 years. All patients were treated operatively by open reduction and internal fixation. In two cases primary arthrodesis (one TNC, one NC) was performed. Thirteen additional procedures were necessary (5 primary closed reduction and K-wire pinning, 6 hardware removals, 1 TN arthrodesis, one corrective osteotomy). Clinical outcome was measured by the AOFAS midfoot score, VAS Hannover Questionnaire, the rearfoot alignment and the talonavicular (TN) and subtalar (ST) motion (normal, reduced, stiff). Radiologically osteoarthritic changes of the talonavicular (TN) und naviculocuneiforme (NC) joints were graded according to Kellgren-Lawrence and Meary's angle was measured. In the new classification system, avulsion fractures of the proximal dorsal lip or the tuberosity were classified as type Ia and Ib. Sagittal split fractures of the body type II. Type III fractures comprised fractures with TN luxation with lateral plantar fragmentation (type IIIa) or multiple fragmentation of the proximal navicular joint surface (type IIIb). Using the new classification 4 patients had type 1 fractures, 6 patients type 2 fractures, 5 type 3a and 9 type 3b fractures.
Results: Overall results showed a AOFAS Score of 84.4 and a VAS Hannover Questionnaire Score of 75.5. There was a significant correlation of the clinical outcome to TN and ST motion (–0.44, $p = 0.016$; –0.53, $p = 0.004$) and to TN arthrosis (–0.53, $p = 0.004$). In contrast to Sangeorzan's classification the new classification correlated significantly with the AOFAS Score (–0.016, $p = 0.470$ vs –0.39, $p = 0.030$), the Hannover Score (–0.14, $p = 0.253$ vs. -0.36, $p = 0.041$), and with arthrosis of TN joint (0.39, $p = 0.029$ vs. 0.53, $p = 0.004$)
Conclusion: The outcome after operative treatment of navicular fractures decreases with increasing comminution. A new classification with better correlation to clinical and radiological outcome that allows anticipation of long term results is proposed.

FM125

Autologous Matrix – Induced Chondrogenesis (AMIC) for Reconstruction of Osteochondral Lesions of the Talus

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Introduction: Surgical treatment of osteochondral lesions (OCL) of the talus remains a challenging task to orthopaedic surgeons and frequently concern young sportive patients. Several operative techniques are available for treatment, however, certain restrictions remain. We present the clinical-radiological results of a novel one-step surgical technique for treatment of OCL of the talus. The autologous

matrix-induced chondrogenesis (AMIC) – aided procedure combines debridement, spongiosa-plasty from the iliac crest and covering with a collagen I/III membrane.
Methods: Twenty-five patients (8 female, 17 male; mean age 35 years [range 17–55 years]) were prospectively assessed in our outpatient clinic for OCL of the talus. Clinical examination included the American Orthopaedic Foot & Ankle Society (AOFAS) hindfoot scale and Visual Analogue Scale (VAS). Radiological imaging consisted of conventional radiographs and magnetic resonance imaging (MRI). For the evaluation of MRI scans the magnetic resonance observation of cartilage repair tissue (MOCART)-Score was used. Surgical procedure consisted of debridement of the OCL, spongiosa-plasty from the iliac crest and coverage with a commercially available I/III collagen membrane. Clinical and radiological follow-up was performed after a minimum of 12 months postoperatively.
Results: Both function and pain could be improved largely and remained stable over a mean of 23.1 months postoperatively. The mean preoperative AOFAS hindfoot scale increased significantly from 60.2 points (SD ±15.9) pre-operatively to 89.6 points (SD 11.9) at final follow-up ($p < 0.01$). Pain measured with VAS improved significantly ($p < 0.01$) from 5.0 (SD 1.7) to 1.5 (SD 2.1). At follow-up conventional radiographs showed osseous integration of the graft in all cases. MRI showed intact cartilage covering of the lesions in all cases with a mean MOCART-Score of 62.0 points (SD 17.1).
Conclusion: Excellent clinical and radiological results were demonstrated after a mean follow-up of 23.1 months. The results are comparable or superior with the results of ACI, OATS and MACI. More, the AMIC-aided technique is a readily available, economically efficient, and a successful one step surgical procedure. Therefore it can be recommended as treatment option of osteochondral lesions of the talus.

FM126

Lower functional, quality of life and survival outcome after total knee arthroplasty for post-traumatic arthritis than for primary arthritis

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Introduction: Total knee arthroplasty (TKA) for treatment of end-stage post-traumatic (PT) arthritis has specific technical difficulties and complications. The aim of this study was to compare pre and postoperative function, postoperative quality of life (QOL) and survival outcome of TKA in patients who developed PT knee arthritis after knee intra-articular or extra-articular fractures with TKA performed for PA.
Methods: This retrospective study includes patients operated for TKA in our institution between 1998 and 2005 for a PT arthritis (PT group) and are compared to a randomly chosen group of patients operated for primary arthritis (PA group) during the same period. 33 patients were included in the PT group and 407 in the PA group. A high flexion posterior-stabilized cemented total knee arthroplasty was used in all patients of the PA group and 30 times in the PT group. A rotating hinge knee cemented prostheses was necessary 3 times in the PT group. Patients were evaluated for clinical and radiographic evaluation using the Knee Society rating system. Postoperative QOL of patients was evaluated using the KOOS. Survival rate was assessed with end-points "any surgery on operated knee."
Results: At a mean follow-up of 4,3 ± 2,3 years, a significant improvement was observed in both groups for the IKS knee and IKS function scores. Post-operative flexion also improved in both groups significantly from 83° to 108° in the PT group versus 115° to 127° in the PA group. HKA angle was restored from 173° to 180° in PA group and from 175° to 180° in PT group with no significant difference. Post-operative QOL results were significantly lower in the PT group. Survival rate of TKA at ten years showed a significant difference between the two groups (PA group: 98.8% vs PT group: 78.8%).
Conclusions: Despite TKA after post-traumatic arthritis is a valuable treatment in terms of symptoms relief and function improvement, patients should be aware pre-operatively that results in term in symptoms, function, QOL and survival rate after TKA for PT arthritis are lower than patient operated for PA.

FM127

The impact of knee anatomy on femoral component rotation and flexion gap balance in total knee arthroplasty

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Introduction: This study aimed to analyze knee anatomy in flexion and estimate its impact on femoral component rotation and flexion gap balance in femur first bone referencing vs. tibia first gap balancing TKA.
Methods: 170 patients (101 female; 69 male) fulfilled the inclusion criteria: full leg and knee radiographs according to Kanekasu; no posttraumatic, postoperative or severely arthritic changes affecting assessments. To assess knee anatomy in flexion we measured frontal inclination of the proximal tibia and condylar twist angle (CTA). Effects of knee anatomy on TKA femoral rotation in gap balancing TKA were estimated with a previously validated radiographic technique. Effects of knee anatomy on flexion gap asymmetry in bone referencing TKA were estimated assuming neutral femoral component rotation.
Results: Knee anatomy in flexion varied greatly. Mean proximal tibial inclination was 2 ± 3° varus (range 6° varus to 6° valgus) with significantly more varus in males. Mean CTA was 5.8 ± 1.8° (range 1.3–12.4) internally rotated without significant gender differences. Knee anatomy in flexion determines femoral component rotation in gap balancing TKA: the higher varus tibial inclination and lower CTA, the more external femoral component rotation (external rotation type); the higher valgus tibial inclination and CTA, the more internal femoral component rotation (internal rotation type). In gap balancing TKA, flexion gap asymmetry would not be expected due to variable femoral component rotation. In bone referencing TKA, medial flexion gap asymmetry would occur in case of preoperative valgus inclination of the proximal tibia or when preoperative CTA is higher than the magnitude of varus inclination of the proximal tibia. Lateral flexion gap asymmetry would occur when preoperative varus inclination of the proximal tibia is higher than CTA. Estimated maximum medial and lateral flexion gap asymmetries were 12.6° and 5.5°, respectively.
Conclusion: Knee anatomy in flexion is variable with gender-specific differences, theoretically leading to variable femoral component rotation in gap balancing TKA while achieving flexion gap symmetry consistently. In contrast, bone referencing TKA aims for neutral femoral component rotation that would result in medial flexion laxity for internal rotation knee types and lateral flexion gap laxity for external rotation types. Potential future surgical techniques may combine aspects from bone referencing and gap balancing TKA.

FM128

Reasons for revision of unicondylar knee arthroplasty – analysis of an institutional joint registry

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Introduction: Longevity of unicompartimental knee arthroplasty (UKA) has been reported to be inferior compared to total knee arthroplasty (TKA). There are controversial reports regarding the failure mechanisms of UKA. We aimed to analyze the reasons for failure of three different UKA systems used at our institution during a 12 year period.
Methods: A retrospective analysis of our institutional joint registry was performed to identify patients that had undergone UKA with subsequent conversion to TKA. From 1997 to 2008, 646 patients (median age 62 years, range 42–81) received unilateral UKA of one of three different fixed bearing types: Allegretto Uni (Zimmer) from 1997 to 2004 (n = 268, 60% females); Preservation (DePuy) from 2004 to 2006 (n = 153, 52% females), and ZUK (Zimmer) from 2005 to 2008 (n = 225, 53% females). Demographic data and details related to revision surgery were analyzed.
Results: The overall revision rate was 7.4% (48/ 646), for Allegretto 13.1% (35/ 268), for Preservation 6.5% (10/153) and for ZUK 1.3% (3/ 225). Time to revision was overall median 28.5 months (range 2–122), for Allegretto 35 months (range 2 – 122), for Preservation 36 months (range 6 – 58) and for ZUK 16 months (range 6 – 27). The overall revision rate was 9.2% (33/360) for females compared to 5.3% (15/286) in males. The main reasons for revision were implant loosening (46%), progression of disease (23%), pain (10%), periprosthetic fracture (6%), instability (4%) and implant breakage (4%). There were no revisions for periprosthetic infection. Time to revision for tibial component loosening (total n = 13, Allegretto n = 10, Preservation n = 3) was median 34 months (range 2–97). Time to revision for femoral component loosening (total n = 9, Allegretto n = 3, Preservation n = 6) was median 25 months (range 4 –51). Time to revision for progression of disease was median 63 months (range 6–122). Time to revision for implant breakage (three cases, all Allegretto Uni, tibial component n = 1, femoral component n = 2) was median 83 months (range 57 – 111).
Conclusion: The majority of UKA failures in our series were due to implant loosening or progression of osteoarthritis. Infection was not identified as failure mode of UKA. In contrast, national joint registries recently reported infection as a significant reason for revision (up to 4.6% of revisions). Optimized implant design and surgical technique as well as careful patient selection may help to further improve the longevity of UKA in the future.

FM129

A simple radiographic method to predict femoral component rotation in gap balancing total knee arthroplasty – moving towards a concept of individual femoral component rotation

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Introduction: The femoral component in total knee arthroplasty (TKA) is believed to be in 3° external rotation (ER) to the transepicondylar axis (TEA) to improve flexion gap balancing and patellofemoral tracking. This concept is based on a knee flexion axis that is parallel to the TEA and a proximal tibia with 3° varus inclination. However osseous knee anatomy in flexion shows great inter-individual variability. We hypothesized that femoral component rotation in tibia first gap balancing TKA is highly variable and can be predicted based on preoperative knee anatomy in flexion.
Methods: We assessed a consecutive series of 50 PCL-sacrificing ultracongruent primary TKA. Gap balancing technique was applied with initial perpendicular tibia cut and femoral component rotation being determined by ligament tension. Anteroposterior full leg and axial knee radiographs according to Kanekasu were obtained before TKA to assess knee anatomy in flexion defined by frontal inclination of proximal tibia and condylar twist angle (CTA) of distal femur, as well as after TKA to measure frontal tibial component alignment, femoral component rotation, and flexion gap symmetry. Patellar tracking was assessed radiographically before and after TKA. Assuming rectangular flexion gap and neutral frontal alignment of the tibial component, femoral component rotation was predicted based on preoperative frontal tibial inclination and CTA. Linear correlation coefficients of predicted and actual femoral component rotation were calculated.
Results: Preoperative osseous flexion gap anatomy varied greatly. Mean proximal tibial inclination was 2.0 ± 2.5° varus (range 6° varus – 6° valgus) and mean preoperative CTA was 6.3 ± 1.9° internal rotation (IR) (range 2–10). Measurements of predicted & actual femoral component rotation strongly correlated (r = 0.77), particularly after correction for frontal tibial component alignment and flexion gap asymmetry (r = 0.90). No patella lateralisation was noted in any cases despite high variation of femoral component rotation (range 12°IR – 2°ER).
Conclusion: We presented a simple radiographic method that allows prediction of femoral component rotation in gap balancing TKA based on preoperative osseous knee anatomy in flexion. Our technique provides additional guidance for component alignment in gap balancing TKA and may prove useful to evaluate femoral component rotation after TKA. This study supports the concept of individual femoral component rotation in TKA.

FM130

Easier recovery following fixed-bearing total knee arthroplasty: an ambulatory gait analysis of fixed- and mobile-bearing knees through a double-blind randomized controlled clinical trial

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Introduction: The goal of this study was to assess total knee arthroplasty (TKA) recovery outcome between adult patients with fixed- and mobile-bearing during the first postoperative year, and at 5 years follow-up, providing gait parameters in real life conditions as a new objective method.
Methods: This randomised controlled double-blinded study included 56 patients with mobile- and fixed-bearing of the same design who were evaluated pre- and post-operatively at 6 weeks, 3 months, 6 months 1 year and 5 years. Each participant completed an EQ-5D questionnaire, and a WOMAC and Knee Society Score were calculated. Objective gait analysis was also carried out with patients walking 30 metres on a flat surface with an ambulatory gait-recording system.
Results: There was no statistically significant difference between age-matched groups at baseline, on any subjective, semi-objective or objective parameter. The results of the traditional scoring systems (EQ-5D, VAS pain, KSS) did not show any clinically meaningful differences between the groups. There was no significant difference between groups at any time in objective gait parameters when the whole population was considered. A secondary analysis after separating the population according to their age (less than 71 years old, versus more than or equal to 71 years old) shows that the bearing type can lead to opposite results in different age groups. Most of the recorded gait parameters show better results for mobile bearing in younger patients, while better gait performances were found systematically in older patients with fixed-bearing TKA at five years follow-up.
Conclusion: To our knowledge, this is the first study where the gait performance of fixed- and mobile-bearing of otherwise similarly designed posterior-stabilized knee replacements have been compared in real-life conditions. Our results suggest that older patients might not benefit from a mobile bearing TKA and that extended age controlled study should be performed to identify an age, above which fixed bearing should not be the recommended choice.

FM131

5 Year Follow-up: 100 Conventional Non-navigated Versus 100 Computer-assisted Navigated Total Knee Arthroplasties – A Prospective Randomized Trial

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Introduction: The aim of introducing computer-assisted navigation systems for total knee arthroplasty was to improve implantation accuracy and ligament balancing of TKA. However beside many contradictory publications after short term there is no mid-term data published comparing computer-assisted surgery with the conventional TKA technique.
Materials and Methods: In a prospective randomized trial with a minimum follow-up of 5 years we enrolled 200 patients (200 TKA), 100 TKA performed with the conventional technique (Group A), 100 TKA performed with a computer-assisted navigation system (Group B). We wanted to show if there is a positive effect of the navigation system towards TKA survival, radiological component alignment and clinical outcome. Radiological investigations were performed by standard X-rays including long leg weight-bearing X-ray measuring the mechanical axis of the limb, medial proximal tibial angle (MPTA), tibial slope, patella alpha angle and lateral distal femoral angle (LDFA). For clinical investigations we determined range of motion (ROM), stability in full extension and 30° flexion, anterior drawer test, subjective feeling of instability, anterior knee pain, effusion, Insall Knee Score, Hospital of Special Surgery Knee Score (HSS) and Western Ontario Mac Master University Index Score (WOMAC).
Results: No significant difference was found towards TKA survival or aseptic loosening (Group A 95.4% versus Group B 98.9% 5-year survival rate, p = 0.368). In Group B we found a significant better mechanical axis of the limb (1.67° ± 1.6° versus 2.44° ± 2.2° in Group A; p = 0.015). 81% of Group A versus 90% of Group B were within 3° varus/valgus deformity of the mechanical axis of the limb (p = 0.157). Accuracy of tibial slope in sagittal plane was higher in Group B (p = 0.001). More patients of Group B (95% versus 79% in Group A) were within a deviation of 4° – 10° tibial slope (p = 0.007). Except mean deviation of 90° LDFA (p = 0.034) alignment in frontal plane and patella alpha angle showed no significant difference (p ≥ 0.253). Clinical examination was similar in both groups (p ≥0.058). Insall Knee Score total and HSS Knee Score total were higher with the navigated procedure (p ≤0.026).
Conclusion: Summarized accuracy of mechanical axis of the limb and alignment in sagittal plane was better with the navigated procedure. However there was no difference of TKA survival or clinical performance 5 years after implantation.

FM132

Systematic follow-up of total knee arthroplasty helps to detect silent massive osteolysis

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Introduction: The aim of this study was to examine occurrence of implant related complications after primary TKA with Wallaby I implant and ultracongruent insert.
Methods: This retrospective case series includes all primary TKAs with a Wallaby I implant using an ultracongruent polyethylene insert (Centerpulse, CH-Münsingen) performed between 1998 and 2004. Inclusion criteria were primary TKA and minimal follow-up of 6 years. Post infection cases were excluded. 561 cases met the inclusion criteria. Patients' age at surgery was mean 69 y (32–90 y). Patients were routinely followed-up at 6 w and 3 mt. Thereafter, patients turned up for regular control at 1 y, 5 y or randomly, when having recurrent effusion or instability. For the purpose of this study, we invited patients to a clinical and radiological follow-up in 2010/2011 (6–13 y follow-up). We also collected data of all patients from archive records. We were unable to trace 167 cases for a minimal follow-up of 6 y; 72 patients had died and 37 refused follow-up as they were satisfied with the result or had difficulties in coming to the hospital. A total of 285 knees were followed-up to a minimal of 6 y or until revision TKA.
Results: 171 knees did not show any sign of clinical or radiological failure (mean follow-up 8.2 y). In 97 cases revision was performed

at a mean of 4.5 y (0–11 y). Reasons for revision included: patellar resurfacing (7), arthrofibrosis (21), hematoma (5), loosening following traumatic periprosthetic fractures (9), early infection (3), late infection (5), PE abrasion with subsequent massive osteolysis (47). Implant related revisions were performed at a mean of 6.7 y (2–10.5 y). A peak of early implant related revision (37% <6 y) was observed in TKAs implanted 2000–2004. Other 12 knees were at risk showing osteolysis without prosthesis loosening at a mean of 7.8 y (6–9.6 y). 74% of implant related revisions turned up for the control of their TKA on their own, 26% were detected as a result of this study.
Conclusion: In our study, massive osteolysis was seen more frequently than described in current literature. The systematic analysis of retrieved specimens showed an addition of a) PE particles due to important backside-wear, and b) a high delamination rate of the ultracongruent insert in this type of prosthesis. Systematic follow-up often helps detecting implant failure before patients develop symptoms and should therefore be mandatory after TKA, in order to preserve bone stock.

FM133

Effect of patellar positioning on flexion gap balancing using eLIBRA – dynamic tensioning system device for total knee arthroplasty

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Introduction: In total knee arthroplasty (TKA)the need of flexion/ extension balancing to create rectangular gap is a well recognized. Intaop techniques used to assess balancing are laminar spreaders or blocks. Some surgeons advocate tensioning devices for more accuracy. It is well known that the flexion gap dictates rotation of the femoral component. Following soft tissue balancing resulting in a symmetric extension gap, the flexion space is equalized by rotating the femoral component. Most guiding systems in flexion act with the patella dislocated or dislocated + everted, not taking into account the tension of the lateral structure. Recent studies suggest an effect of patellar position on soft tissue balancing. A new developed tensioner (eLIBRA) is available for soft tissue balancing of the flexion gap allowing mesurements with the patella in normal enlocated position.
Question: Effect of patella position on flexion gap balancing using the eLIBRA tensioning system in TKA.
Patient and methods: 40 patients scheduled for primary TKA using MyKnee GMK (posterior stabilized) were intraop assessed + balanced using the eLIBRA in a prospective study. Excl criteria were presence or history of prior knee infection, extraarticular deformities requiring additional correction or conditions requiring a constrained prosthetic design. Preop assessment incl measurement of mechanical axis, patellar height, epicondylar axis using x-ray + CT. Intraop study incl measurement of femoral component rotation following soft tissue balancing + achieving identical pressure on either side of the flexion gap. The measurement was repeated thrice with the patella in either reduced position, in dislocated or in dislocated/everted position.
Results and Conclusion: Out of the 40 patients with a similar male to female ration, 31 had a varus of 9°(±3°)and 9 a valgus of 5° (± 2°). The patellar height was similar in the valgus/varus group. In the varus group (n = 31), external femoral rotation required for symmetrical flexion gap balance with the reduced patella was 5.4°(± 2°), with dislocated patella 4.5°(± 3°), with the dislocated/everted patella 4.1° (± 2°). Similarly in the valgus group (n = 9), the values with the patella enlocated was 5° (±1°), for the dislocated patella 4°(±1°) and for the dislocated/everted patella 4.3° (±2°). None of differences above were significant.
Conclusion: Position of the patella did not show any effect on flexion gap balancing using the eLIBRA flexion gap tensioner. Further studies seem justified.

FM134

A minimum 20 year survivorship of cementless femoral components in cruciate-retaining TKR

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We present a minimum of 20 year follow up of the survivorship of uncemented porous-coated femoral components in total knee arthroplasty (range 240–290 months). Uncemented porous-coated femoral components in total knee arthroplasty have been available since the early 1980's. We present to our knowledge the first minimum of 20 year follow up of the survivorship of these components (range 240–290 months). Between November 1984 and November 1988, 267 total knee arthroplasties (in 205 patients) were implanted, using uncemented porous-coated femoral components. Intraoperatively the press-fit of the trial implants was tested with a simple pull-out test to determine if an uncemented femoral component would have an adequate press-fit for cementless application. 133 patients / 166 implants died during the minimum 20 year follow up time and 18 patients / 25 implants were lost for follow up. 31 patients / 41 implants had a physical follow up with radiographic evaluation after at least 20 years postoperatively. 23 patients / 35 implants or their next of kin were interviewed over the phone. For various reasons, those patients were unable to undergo a follow up examination with x-rays. Only 6 implants in 5 patients had to be removed, none of them for aseptic loosening. Of the 166 implants in 133 patients who died before the 20 year follow up, none required revision for isolated femoral component loosening. The 20 year survivorship of uncemented femoral components for isolated femoral component loosening was 100% and survivorship for reoperation for any reason was 78%.Cementless femoral components in selected patients have a low 20 year loosening rate and remain an attractive alternative in total knee arthroplasty.

FM135

Combined unicondylar knee arthroplasty and high tibial osteotomy for isolated medial compartmental knee arthritis with juxta-articular coronal deformity

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Introduction: Unicondylar knee arthroplasty (UKA) is an effective treatment for isolated unicompartimental knee osteoarthritis (OA). Correct mechanical alignment is crucial to prevent overloading of implant or unaffected knee compartments. Medial knee OA with juxta-articular coronal deformity may not be addressed by UKA alone. Thus we present a technique of combined medial UKA and high tibial osteotomy (HTO).
Methods: In 2010 and 2011, four patients were treated at our institution using this approach. Coronal deformity was analyzed on weight bearing full leg radiographs. Two patients had marked varus deformity (mechanical femorotibial angles of 12° and 10° varus) with decreased medial proximal tibial angle of 82° each (hypervarus group). Two patients had neutral mechanical femorotibial alignment with increased medial proximal tibial angles of 96° and 92° (hypovarus group). Surgery involved initial UKA with varus or valgus tibial cut anticipating the degree of HTO needed to correct for increased or decreased medial proximal tibial angle. HTO was performed more distally than usual to maintain adequate bony bridging between HTO and tibial UKA component, and fixed by locking compression 3.5 T-plate. Opening HTO gaps were filled with autologous bone from UKA cuts. Postoperatively, patients were subject to routine UKA aftercare except for partial weight bearing of 15 kg for 6 weeks.
Results: There were no complications. All osteotomies healed uneventfully. Hypervarus patients required 5 and 6° medial opening wedge HTO while hypovarus patients had 5° medial closing wedge HTO each. Postoperatively, hypervarus patients revealed mechanical femorotibial angles of 3.5° and 5° varus and medial proximal tibial angles of 89° and 87°. The hypovarus group showed mechanical femorotibial angles of 3.9° and 3.3° varus and medial proximal tibial angles of 87° and 89°. All patients revealed good to excellent outcome at mean 8.5 (range 3–16) months postop. Knee ROM improved from preoperative 117.5 ± 21° (100-140) to postoperative 131.3 ± 6° (125–140) flexion with full extension.
Conclusion: We presented a surgical technique of combined medial UKA and HTO to treat medial knee OA with juxta-articular coronal deformity. This technique may expand indications for UKA after further evaluation with larger patient series and longer follow-up.

FM136

Tibial tubercle osteotomy for total knee arthroplasty: Can we predict the problems?

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Introduction: The purpose of this study was to investigate a consecutive series of patients after tibial tubercle osteotomy (TTO) in primary total knee arthroplasty (TKA) and to identify predictive factors for the occurence of complications after tibial tubercle osteotomy in TKA.
Methods: 422 consecutive patients who had undergone primary TKA using the lateral parapatellar approach combined with a TTO were included (TTO refixation two screws n = 412, one n = 6, three n = 8. The occurrence of complications related to the TTO was noted. Standardized ap and lateral weight bearing radiographs were used for measurement of the length and depth of the TTO fragment and the size of the proximal abutment. The distance of the screw heads to each other (SS), the distance of the screw head to the lower margin

of the tibial TKA (ST[1], ST[2]), the distance of each screw head to the central perpendicular of the tibial TKA (SL[1], SL[2]), the length of the TTO (O), the distance of the screw heads to each other (SS'), the length of proximal osteotomy (P), the maximal depth of the osteotomy (Q), the width of the proximal abutment (OT). All data were analyzed by a statistician using SPSS. Univariate analysis (Pearson chi square, p <0.05) identified correlations between TTO related factors.
Results: 12/422 patients (3%) showed a clinically significant complication, 1/8 (13%) patients with 3 screw fixation, 3/6 (50%) patients with 1 screw fixation and 8/412 (2%) patients with 2 screws fixation. 4 hematomas, 2 skin necrosis, 6 screw displacements and 6 tibial tubercle displacements were noted. SS was 16.3 ± 4.1 mm, ST1 43.9 ± 8.1 mm and ST2 59.2 ± 9 mm. SL1 was 9.4 ± 5.5 mm and SL2 6.6 ± 4.8 mm. O was 69 ± 15.4 mm, SS' 15.5 ± 4.3 mm, P 11.4 ± 2.7 mm, Q 9.9 ± 2.5 mm and OT 17.4 ± 4.2 mm. A proximal abutment <14 mm in width and <55.4 mm in length was significantly correlated to more complications. Also when the distal screw had a distance to the tibial TKA <51.7 mm. A medial spatial orientation was associated with more complications in the proximal (7%) and the distal screw (11%, p <0.046).
Conclusions: The overall complication rate related to the TTO was small (3%) in the biggest series of patients after TTO in TKA. The length of the TTO (<55.4 mm) as well as the width of the tibial proximal abutment (<14 mm) as well as the distance of the refixation screw to the TKR were significant factors for the occurrence of complications. Considering these surgical key factors leads to improvement of outcome.

FM137

Patellar Tendon Shortening Improves Knee Extension In Cerebral Palsy

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Introduction: Flexed knee gait is a common problem in patients with bilateral spastic cerebral palsy (BSCP). Increased knee and hip flexion progressively lead to fixed knee flexion contractures and to patella alta with functionally insufficient knee extension. It has recently been described that inclusion of patellar tendon advancement is necessary to achieve optimal results in the surgical management of persistent crouch gait [1]. The aim of this study is to evaluate the outcome of patellar tendon shortening (PTS) in BSCP.
Methods: Retrospective cohort study: A total of 24 patients (8 female/16 male) with a mean age of 16.1 ± 5.8 years (range 10.5 – 40y at time of surgery) were included. 19 patients had additional surgery and 10 had supracondylar extension osteotomies (SEO).
Two patients had unilateral surgery. 18 patients had GMFCS level II and 6 patients had GMFCS level III. 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) and joint angles for the sagittal, coronal and transverse planes were calculated. All data was uploaded into Gaitabase [2].
Results: The temporal parameters did not change postoperatively. Clinical assessment of joint angles revealed statistically significant changes in the following parameters (Table 1, pre,- postoperative, p-value): Internal hip rotation in stance *: 13.9 ± 15.2°, 7.2 ± 11.3°, 0.02, Knee flexion at initial contact *: 51.1 ± 18.2°, 32.4 ± 1.8°, <0.001, Maximum knee extension in stance *: 42.5 ± 22.8°, 20.5 ± 13.9°, <0.001, Knee flexion in mid stance*****: 46.0 ± 24.4°, 22.9 ± 14.5°, <0.001, Range of knee flexion *****: 30.1 ± 12.1°, 37.6 ± 12.2°, <0.001, Maximum knee flexion in swing **§:** 71.9 ± 16.5°, 57.8 ± 10.0°, <0.001, Average pelvic tilt **§:** 14.1 ± 6.8°, 21.6 ± 6.6°, <0.001. Tab. 1:***** shows an improvement and **§** markes a deterioration. All the other joint angles (3D kinematics) did not change significantly. The graph of knee flexion-extension kinematics is approximately 20° shifted towards more extension.
Conclusions: For correction of flexed knee gait in CP we recommend PTS. The range of knee flexion during the gait cycle is improved. The trace for knee flexion-extension kinematics is shifted approximately 20° towards extension during the whole gait cycle.
References: [1] Stout JL et al., J Bone Joint Surg Am. 2008;90(11):2470-84, [2] Tirosh O et al., Comput Biol Med. 2010;40(2):201-7

FM138

Patellar Tendon Shortening In Combination With Supracondylar Extension Osteotomy Provides The Best Correction Of Severe Knee Dysfunction In Cerebral Palsy

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Introduction: Flexed knee gait is a common problem in patients with bilateral spastic cerebral palsy (BSCP). Increased knee and hip flexion progressively lead to fixed knee flexion contractures and to patella alta with functionally insufficient knee extension. It has recently been described that inclusion of patellar tendon advancement is necessary to achieve optimal results [1]. The aim of this study is to evaluate these procedures in relation to outcome regarding correction of knee dysfunction.
Methods: Retrospective cohort study: A total of 24 patients (8 female/16 male) with a mean age of 16.1 ± 5.8 years (range 10.5 – 40y at time of surgery) were included. 19 patients had additional surgery and 10 of them had supracondylar extension osteotomies (SEO). Two patients had unilateral surgery. 18 patients had GMFCS level II and 6 patients had GMFCS level III. 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 Movement Analysis Profile (MAP) and the Gait Profile Score (GPS) was calculated [2]. All data was uploaded into Gaitabase. For statistical analysis the legs were put into three different groups: A) patellat tendon shortening (PTS) only, B) PTS and femoral derotation osteotomy (FDO), C) PTS and SEO.
Results: The numbers of treated knees in each group were: A) 14 knees PTS only, B) 14 knees PTS and FDO, and C) 18 knees PTS and SEO. MAP for knee flexion extension preoperative: Group A: 29.5°, Group B: 25.5°, Group C: 40.9°. Patients treated with PTS and SEO had the most abnormal preoperative scores. Postoperatively in all groups a similar MAP of approximately 18° was achieved. Preoperative GPS representing the quality of the overall gait pattern for the three groups: Group A: 15.2°, Group B: 17.0°, Group C: 40.9°. At baseline patients in group C showed the most abnormal gait deviation. After surgical correction very similar GPS values could be achieved in all three groups (approximately 13°).
Conclusions: For best correction of knee dysfunction in severe flexed knee gait we recommend the combined procedures of PTS and SEO. The surgical procedure needs to be tailored to each patient's individual needs: for mild knee dysfunction PTS (alone or with FDO) is indicated and for cases with fixed knee flexion, PTS in combination with SEO is required.
References: [1] Stout JL et al., J Bone Joint Surg Am. 2008;90(11):2470-84 [2] Baker R et al., Gait Posture 2009;30-3:265-9

FM139

Microfracture – A Hands-On Survey of Consistency in Surgical Technique

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Introduction: Steadman's microfracture is considered to be the "work horse" of cartilage repair and is commonly used as comparative standard for more sophisticated cartilage repair procedures. Review literature, however, reports a mid-term failure rate of 2–31%. This broad range may be caused technical inaccuracy. This cadaveric study aimed to validate technical consistency of microfracture.
Methods: Four experienced surgeons using microfracture on a regular basis were asked to perform this procedure on each six preformed cartilage lesions in fresh human cadaveric knees. Specific instructions varying in penetration depth and interhole distance were given. Micro-CT (resolution 1.4µm) was used for radiographic analysis. Depth errors, distance errors and penetration angles were measured.
Results: All surgeons misjudged depth and inter-hole distance, aiming too deep (1.12 mm ± 1.91) and too close together (0.77 mm ± 0.35). Angle measurement showed deviation errors within a 10° to 20° margin in 35.8%, while 15.2% deviated more than 20° (up to a maximum of 40°). While defect localisation had no influence on hole angles (p = 0.25), both depth and distance error were significantly lower in the trochlear groove than on the femoral condyle (p <0.01). Surface shearing was associated with penetration depth >4 mm and angles >20°. Interhole infraction showed a tendency to occur in holes closer than 2.5 mm to each other.
Conclusions: Even experienced arthroscopists showed high inconsistency in surgical technique. Further biomechanical research is needed in order to judge, if technical inaccuracy may lead to destabilization of subchondral support and consecutive therapeutic failure.

FM140

Surgery of patellofemoral instability with trochlear dysplasia: Clinical and radiological results after osseous and ligamentous correction with a minimum follow-up of 2 years

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Introduction: Trochlear dysplasia is frequent in patients with chronic patellar instability. Various surgical procedures have been developed, all aiming at stability and prevention of patellofemoral osteoarthritis (PFOA). Reconstructions of soft tissues such as the medial patellofemoral ligament (MPFL) and vastus medialis obliquus muscle (VMO) are well established but were found to be insufficient for severe trochlear dysplasia. In these cases additional trochleaplasty was recognized safe to achieve stability but progression of the PFOA and high rates of patellofemoral pain were stated. We established a procedure using a parapatellar medial approach to perform the reconstruction of the medial soft tissues and trochleaplasty.
Methods: We retrospectively reviewed the clinical and radiological outcomes of consecutive patients, all operated on by a single surgeon. A parapatellar medial approach – including reconstruction of the MPFL and reefing of the VMO when necessary – was carried out. During trochleaplasty, the osteochondral flake was fixed with 2 mm titan screws. Clinical data included apprehension sign and Kujala Knee Score. Pre- and postoperative plain radiographs were compared to evaluate correction of crossing signs, trochlear depth, changes in patella height, and signs of PFOA.
Results: Data for 45 knees in 42 patients undergoing operation between 2003 and 2010 were reviewed. The Kujala Score improved from 57 points preoperatively to 80 points postoperatively; no patient suffered from patellar redislocation. On radiographs, signs of trochlear dysplasia disappeared, trochlear depth increased significantly from a mean of 4.2 to 6.5 mm ($p < 0.0001$), and patellar height changed slightly compared to normal values. We found progressive PFOA in 24% of patients, independent of Dejour grade or intraoperative chondral lesions.
Conclusion: Our procedure using a parapatellar medial approach for trocheaplasty and ligamentous reconstruction is effective in restoring patellar stability and improves knee functionality and patient satisfaction. No further dislocation occurred. The radiological findings show effective correction of the underlying pathomorphology of the trochlear dysplasia. Progress of PFOA after this procedure is not predictable.

FM141

Screw-home mechanism and its influence on tibial tuberosity-trochlear groove distance (TTTG): Measurement on MR examinations of the knee in asymptomatic volunteers in full extension, 15°flexion and 30°flexion

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Purpose: Increased tibial tuberosity-trochlear groove distance (TTTG) is one potential correcting parameter in patient suffering from lateral patellar instability. The so-called screw-home mechanism refers to an outward rotation of the tibia when the knee reaches full extension. We hypothesized that the screw-home mechanism of the knee increases the TTTG of the knee on MRI.
Methods: Transversal T1-weighted spin-echo MR images of the knee were acquired at full extension, 15° and 30° flexion of the knee in 30 asymptomatic volunteers. MRI parameters: slice thickness: 3 mm, matrix: 256x384, FOV: 150x150 mm. Two observers measured the TTTG at all positions. Student t-test and intraclass correlation coefficient (ICC) served for statistics.
Results: Mean TTTG for observer 1 was 15.1 ± 3.2 mm (range: 8.4–19.9 mm) at full extension, 10.0 ± 3.5 mm (range: 4.0–15.6 mm) at 15° flexion and 8.1 ± 3.4 mm (range: 2.5–14.6 mm) at 30° flexion (observer 2, full extension: 14.8 ± 3.3 mm, 15° flexion: 9.4 ± 3.0mm, 30° flexion: 8.6 ± 3.4 mm). Mean values were significantly different (p-value <0.001) between full extension and 15° as well as 30° flexion for both observer. Mean values were significantly different (p-value <0.001) between 15° and 30° for observer 1 (p-value for observer 2: 0.102). Interobserver agreement was very good (ICC: 0.87–0.88; p <0.001).
Conclusions: The TTTG increases significantly at the endstage extension of the knee. Therefore the comparability of published TTTG values measured on radiographs, CT and MRI at various flexion/extension angles of the knee is limited. These different measured values must be considered for the overall surgical treatment of patellofemoral instability.

Posters

P1

Injury of the Axillary Nerve After Reverse Shoulder Arthroplasty: An Anatomic Study

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Purpose: Subclinical neurological lesions after reverse shoulder arthroplasty, involving mainly the axillary nerve, are frequent. One of the major risk factor is the postoperative lengthening of the arm. The purpose of this study was to evaluate the anatomic relationship between the main anterior circumflex branch of the axillary nerve and prosthetic component after reverse shoulder arthroplasty. Our hypothesis was that inferior overhanging of the glenosphere related to glenoid could put this nerve at risk.
Methods: Six fresh-frozen shoulder specimens were dissected after having undergone reverse shoulder arthroplasty.
Results: The mean distance from the inferior border of the glenoid o the inferior glenosphere was 5.7 ± 4.0 mm (range, 2.0 to 12.6 mm). There was no proximity between the main anterior circumflex branch of the axillary nerve and the glenosphere (>15 mm). The main anterior circumflex branch of the axillary nerve was in close contact with the posterior metaphysis (fig. 1). The mean distance between the nerve and the humeral implants was 5.8 ± 2.4 mm (range, 1.2 to 8.1 mm).
Conclusions: The proximity of the axillary nerve to the posterior metaphysis or humeral implants may be a risk factor for neurologic lesions after reverse shoulder arthroplasty.

P2

Long-term Outcome Following Arthroscopic Repair of Type II SLAP Lesions: Results According to Age and Worker's Compensation Status

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Purpose: The purpose of this study was to determine the long-term functional outcome of anatomic arthroscopic repair of type II superior labrum anterior and posterior (SLAP) lesions with suture anchors.
Methods: We examined all arthroscopic repairs of isolated type II SLAP lesions from January 2002 through December 2007. Fifty-five patients were available for long-term follow-up at a mean of 77 months. The average patient age at the time of surgery was 39.7 years (range 17 to 65); 23 patients were under the age of 40, and 32 patients were >40 years of age. Fourteen cases involved worker's compensation claims.
Results: Overall, functional outcome was improved from baseline compared to final follow-up for both ASES scores (44.1 vs. 86.2; $p < .001$) and UCLA scores (19.1 vs. 31.2; $p < .001$). According to the UCLA grading system, there were 87% good or excellent results. Although the percentage of good and excellent results amongst patients >40 of age (81%) was lower than amongst patients less than 40 years of age (97%), this difference did not reach statistical significance ($p = .219$). The percentage of good and excellent results amongst the non-worker's compensation cases (95%) was significantly higher than the percentage of good or excellent results in worker's compensation cases (65%) ($p = 0.009$). Overall, patient satisfaction was reported in 91% of cases and return to normal sport or activity was reported in 82% of cases.

Conclusions: In 87% of cases, a good or excellent functional outcome can be anticipated following arthroscopic repair of type II SLAP lesions with the described techniques. Variables associated with a poor outcome include worker's compensation cases and possibly age over 40.

P3

Validation of a Smartphone application for shoulder elevation

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Introduction: Angle of arm elevation is of interest for mobility and function evaluation in shoulder pathologies. Measurement methods applied in clinical research and practice, such as observation, goniometry or inclinometry, display only a moderate reliability. Embedded kinematic measurement is more reliable, but access to technology has limited its clinical application up to now. A Smartphone application has been developed to facilitate implementation of kinematic measurement of arm elevation in current practice. The results of this method have been compared to the results of a kinematic measurement approach.
Methods: Twenty participants (11 patients with various shoulder conditions and 9 healthy participants) were measured using simultaneously two systems containing 3D gyroscopes and accelerometers, an embedded Physilog system (EPFL) and a Smartphone (Apple). A Physilog module was fixed on the distal posterior side of the humerus and a Smartphone was attached 2.5 cm higher. The patients performed 3 arm elevations. Arm elevation angle with regard to gravity was computed. Statistical analysis included between movements and between devices reproducibility (intraclass coefficient of correlation, ICC) and 95% limits of agreement (95% LOA).
Results: Results were comparable for patients and healthy participants, and for one movement or mean of 3 replications. Overall mean difference in elevation angle between Smartphone and Physilog was -7.6° (SD ± 9.2). ICC between devices was 0.88 for mean of 3 replications and ranged for 0.76 to 0.81 for isolated movements. Between movements ICC ranged from 0.97 to 0.99 and 0.95 to 0.99, respectively for Smartphone and Physilog. 95% LOA between devices for mean of 3 replication were –7.6 ± 18.1°. Between movements 95% LOA for Smartphone was –0.3 ± 6.1°.
Conclusion: Evaluation of shoulder elevation using a Smartphone is easy. These results show an excellent reproducibility when considering between movements results. The relation with an embedded measurement method is also good, but systems are not interchangeable. Limits of agreement between movements for the Smartphone were better than those of other methods currently used in clinical practice. Thus, the method is promising even if further outcome studies are necessary to fully validate the system in a routine clinical practice. A study aiming at the validation of shoulder function and arm elevation angle is ongoing on a larger sample size.

P4

Long-term Outcome Of Arthroscopic Massive Rotator Cuff Repair: The Impact Of Double-row Fixation

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Introduction: Little information is available about the long-term functional outcome following arthroscopic rotator cuff repair (ARCR) of massive rotator cuff tears (RCT). A double-row repair may improve the functional outcome of massive tears given the higher recurrence rate associated with increased tear size. The purpose of this study was to: 1) evaluate the long-term functional outcome of ARCR of massive RCTs, and 2) compare the functional outcome of double-row and single-row repair of massive RCTs.
Methods: We performed a retrospective review of an 8 year period of patients with a primary massive RCT which was treated with an ARCR. The minimum follow-up was 5 years. Functional outcome data was available for 126 patients at a mean of 99 months.
Results: In the overall cohort compared to preoperative status, statistically significant improvements were observed in forward flexion (132 degrees vs. 168 degrees; $p < .001$), pain (6.3 vs. 1.3; $p < .001$), UCLA score (15.7 vs. 30.7; $p < .001$), and ASES score (41.7 vs. 85.7; $p < .001$). A good or excellent functional outcome by UCLA score was obtained in 78% of cases and was associated with a complete repair ($p = .035$) and a double-row repair ($p = .008$). Patient satisfaction was observed in 91.3%, return to activity in 86.5%, and overall patients rated their shoulder as 86.6% of normal. Excluding partial repairs, the UCLA score improved from 16.4 to 29.8 in the group I compared to 15.2 to 32.8 in group II ($p = .007$), and pain improved from 6.2 to 1.5 in group I compared to 6.8 to 0.5 in group II ($p = .033$). At final follow-up, patients in group I rated their shoulder as 84.4% of normal compared to 93.5% of normal in group II ($p = .006$). In multivariate analysis of complete repairs a double-row repair was 4.9 times more likely to lead to a good or excellent UCLA functional outcome (95% CI, 1.3–18.8; $p = .021$).
Conclusion: A good or excellent long-term functional outcome can be achieved in the majority of cases with ARCR of massive RCTs. Preoperative active external rotation past neutral and a complete repair are associated with improved long-term functional outcome. A double-row repair improved the functional outcome of massive RCTs. Given the known high risk of recurrence following repair of massive RCTs and the knowledge that functional outcome is related to recurrence, our data suggests that when there is sufficient tendon mobility a double-row repair should be performed for massive RCTs.

P5

Arm velocity distribution during daily activity: objective outcome evaluation after shoulder surgery

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Introduction: Shoulder disorders imply pain and limitation in the arm function. Assessment of arm movement in daily activity is thus essential for the evaluation of treatment outcome. Wearable measurement devices are useful tools to monitor movement in real-life condition. Such systems have been used to quantify upper limb usage, but there is a need to assess the quality of the movement. Therefore this study aims at providing an objective evaluation of the arm velocity in daily condition.
Methods: 21 patients with rotator cuff tear were assessed before and after surgery (at 3, 6 and 12 months) and compared to 41 controls. Participants completed the Constant score (CS) and were monitored during 7h of usual activity. Inertial modules with 3D gyroscope and accelerometer were fixed on each humerus and on the sternum, while an embedded datalogger recorded the signals. Movements of humerus were detected using the angular velocity of the arm and thorax. The distribution of the mean velocities of detected movements was compared to a reference distribution from controls, using the Kolmogorov-Smirnov distance (KS). Relationship between KS and CS was quantified and the probability of "healthiness of movement", prhealthy, was defined as the probability to be similar to the controls in terms of KS.
Results: KS of the painful sides of patients were significantly different from the controls at each evaluation time. In average the patients were thus not able to move with velocities comparable to controls, even one year after surgery. Healthy sides of patients did not present significant difference with reference. KS was correlated to CS and explained 55% of the CS variance. Before surgery, prhealthy showed that 15 of the 21 patients had a probability lower than 0.25 to perform as well as controls. One year after surgery, 11 patients improved their velocity with prhealthy higher than 0.5. Among the 10 other patients, 5 had a CS higher than 72, which is in the range of healthy values. Although the clinical evaluation was good, prhealthy showed an alteration of velocity.
Conclusion: The analysis of the arm velocity measured by inertial sensors highlights differences between painful and healthy arms. These results are encouraging for future assessment of patients since velocity analysis provides an objective evaluation of the upper limb mobility in daily activity. Moreover it is complementary to the Constant score as it detects movement alteration at a late stage of recovery.

P6

Surgical outcome of humeral shaft fractures with proximal extension treated with long locking plate

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Introduction: Most humeral shaft fractures are amenable to non-operative treatment with satisfactory outcome. Limitations to non-operative treatment do exist. Due to the biomechanical consequences of deltoid and pectoralis major muscles, humerus shaft fractures with proximal extension are associated fracture with displacement and nonunion. The aim of this study is to assess the outcome of humeral shaft fractures with proximal extension treated surgically using a long locking plate.
Material and methods: Between January 2010 and June 2011, 22 patients with displaced humeral shaft fractures with proximal extension underwent open reduction and internal fixation. There were 14 women and 8 men with a mean age of 73.8 years. In all cases, a long locking Philos plate (Synthes®) was implanted using an enlarged delto-pectoral approach. All patients were reviewed with a clinical and radiographic assessment until union.

Results: At a mean follow-up of 9 months (range, 6–12 months), 20 fractures (95%) healed. At final follow-up the mean range of motion was 95° (range, 50°–170°) in flexion; 90° (range, 50°–170°) in abduction; 37° (range, 20°–50°) in external rotation, and L1 (range, sacrum-D10) in internal rotation. One fracture healed despite secondary displacement after an accidental fall. No malunion of more than 20° was reported on standard antero-posterior and lateral radiographic views. One low demand patient reported nonunion and did not ask for secondary surgery. Two preoperative radial nerve palsies recovered after surgery. No infection was reported.
Conclusion: Humeral shaft fractures with proximal extension treated with a long locking plate yield satisfactory results. We reported a high rate of union and a predictable outcome. Therefore we recommend open reduction and internal fixation for these types of displaced fractures.

P7

An experimental shoulder model to determine the stability of fracture fixations at the proximal humerus

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A preclinical analysis of novel implants for fracture fixation at the proximal humerus requires biomechanical testing conditions close to physiology. A test setup which simulates conditions according postoperative rehabilitation is therefore of high interest to test primary implant stability. To actively mobilise the upper arm by the relevant shoulder muscles, the Deltoideus and the rotator cuff muscles were simulated. The aim of the present study was therefore the development of an experimental shoulder simulator which is able to perform physiological, reproducible humeral movements. Important muscles, such as the Deltoideus (Delt), Supraspinatus (SSP), Infraspinatus / Teres Minor (ISP/TM) and Subscapularis (SSC), were incorporated. A free hanging humerus pivoted in the glenoid is activated by the contracting muscle forces of SSP, Delt, SSC und ISP/TM. The principal abductors Delt and SSP apply an increasing tension force in the relation of 3:1, until maximum abduction angle of 85° is achieved. The scapula itself rotates actively according to the humerus and contributes to one third of the overall arm abduction. Four electro actuators (Maxon Motor, Switzerland) transfer individual tension forces to the proximal humerus by cable pulleys. The whole arm weighs 2.5 kg, which corresponds to a normal arm weight. One abduction cycle (abduction to 85°, adduction to 0°) requires 20s. Joint forces orthogonally and laterally to the glenoid are measured by a 6-axis load cell (Transmetra GmbH, De). Controlling and data acquisition was performed by a real time target (Nat. Instr., US). The Delt and SSP muscle forces show linear increasing force characteristics up to a maximum of 148 N (Delt) and 48 N (SSP) at 85° abduction angle. These values correspond to the desired ratio of 3/1. The ISP/TM muscles and both segments of the SSC together apply each a force of 30 N at maximum abduction. The reproducibility of subsequent cycles is guaranteed. The force vector in the glenoid resulted in 253 N ($F_{orthogonal}$ = 245 N, $F_{lateral}$ = 63 N. An initial force of 84 N is detected due to pretension of the muscles at 0° abduction. The present investigation shows the amount of individual muscle forces at the proximal humerus during active abduction. Acting forces at the bone fragments, as for instance at the tuberculum majus and minus, may therefore be quantified. This biomechanical testing setup is able to compare different fracture fixation techniques with respect to their primary stability.

P8

Mid-term outcome of arthroscopic revision repair of massive and non-massive rotator cuff tears

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Introduction: No information is available regarding the outcome of arthroscopic revision of massive rotator cuff tears, at mid-term follow-up
Objectives: The purpose of the present study was to evaluate the mid-term functional outcome of arthroscopic revision rotator cuff repair and compare the outcomes of non-massive and massive rotator tears
Methods: A retrospective review was performed of patients over a ten year period who underwent an arthroscopic revision rotator cuff repair. The cohort was divided into two groups based upon tear size (non-massive and massive tears).
Results: The cohort consisted of 21 non-massive tears and 53 massive tears with a mean follow-up of 63 months. The two groups hadsimilar baseline characteristics. In the overall cohort, following arthroscopic revision repair there was a significant reduction in pain ($p < .001$), and increase in active forward elevation ($p = .003$) and functional outcome by American Shoulder and Elbow Surgeons ($p < .001$) and University of California, Los Angeles (UCLA) ($p < .001$) scores. The rate of patient satisfaction was 78%. There was no significant difference between the two groups (non-massive vs. massive) in postoperative forward elevation, pain, or functional outcome. A poor functional outcome according to theUCLA score was associated with female sex ($p = .005$), preoperative active forward flexion below 136° ($p = .004$), and preoperative pain score >5 ($p = .002$).
Conclusion: The results of the present study suggest that arthroscopic revision rotator cuff repair may be a reasonable treatment option even in cases of massive retears. This technique can yield reliable improvements in both pain and function at an acceptably high rate in this difficult patient population.

P9

Efficency of conservative treatment in distal radius fractures in elderly patients

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Introduction: Fractures of distal radius are very common especially among elderly patients. Even surgical treatment is indicated this patients ofenly do not agree with it, because of their general conditions or low demands. Conservative treatment remain more acceptable for these patients.
Objectives: The aim of my study is to find out that conservative treatment is not so efficent but comparing anatomic and functional results it is acceptable.
Methods: This case-control study examined 116 patients with fractures of distal radius over the age of sixty are treated by closed reduction with cast immobilization from 4–6 weeks. The fractures have been classified after AO. Fractures were reduced under acceptable anatomic criteria. Radiographs after reduction, a week later and eight weeks later were analyzed to study: Dorsal tilt, radial inclination and ulnae variance. Anatomical and functional results are assessed.
Results: 116 patients with distal radius fractures are treated by closed reduction. Mean age 70.25 years old (61–88). 86/30 were female/male and 67 left hands. 4 fractures lost reduction in a week and 88 lost reduction in the period 1-6 weeks. Radiologic results were excellent in10 cases (8.8%) , good in17 cases(14.7%), fair in 42 cases (36.2%) and bad in 47 cases (39.2%). Functional results were excellent in 20 (17%) cases, good in 36 (31%) cases, fair in 40 (35%) cases and bad in 20 (17%) cases. There is a correlation between bad anatomic results and classification
Conclusion: Even though we may have anatomic reduction we have lose of reduction in distal radius fractures in elderly patient. Functional results in low demand elderly patients donot correlate with anatomic results. Conservative treatment remains the treatment of choice in elderly patients

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P10

Management of failed vertebral body stenting for treatment of vertebral fractures – report of two cases

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Introduction: Vertebral Body Stenting (VBS) was introduced for treatment of vertebral fractures. In contrast to balloon kyphoplasty, expandable metallic stents are utilized in VBS to maintain the correction of the vertebral body height. The presented report describes complications in the use of VBS and their management in two patients.
Methods: A 69 year-old patient presented to an outside hospital with persistent right-sided lumboischialgia eight months after VBS for a 3rd lumbar vertebral fracture (AO A2.3, case 1). A 53 year-old suffered from persistent pain after two months of conservative treatment of a 1st lumbar vertebral fracture (AO A3.1, case 2). In preoperative MRI the fracture was not consolidated. VBS was performed at our institution. Efforts to expand the cage failed. Removal of the cage resulted in avulsion of one metallic stent with approximatively 1 cm of the injection drain remaining attached.
Results: In case 1, radiographic examination revealed fracture non-union with secondary dislocation of the right-sided metallic stent. The stent was removed by open corpectomy from an anterior approach. Fracture treatment consisted of monosegmental anterior fusion. In case 2, stent removal and fracture stabilization was performed four days after failed VBS by thoracoscopical partial corpectomy, bisegmental fusion and cage interposition. In the postoperative course both patients had resolution of their initial complaints.
Conclusion: VBS failed in a split fracture pattern or a partially consolidated fracture and required implant removal. The application of VBS might be limited so that treatment of specific fractures as well as the timing of VBS has to be well defined.

P11

The potential for correction of degenerative lumbar spine deformities by the XLIF approach

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Introduction: There is a growing number of patients with deformities of the lumbar spine in the elderly population. The clinical symptoms are related to the altered spinal balance (scoliosis, kyphosis) on the one hand and spinal stenosis on the other hand. The extreme lateral interbody fusion (XLIF) procedure appears promising in treating degenerative deformities more efficiently with less surgical trauma.
Methods: Monocenter nonrandomized prospective case study, including all patients treated by a lumbar standalone interbody fusion with an Oracle cage (Synthes, Oberdorf, Switzerland). Radiological analysis to compare the pre- and postoperative outcome with respect to kyphosis- and scoliosis correction, expressed by the Cobb angle. Pre- and postoperative standing x-rays of the lumbar spine were compared at corresponding levels. Statistical analyses were performed by Wilcoxon signed-rank.
Results: 63 patients were treated on 110 levels (average 1.7 levels per patient, min 1, max 3). The mean age was 66.9 years (42–83), there were 20 males and 43 females. 31 patients underwent a single level, 32 a bi- or trisegmental procedure. In total the scoliotic deformity was reduced by 4.6° from 9.6° to 5.4° (p In patients with monosegmental treatment the scoliotic correction was 3.7°, in patients with bisegmental treatment 3.3° and in patients with trisegmental treatment 7.5° (p The correction of the segmental lumbar lordosis increased by the number of segments addressed. In the single level group it was 3.6° (p
Conclusion: The potential for deformity correction in degenerative deformities of the lumbar spine by the XLIF approach with cages is higher for the sagittal plane than the coronal plane. The procedure provides a significant change of the spinal alignment. The potential for correction increases with the levels addressed. The radiological parameters are promising, its impact on the clinical outcome needs to be assessed.

P12

Invisible Failure of an Alumina-Polyethylene Sandwich Liner

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Introduction: Mechanical failures of ceramic components are a known but underestimated complication of total hip arthroplasty using alumina-on-alumina surfaces. In order to reduce the rigidity of the ceramic-on-ceramic coupling and prevent impingement between the rim of the ceramic liner and the metal neck, insertion of a modular alumina-polyethylene liner was proposed. In the literature high failure rates of such alumina sandwich liners are reported.
Case report: We report the case of a 49 years-old man who presented with mechanical pain in the groin eight years after total hip arthroplasty using an alumina-polyethylene sandwich liner. Standard radiographs did not reveal any signs of loosening or wear of the prosthetic components. Cup inclination was measured to be 49° and anteversion 37°. Bone szintigraphy showed no activity of the bone and the soft tissues around the prosthesis. Blood parameters were found to be normal and needle aspiration of the hip did not show any signs of an infection. At the end, a CT-scan performed to analyze the interface between the prosthetic components and bone revealed multiple undisplaced split fractures of the alumina liner. Total hip exchange arthroplasty was performed using a ceramic head and a highly cross-linked polyethylene liner.
Conclusion: Alumina sandwich liners remain a subject of concern since the increasing clinical follow-up period may predispose them to fatigue failure. Mechanical pain after total hip arthroplasty using alumina-on-alumina liners should be analyzed with a CT-scan to visualize undisplaced failure of the ceramic liner potentially not visible on standard radiographs.
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P13

Distal Femoral Cortical Hypertophy Using The Fitmore Stem©: A Two Year Follow Up Regarding Incidence, Development And Clinical Implications

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Introduction: In a one year follow up of a series of 88 total hip arthroplasties with the Fitmore© uncemented tapered femoral stem, cortical hypertrophy of the femur was observed in 53% of all patients. Neither demographic data, Harris Hip Sore and Thigh pain Scale, nor cortical index, subsidence or position of stem showed a significant correlation to cortical hypertrophy. A two year follow up is investigating the evolving of the hypertrophy over time and the effect on the clinical outcome.
Methods: For the two year follow up the data of 86 patients were at disposal. Clinical evaluation included Oxford, SF 12 and EQ-5D score, the incidence of thigh pain and BMI. Radiographic examination at t1 (postoperative), t2 (12 months postoperatively) and t3 (24 months postoperatively) was used to evaluate cortical hypertrophy, subsidence and resorption of the calcar.
Results: Cortical hypertrophy was observed after 24 months in 66% of the patients. Within the last year the cortical hypertrophy remained stationary in 5% of the patients, reducing in size in 46% and increasing in 49%, respectively. Positive radiographic appearance of the hypertrophy after 24 months postoperative did not correlate with subsidence, amount of resorption of the calcar, the stem family, gender, age or BMI. No correlation of the radiographic findings with the HSS or thigh pain at 24 months postoperative was found. We could not identify any factor analysed which might be responsible why the hypertrophy increased or decreased.
Conclusion: Allover the number of patients with a cortical hypertrophy using the Fitmore© Stem increased slightly. In almost half of the patients the hypertrophy remained the same or reduced in size and in the other half the hypertrophy was increasing. As supposed in the one year follow up, the initial distal hypertrophy is most likely due to fast proximal bone ongrowth to the short stem creating a secondary load transfer from the whole proximal fragment to the distal part of the proximal femur. The reduction in size in nearly half of the patients might be due to the progressive ongrowth also distally. It could be postulated that in the other half of the patients, bone response needs some more time and decreasing of cortical hypertrophy mighty could be seen at the 3 year follow up. Important is the fact, that neither the existence of distale cortical hypertrophy nor the increase has any significant correlation with the clinical outcome.

P14

Psychological Aspects After Pelvic Ring Fractures

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Introduction: Pelvic ring fractures caused by trauma are severe injuries with well described radiological and clinical outcomes, whereas psychological consequences are less well documented. The purpose of this study was to investigate patient-reported outcome following treatment of pelvic fractures regarding functional outcome, quality of life, depression and anxiety.
Methods: In a retrospective analysis, 92 patients with type B and C fractures of the pelvic ring were treated between 2003 and 2009 at our level I trauma center. For this purpose, patient charts, surgery reports and x-ray images were analyzed consecutively. The outcome of 62 patients could be evaluated regarding the mobility and function according to Extra Short Musculoskeletal Function Assessment questionnaire (XSMFA), quality of life according to short-form 12 (SF12) and depression according to Beck Depression Inventory (BDI) and Hospital Anxiety and Depression Scale (HADS). Statistical analysis was performed with the computer software SPSS.
Results: Mean age of patients at time of accident was 48 ± 17 years. A total of 16% of patients were female. Mean follow up was 57 ± 21 months. Mean functional index of XSMFA was 23 ± 19. Patients with AO C-type fracture (MCS: 44 ± 13, BDI: 12 ± 12) had statistically lower results in summary score of the SF36 (MCS) and BDI compared to patients with AO B-type fracture (MCS: 52 ± 7, BDI: 6 ± 8) ($p < 0.05$). XSMFA and physical summary score of the SF36 (PCS) correlated highly with BDI and HADS ($p < 0.01$). Patients who were depressed showed significantly worse results in relation to the XSMFA and the SF12 score ($p < 0.01$).
Discussion and Conclusion: For the first time, we could show that a high correlation exists between disabilities, quality of life and psychological consequences after pelvic fractures. Therefore, we recommend inclusion of psychological components in the treatment and outcome-evaluation of the pelvic ring fracture in future.

P15

Treatment of femoral shaft fractures in patients with ipsilateral ankylosed hips – a report of two cases

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Introduction: Femoral shaft fractures are usually a result to high energy trauma. In elderly patients with osteopenic bone and concomitant ipsilateral hip ankylosis low energy trauma might even cause femur spiral fractures due to a lack of hip motion. In these rare cases optimal treatment remains unclear and treatment recommendations in the literature are scarce. The presented report describes the management of this entity in two patients.
Methods: In an 89 year-old patient (case 1) hip fusion using a blade plate (flexion: 30°, abduction: 10°, external rotation: 15°) and total knee replacement were performed for the treatment of osteoarthritis 40 and 15 years before trauma, respectively. In an 86 year-old patient (case 2), the hip was ankylosed (flexion: 45°, adduction: 20°, neutral rotation) due to spontaneous fusion as a result to heterotopic bone formation 40 years after osteosynthesis of an acetabular fracture. Both patients presented on the emergency department after a fall from standing with painful disability for weightbearing of their left legs.
Results: A spiral fracture of the ipsilateral femoral shaft was seen on radiographs (AO 32-A1.2, case 1). After removal of the blade plate the fracture was fixed using a 20-hole locking compression plate. In case 2, radiographic examination revealed a spiral fracture of the femoral shaft (AO 32-A1.3, case 2). Fracture fixation was provided using a LISS plate. No intraoperative complications were noted, wounds healed uneventfully. Prior to trauma and after surgery both patients were acting independently at home, mobility was supported by a single stick (case 1) or a walking frame (case 2).
Conclusion: For optimal treatment of femoral shaft fractures closed-locked intramedullary nailing has been recommended. However, in cases with ipsilateral ankylosed hips nail insertion might be unfeasible due to the distorted anatomy. Alternatively, total hip replacement with a long stem to address both comorbidities might be unreasonable in elderly patients due to the surgical morbidity. In addition, in distal femoral shaft fractures even a long stem might not ensure proper fracture fixation stability. The presented fracture treatment using plate implants with minimal bone contact to limit soft tissue damage and preserve blood supply had the potential for fracture healing with minimal efforts for fast recovery in these geriatric patients.

P16

Fixation of pelvic ring injuries using the Stoppa approach

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Introduction: The Stoppa approach was introduced as an alternative to the ilioinguinal approach for fixation of anterior pelvic ring injuries. The aim was to describe our experience in treatment of pelvic ring injuries using this approach.
Methods: Lateral compression or vertical shear pelvic injuries were treated operatively using the Stoppa approach between 07/2004 and 08/2011 in a consecutive series of 63 patients (52 yrs, 16–88). Surgical data, complications, need for revision surgery and union rates were assessed retrospectively. Patients with a radiographic follow up of less than three months were excluded to the study. Patients were subdivided in two groups (group A: ≤60 yrs, group B: >60 yrs).
Results: Data were available in 43 patients (50 yrs, 16–79) with a mean follow up of 14 months (3–67). For anterior fixation reconstruction plates (26/43 unilateral, 17/43 bilateral; 30/43 bridging the symphysis), for posterior fixation screws (20/43), anterior plates (2/43), posterior ilio-iliacal plates (2/43) were used or lumbopelvic stabilization (2/43) was performed. The mean delay to surgery was 5 days (0–35), operation time was 160 min (70–360), overall blood loss was 750 milliliter (200–2400). All surgeries completed uneventfully and fractures consolidated in postoperative course. Revision surgery was necessary in 3/30 in group A (hardware failure in 2/30 due to non-compliance, 1/30 infection) and in 3/13 in group B (1/13 non-union, hardware failure in 1/13 due to non-compliance, 1/13 failure).
Conclusion: The modified Stoppa approach provided adequate exposure for reduction and fixation of pelvic ring injuries. Surgical treatment of pelvic ring injuries even in the elderly might be favourable.

P17

Floppy positioning of the patient for treatment of complex acetabular fractures

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Introduction: In the management of complex acetabular fractures a single approach can result in non-anatomic reduction due to insufficient fracture visualization, whereas the use of an extended iliofemoral approach is associated with high morbidity. This paper presents a technique for floppy positioning of the patient, which allows a simultaneous anterior and posterior approach to the acetabulum.
Methods: Between 1998 and 2010, a consecutive series of 17 patients (mean age 37, 19–79 yrs; 12 primary, 5 revisions) from 381 operatively treated acetabular fractures were treated using a flexible, semi-lateral positioning to allow simultaneous anterior (Stoppa, ilioinguinal) and posterior approaches.
Results: The mean follow up was eight years (0.3–12.6), overall mean operating time was six hours (1.5–12), blood loss was 1.8 liters (0.3–6.5). No complications related to the floppy positioning were observed and all surgeries completed uneventfully. Two intraoperative injuries occurred (bladder, superior gluteal nerve). Reduction was considered anatomic in 10 cases with excellent or good results.
A primary total hip arthroplasty was implanted in four cases. In the postoperative course heterotopic ossification occurred in four cases (≤ Brooker II), a deep infection in one, early posttraumatic osteoarthritis in two.
Conclusion: The floppy positioning allows the simultaneous use of anterior and posterior approaches for joint preserving treatment of complex fractures as well as fracture fixation with combined primary hip arthroplasty.

P18

Osteochondromatosis of the hip often misdiagnosed as chondrosarcoma – a case report

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Case report: We present a case of a 50-year old female with a one year history of right sided hip pain and increasing flexion deficit. The patient was referred for a third opinion in suspicion of a chondrosarcoma. At presentation to our clinic the patient described a worsening of pain during last 6 months. Clinical examination revealed an antalgic gait, limping and mechanical blocking in flexion; we could no palpate anything abnormal due to her heavy body weight. Pelvic anterior-posterior and axial radiographs of the hip showed the presence of multiple nodular radio opaque masses within the joint capsule and a degenerative osteoarthritis of the hip joint. MRI confirmed the extensive presence of hyaline cartilage nodules involving the synovial and capsular tissue. The diagnosis of a combined synovial osteochondromatosis (stage III Milgram classification) and osteoarthritis of the hip was established. We treated the osteochondromatosis by open synovectomy, removal of all cartilage nodules and total hip arthroplasty. Histology of the taken biopsy samples confirmed the diagnosis of an osteochondromatosis. The patient's follow-up at 2 months, 6 months and one year post operatively was uneventful and the patient was pain free.
Discussion: Primary synovial chondromatosis is a rare neoplastic process involving benign nodules of hyaline cartilage in the capsule. Typically it involves more males and patients between the third and fourth decades of life. The hip joint is the second most frequently involved joint. The average time to diagnosis from first symptoms is often larger than 5 years. One of the reasons ist that the disease may be misinterpreted as chondrosarcoma, which could be only differentiated by histology. In summary this exceptional case in which the patient had consulted two expert orthopedic surgeons giving the diagnosis of chondrosarcoma, shows that the clinical and radiological examination is not well understood and it is easy to misdiagnosis as a chondrosarcoma.

P19

Clinical and Radiological Outcome of the Direct Anterior Approach in Hemiarthroplasty for Displaced Femoral Neck Fractures

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Hip replacement is the most common treatment for displaced femoral neck fractures in the elderly, and minimally invasive surgery is popularised in the field of orthopedic surgery.The present study

evaluated the outcome of monopolar hemiarthroplasty by the direct anterior approach over a postoperative period up to 2.5 years. A total of 86 patients with displaced femoral neck fractures were included (mean age of 86.5 years). Surviving patients were reviewed 3 months (retrospectively) and 1 to 2.5 years (prospectively) after surgery. The 3-month mortality was 30%, the 1-year mortality 36%.For all stems, implant positioning concerning stem alignement, leg length and restoration of femoral offset was radiographically correct. Acetabular protrusion was observed in 55% of the patients 1 to 2.5 years postoperatively. Subsidence and intraoperative periprosthetic fractures occurred in 3 patients (3%) each. All revision stems for postoperative periprosthetic fractures could be implanted using the initial surgical technique without extension of the previous approach. The mean Harris Hip Score increased from 81 points (range 35–100) at the 3-month follow-up to 85 points (range 33–100) at the 1- to 2.5-year follow-up. According to these findings, hip replacement for displaced femoral neck fractures can be performed safely and effectively through the direct anterior approach with good functional outcome and high patient satisfaction.

P20

Total hip replacement gives better clinical results than total knee replacement– comparison with the Repp-factor (relative effect per person)

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Introduction: It's a common belief that total hip replacement (THR) gives better clinical results compared with total knee replacement (TKR). The result for the individual patient seems to be more important than the cohort. We developed a method to calculate the effect of a treatment for the individual patient based on patient questionnaires. The formula (Score before – Score after) divided through (Score before) gives a factor "Repp"-factor (Relative effect per patient). This factor can be 1.0 for the best treatment (Score before-0/Score before) and goes to minus with a higher score after treatment (worse result). If the Score before is 0 the calculation is not possible. To interpret the results we propose 5 categories, depending on the "Repp" factor. Excellent: 1.0 to 0.95, good: <0.95 to 0.5, moderate: <0.5 to 0.2, no effect: 0.2 to –0.2, worse: <-0.2. We compared our clinical results after THR and TKR with this method.
Objectives: Comparison of results after THR and TKR with the Repp-factor. Analysis of insufficient results for possible reasons.
Patients and methods: The study was a monocentric register study. Included were all patients in our registry after THR and TKR with a WOMAC Score before and a year after surgery at the Orthopaedic Clinic, Kantonsspital Aarau, Switzerland. The Repp-factor was calculated for each patient and the results of both cohorts were compared. All patients with a negative Repp-factor were analyzed individually for possible reasons.
Results: The THR cohort includes 152 patients, 49% females. Average age at surgery was 67.9 years. The mean WOMAC score changed from 51 to 13. The TKR cohort includes 95 patients, 66% females. Average age at surgery was 68.2 years. The mean WOMAC score changed from 49 to 20. The results for the THR cohort were: 31% excellent, 51% good, 11% moderate, 4% no effect and 3% worse. In the TKR cohort the results were: 14% excellent, 54% good, 13% moderate, 12% no effect, 7% worse. In both groups the patients with a worse result had either low score before surgery, complications or additional unrecognized lumbar spinal stenosis.
Conclusion: Results after THR/TKR can be easily analyzed with the Repp-factor. We found more excellent and good results for THR (82%) compared to TKR (68%). Our patients can expect a good to excellent result for THR in about 82% of the cases and for TKR in 68%.

P21

Evaluation of treatment and risk of falling in patients with knee and/or hip prosthesis – a longitudinal study with 6 months follow up

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Introduction: Various international studies have reported that up to 53% of all trauma patients with total hip arthroplasty will fall again once or more in the first 6 months postoperatively. Different assessment instruments are recommended to determine the risk of falling. No previous studies have been conducted in Switzerland to determine this risk in patients receiving total knee and hip arthroplasty as elective surgery to manage degenerative joint disease. The following were investigated: (1) How high is the fall rate and what are the consequences, (2) are there differences in terms of sociodemographic data and functional outcome between those who fall and those who do not?
Methods: A total of 221 patients with planned total or partial knee/hip arthroplasty participated in a non-interventional, prospective, multicentre study. The patients were assessed preoperatively, and at 1 week and 6 months postoperatively on the WOMAC questionnaire (pain, stiffness, function), STRATIFY (fall risk), and 2 functional performance tests (Timed Up and Go –TUG, and Iowa Level Of Assistance Scale - ILOAS). Effect sizes (ES) were calculated for the WOMAC as well as bivariate and multivariate logistic comparative analysis of those who fell and those who did not.
Results: Of the 221 patients a total of 45 fell again in the first 6 months post-surgery. In 68% the fall was caused by stumbling or slipping outside (50%) or at home (36%). There was 1 fracture of the study joint, bruising (23%) or no injury (71%). Great improvements (up to ES = 1.60) were recorded for those who fell and those who did not at the 6 month follow up. There were however no significant differences between the groups. The preoperative STRATIFY correctly identified all those who fell but it also classified those who did not as patients with a high risk of falling. Regression analysis of those who fell and those who did not for the variables sex, age, number of comorbidities, sports activity, study joint, postoperative ILOAS score, and WOMAC pain only explained 1% of the variance.
Conclusion: A fall rate of 20% in the first 6 months postoperatively requires a valid assessment instrument that can reliably identify the fall risk. Neither STRATIFY, ILOAS TUG nor can WOMAC reliably predict falls in the preoperative or immediately post-operative periods.

P22

Acetabular osseointegration and bone density one year after RM Pressfit vitamys® cup implantation

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Introduction: The survival of acetabular components depends on osseointegration and wear. The idea of a cementless, elastic, titanium coated monoblock socket is to mimic the elastic properties of acetabular bone so that the resulting physiological distribution of articular forces protects the acetabular bone and provides optimal conditions for ingrowth, and subsequent results in long lasting component fixation. Long-term studies have shown excellent results for the RM Classic and RM Pressfit Cup with conventional polyethylene. Highly cross-linked polyethylene shows a significant decreased wear rate. Therefore, the RM Pressfit vitamys cup was designed. It combines the successful concept of the RM Pressfit Cup with a vitamin E stabilized highly cross-linked polyethylene. We report our short-term results with regard to acetabular osseointegration and periacetabular bone reaction.
Methods: For this investigation we included 50 patients who underwent total hip arthroplasty with a RM Pressfit vitamys cup between September 2009 and April 2010. All cups were implanted through a minimally invasive direct anterior approach in lateral decubitus position. Clinical and radiographical follow up's were performed 6 weeks, 6 months and 1 year after surgery. Analyses of osseointegration and bone density were investigated on pelvic ap X-rays using the classification by DeLee and Charnley.
Results: 24 women and 26 men with a median age of 69 years (47-89) were included. 7 patients had bilateral hip arthroplasty. In the aggregate we implanted 57 RM Pressfit vitamys cups. The acetabular inclination measured <35° in 12.5%, 35–40° in 23%, 41–45° in 43%, 46–50° in 20%, and >50° in 1.5%. Cup anteversion was in 5% of <10°, in 43% of 10–15° and in 52% of >15°. 26 hips showed increased bone density in zone I, 18 hips showed increased bone density in zone I and II. No increased bone density was observed in zone III. In 13 hips no increased bone density was observed in any of the 3 zones. In 6 patients a sclerotic line at the one year follow-up was visible. In one patient a lucent line was observed at the one year follow-up.
Conclusion: The short-term results show good osseointegration and increased bone density in zone I and II, supporting the concept of the isoelastic cup. The cause of the sclerotic lines can be explained by the increased bone density at the periacetabular bone. Our promising early results have to be proven on the long-term.

P23

Comparison of patients in different rehabilitation settings after knee or hip arthroplasty

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Introduction: Patients after hip or knee replacement can benefit from postoperative treatment in terms of improvement of independence in ambulation and transfers, range of motion and muscle strength. After discharge from the hospital, patients are referred to different treatment destination and modalities: intensive inpatient rehabilitation, cure

(medically prescribed stay at a convalescence center), or ambulatory treatment at home. The goal of this study was to analyze the differences in patient's health status after hip or knee arthroplasty and its relation to the choice of the rehabilitation setting.
Methods: 201 patients after elective hip or knee arthroplasty were included in this prospective multicenter study. Sociodemographic data, functional mobility assessed by Timed Up and Go (TUG) and Iowa Level of Assistance Scale (ILOAS) and the Western Ontario and McMaster Universities Osteoarthiris Index (WOMAC) for pain, stiffness and function were analyzed. 6 months follow-up data was measured with WOMAC (visual analogue scale from 0 = best to 100 = worst).
Results: 62 (31%) patients were treated in inpatient rehabilitation and 46 (23%) in a cure. 93 (46%) patients received ambulatory treatment. Patients treated in an inpatient rehabilitation were significantly older (mean 71.5 years, p <0.001) and had more comorbidities (median = 2, p <0.011) compared to the other groups. All WOMAC scores measured before surgery were the lowest in the ambulatory treatment group (mean global score 41.2), higher in the inpatient (46.6), and in the cure group (49.3). The TUG measured before discharge from hospital was 27.4s in the ambulatory treatment, 33.9s in the cure, and 39.2s in the inpatient rehabilitation group (p = 0.018). Significant differences of functional mobility were also measured by ILOAS with scores of 12.5 in the ambulatory treatment, 13.8 in the cure, and 16.0 in the inpatient rehabilitation group (p = 0.007). 6 months after arthroplasty, all groups had improved in pain, stiffness, and function.
Conclusion: These findings suggest that patients referred to intensive inpatient rehabilitation are older, suffer from more comorbidities and impaired mobility. All patients benefit from their postoperative treatment, independent of treatment destination and modalities. After hip or knee arthroplasty, patients seem to be admitted to the appropriate postoperative treatment according to their impairment.

P24

Femoral fixation strength of device-free isoanatomical bone-patellar tendon-bone single-bundle ACL reconstruction – a biomechanical study

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Objectives: Implant-free fixation methods such as the A3B-technique are increasingly recognized. A3B achieves femoral fixation using a conoid shaped bone block in a conoid shaped tunnel. This study investigated the graft slippage and the strength of femoral press-fit fixation under cyclic and ultimate loading. We hypothesized that press fit fixation provides at least equal or higher ultimate strength of fixation than published values for interference screw fixation.
Materials and Method: 9 fresh frozen knees were obtained from an accredited tissue bank. Standardized harvesting of the B-PT-B graft was performed. Stripped of all soft tissue, the femora were cemented into steel rods and fixed with 2 screws for rotational motion. Femoral tunnels were drilled in anteromedial bundle position at 9.30 or 2.30 o'clock respectively. The grafts were inserted into the femoral tunnel and the steel rods were mounted in a MTS 858 Bionix® testing machine. The femoral tunnel was oriented in 30° to the horizontal plane, for natural angulation of the knee during walking. The tibial bone block of the graft was fixed by a steelrod-rope construction and frozen by a cryocuff. Optical tracking markers were adjusted to the femora at both ends of the tendon and on the bone-block itself. A Vicon™ motion capture system was used to assess micro-motion of the bone, plastic deformation and slippage. The grafts were then put under cyclic tensile loading (1000 cycles between 70 and 220N at 1Hz). Ultimate load to failure was measured at 1 m/min until the bone blocks were either torn out of the femoral tunnel or the grafts ruptured.
Results: The mean pull out force of all grafts was 806 ± 295N (median 852N, Range 448-1349N). Samples which elongated before graft failure, had significant higher ultimate load to failure forces than samples which did not (graft failure n = 6, 860 ± 319N, vs. block pullout n = 3, 684 ± 137N). A correlation of maximal pull out force and size as well as gender of the specimen was observed. The failure pattern differed between larger and smaller knees; while the bone-blocks in the smaller specimens tended to slip out of the tunnel at lower loads, the tendon ruptured at higher loads in the larger specimens.
Conclusions: Femoral implant free press-fit fixation method showed excellent primary stability with pull out force at least equal to the published results for interference-screw fixations (500–600N).

P25

Clinical and radiological long-term outcome after PCL reconstruction and popliteus bypass surgery

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Introduction: The primary purpose of our study was to analyze the long-term outcome of patients treated for combined posterior cruciate ligament and posterolateral corner injuries by posterior cruciate ligament reconstruction and popliteus bypass according to Mueller or refixation of the popliteus tendon.
Methods: 16 patients (male:female = 10:6, mean age at surgery 32 ± 14 years) treated by combined posterior cruciate ligament reconstruction and popliteus bypass according to Mueller (n = 7) or a refixation of the popliteus tendon (n = 9). The patients were evaluated with a mean follow-up of 24 ± 3 years using IKDC2000, the SF36, Lysholm and Tegner score and KOOS score. Anterior and posterior KT-1000 arthrometer measurements were performed. Bilateral anterior-posterior stress radiographs (in 30° and 90° flexion) were performed as well as varus stress radiographs. The degree of osteoarthritis was assessed with regards to the Kellgren Lawrence Score. Pearson correlations of predictive factors for worse outcome were performed. The level of statistical significance was p
Results: The total IKDC2000 was B (nearly normal) in 5 (31%), C (abnormal) in 7 (44%) and D (severely abnormal) in 4 (25%) of patients. The mean total SF-36 health survey was 79 ± 20, the Lysholm score 68 ± 22, the KOOS-symptoms 40 ± 13, KOOS-pain 26 ± 24, KOOS-activity 18 ± 18, KOOS-sport 51 ± 32, KOOS-LQ 44 ± 26. The Tegner score decreased from preinjury (7, 4-10) to (4, 2-10) at follow-up. The side to side differences of anterior KT-1000 arthrometer measurements 134N were 5 ± 5 mm. The side to side difference of bilateral posterior stress radiographs in 30° was 4 ± 5 mm and 6 ± 3 mm in 90° flexion. The side to side difference of bilateral varus stress radiographs was 3 ± 2 mm. The Kellgren Lawrence score showed minimal osteoarthritis in 7 (44%), moderate osteoarthritis in 7 (44%), and severe osteoarthritis in 1 patient (12%). One of the patients had undergone a total knee replacement.
Conclusions: The challenging group of patients with combined posterior cruciate ligament injury and posterolateral corner injuries treated by posterior cruciate ligament reconstruction and popliteus bypass according to Mueller et al. or popliteus refixation showed only moderate clinical and radiological outcome, even when the age of the patients at surgery and the long-term follow-up is acknowledged. The type of posterolateral corner reconstruction using these two methods did not show any statistical difference in outcomes.

P26

Radiological MRI mid-term outcome in patients after collagen meniscus implantation (CMI)

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Introduction: Meniscal substitution using collagen or polyurethane meniscal implants is a promising procedure in patients after subtotal meniscectomy. The aim of the study was to evaluate the radiological outcome of a collagen meniscus graft implanted in an injured medial or lateral meniscus after a minimum follow-up of 1 year.
Methods: 81 patients (male:female = 55:26) underwent arthroscopic implantation of the collagen meniscus device (CMI) after subtotal medial (n = 62) or lateral meniscectomy due to persistent compartment pain. The lesions were in the anterior horn (n = 33), corpus (n = 65) and/or posterior horn (n = 65) of the meniscus. 63 underwent an additional procedure such as anterior cruciate ligament reconstruction (n = 52). The patients were seen for radiological follow-up using MRI. MRI scans were performed in all patients at minimum one year follow-up and analyzed according to the Genovese criteria. The Genovese criteria consisted of direct (implant morphology/size, signal intensity) and indirect (state of the corresponding cartilage of the medial/lateral femur or tibia, size of the cartilage lesions ><50%, signs of bone marrow edema). The extrusion of the meniscus was noted as < and >3 mm.
Results: In 10 patients (12%) the meniscus implant was entirely resorbed, in 47 (57%) partially resorbed and in 25 (31%) entirely preserved. It was in particular obvious that sagittal, coronal and axial slices have to be taken into consideration to evaluate size of the meniscus. In 15 patients (18%) the meniscus graft was isointense, 63 (78%) were slightly hyperintense and 3 (4%) highly hyperintense. The size of the cartilage lesion was <50% in 47 patients (58%) and >50% in 34 patients (42%). 45 patients (56%) showed no signs of bone marrow edema. 55 (68%) patients showed an extrusion of the meniscus >3 mm at last follow-up.

Conclusions: The MRI results clearly indicate that the collagen meniscus implant undergoes significant remodeling, degradation and extrusion in a significant number of patients. However, to draw conclusions on the success of this procedure, the clinical outcomes have to be taken into consideration.

P27

Does knee alignment influence gait compensations in patients with advanced knee osteoarthritis?

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Introduction: The mechanical knee alignment has been identified as a risk factor for the progression of knee osteoarthritis (OA). Patients with knee OA are also recognized to present an altered gait pattern associated with the disease level. However, during gait, important compensations can be used to reduce knee pain and increase functional capacity [1]. The aims of this study are to determine how the knee alignment influences gait compensations and if it is associated with knee pain and functional capacity.
Method: 0 patients with knee OA (46 varus/16 valgus) scheduled for a total knee arthroplasty (TKA) and 26 control subjects were recruited for a full-body gait analysis. Kinematics and kinetics were obtained from PlugInGait model (Vicon) and 2 force plates (AMTI). Pain level and functional capacity were evaluated with use of the WOMAC score. The mechanical knee angle was assessed by means of full limb radiography. A knee was defined as varus when the angle was inferior to 180°, as valgus when the angle was superior to 180°. Results were compared between groups using ANOVA and Tukey post-hoc tests. Pearson coefficients of correlation were used to explore the influence of knee alignment on pain and functional capacity.
Results: Compared to the control group (CT), patients with a varus (VR) or a valgus (VL) knee presented a significant reduction of knee flexion range (VR: 42 ± 10° / VL: 45 ± 8° / CT: 54 ± 4°), maximal knee extensor moment (VR: 0.22 ± 0.14 Nm/kg / VL: 0.21 ± 0.18 Nm/kg / CT: 0.36 ± 0.15 Nm/kg) and hip flexion range (VR: 38 ± 5° / VL: 36 ± 6° / CT: 42 ± 5°). Compared to VL patients, VR patients presented a significant increase of thorax flexion range (VR: 4 ± 1° / CT: 3 ± 0.5°), maximal thorax obliquity (VR: 4 ± 2° / CT: 2 ± 1°), and a reduction of hip adduction range (VR: 7 ± 2° / CT: 9 ± 2°) in comparison to the control group. A significant correlation was found between the level of pain score and the increase of knee malalignment in valgus ($r = 0.34$; $p = 0.007$).
Discussion: We found that gait compensations were influenced by lower limb alignment in patients with advanced knee OA. Patients with varus knee alignment seem to adapt their gait in a more efficient way to reduce pain than those with valgus knee by increasing upper body compensations. These results could be associated with the higher level of pain reported during functional activities by patients with valgus knee compared to patients with varus knee.
Reference: [1] Murray PB, Rand JA. 1993. J Am Acad Orthop Surg 1(1):1-9.

P28

Reliability of the Genovese grading for evaluation of collagen meniscus implants (CMI)

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Introduction: The Genovese grading (GG) is one of the most commonly used scores for the evaluation of radiological outcome after partial meniscus substitution using collagen meniscus. It was the purpose to evaluate the intra- and inter- observer reliability (OR) of the GG on MRI in patients after collagen meniscus substitution.
Methods: MRI images of 79 consecutive patients who underwent partial meniscus substitution using collagen meniscus (CMI) were assessed. The GG was used, which consists of direct (implant morphology/size, signal intensity) and indirect (state of the corresponding cartilage of the medial/lateral femur or tibia, size of the cartilage lesions ><50%, signs of bone marrow edema). The inter- and intra-OR was assessed using intra-class correlation coefficients (ICCs, 1 = highest, 0 = lowest). Two observers performed the grading with two week interval twice. The sample size was calculated according to Walter et al.
Results: The GG for the morphology/size of the implant showed an ICC intra-OR of 0.456-0.775 and an ICC inter-OR of 0.256-0.614. The GG for the signal intensity of the implant showed an ICC intra-OR of 0.469-0.651 and an ICC inter-OR of 0.287-0.485. The GG for the bone marrow edema of the implant showed an ICC intra-OR of 0.702-0.740 and an ICC inter-OR of 0.667–0.804.
Conclusions: In the clinical routine the GG shows only moderate inter- and intra-OR for the evaluation of partial meniscus substitution using CMI. We believe that the implant size should be better evaluated on 3D-reconstructed MRI.

P29

Partial meniscus substitution using the collagen meniscal implant (CMI) – does it work?

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Introduction: Meniscal substitution using either collagen meniscus or polyurethane meniscus is increasingly performed in patients after subtotal meniscectomy. The aim of this study was to evaluate the clinical outcome of patients who underwent collagen medial or lateral meniscus graft implantation at minimum follow-up of 1 year.
Methods: 67 patients (male:female = 47:20, mean age 36 ± 10 years) underwent arthroscopic implantation of the collagen meniscus device (CMI) after subtotal medial (n = 55) or lateral meniscectomy (n = 12) due to persistent compartment pain. The lesions were in the anterior horn (n = 29) and/or corpus (n = 53) and/or posterior horn (n = 54) of the meniscus. 53 patients underwent an additional procedure such as anterior cruciate ligament reconstruction (n = 44). The patients were seen for clinical follow-up at minimum 1 year after surgery. The clinical follow-up consisted of IKDC score, Tegner score preinjury, preoperatively and at follow-up, Lysholm score and visual analogue scale for pain and satisfaction (0 best-10 worst) The follow-up rate was 90%. Implant failure was defined as infection due to the implant or mechanical failure of the device.
Results: 19 patients (29%) showed a normal total IKDC score (A), 35 were nearly normal (B), 5 abnormal (C) and 1 patient was severely abnormal (D). The median Tegner score preinjury was 7 (range 2–10), it decreased preoperatively to median 3 (range 0–8). At follow-up the median Tegner score was 6 (range 2-10). At latest follow-up maximum 7 years after surgery it was 6 (range 3–10). The mean Lysholm score before surgery was 68 ± 20 and 93 ± 9 at follow-up. The mean VAS satisfaction preoperatively and at follow-up was 4.0 ± 0.5 and 1.9 ± 1.0. The mean VAS pain preoperatively and at follow-up was 4.4 ± 3.1 and 2.0 ± 1.0. The Tegner score and satisfaction significantly improved further up to 7 years after surgery ($p < 0.05$). There was not significant difference in outcomes between the medial and lateral CMI.
Conclusions: Meniscal substitution with the collagen meniscal implant showed excellent clinical one year results. It further provides significant pain relief and functional improvement throughout all scores at a minimum of 1 year follow-up. No difference between the medial and lateral CMI was observed.

P30

Patient Specific Cutting Blocks Improve Accuracy of Mechanical Alignment in Total Knee Arthroplasty

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Introduction: Long-term survival of TKA is mainly determined by optimal positioning of the components and prosthesis alignment. Implant positioning can be optimized by computer assisted surgery (CAS). However, CAS requires specially educated surgeons and operating staff, is time consuming and costly. This study was performed to evaluate the relatively new surgical technique, based on patient-specific cutting blocks regarding implant position and operating time.
Methods: 113 knees (62 right, 51 left) in 106 patients with a mean age of 70 years were included in this study. Our surgical technique uses patient-specific cutting blocks (PSCB), allowing to realize pre-operative planning of axial and rotational alignment, based on CT images of the patient's knee. Pre- and postoperative mechanical axis, represented by the hip knee ankle (HKA), the proximal tibial angle (PTA), the distal femoral angle (DFA) and the tibial slope (TS) were measured on lateral x-rays and on long-leg-standing x-rays. For all patients the deviation from expected ideal values was calculated. Furthermore the operating time of the whole procedure was recorded.
Results: With a margin of error for alignments each within ±4°, we obtained a success rate of 92.9% for the HKA, 98.2% for the PTA and 99.1% for the DFA. With a margin of error within ±3°, success rates were 81.4% for HKA, 92% for TPA and 94.7% for DFA. The TS showed postoperative results of 2.86 ± 2.02° (mean change 1.76 ± 2.85°). Mean surgical time of the procedure was in general lower than for CAS in current literature.
Conclusion: With the PSCB-technique for TKA, optimal mechanical alignment can be achieved with very high accuracy compared with CAS. Concerning mechanical leg axis, our results were slightly inferior. However, the values of each single component alignment showed excellent results. We explain this discrepancy due to postoperative ligamentous laxity in patients with extreme preoperative varus/valgus deformity which are emphasized in weight bearing x-rays. Those cases should have initially been discussed for constrained implants.

Furthermore, the operating time can be reduced compared to CAS due to a reduced number of surgical steps in this easy technique. We think that PSCB-technique for TKA is a relatively easy method with very good radiological results concerning mechanical alignment in coronal and sagittal planes in comparison to CAS.

P31

Ankle Range of Motion (ROM) – A Simple Measurement?

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Introduction: Ankle motion is connected to motion in subtalar and midfoot joints. True ankle joint ROM is hard to determine clinically. Measurements of ankle ROM are taken as documentation but intra- and interobserver reliability seems poor. We studied the reliability of measuring passive ankle joint ROM in different combinations of knee and subtalar joint positions.
Methods: 9 orthopaedic surgeons measured the passive ankle ROM in 10 healthy women (age: 20–35 years), exclusion criteria: previous ankle surgery, ankle treatment, malpositions or symptoms (e.g. instability, pain). Dorsi-/plantarflexion were measured in 6 different combinations of subtalar joint (neutral, supinated, pronated) and knee (flexed, extended) position. Data were collected in a randomised order. Fibula and the sole of the foot were defined measuring lines, determined with a slat. Values were taken in steps of 5° with a goniometer. Measurements were carried out twice (interval 5 weeks, same setting). Mixed-model analysis of variance was used to estimate effects of knee and subtalar joint position, interaction of the two, measurement time as well as variance components for observer, subject and observer x subject interactions. These variance components were estimated separately for each of the 6 combinations to calculate measures of intra- and interobserver reliability.
Results: Ankle dorsiflexion reliability was best when the knee was flexed to 90° and the subtalar joint neutrally positioned. Ankle plantarflexion reliability was best with extended knee and neutrally positioned subtalar joint. Dorsiflexion was significantly higher ($p < 0.001$ when the knee was flexed to 90°. Dorsiflexion was significantly reduced ($p < 0.001$) in supination of the subtalar joint. Plantar flexion was significantly reduced ($p < 0.001$) in pronation.
Conclusions: Measurements of ankle ROM show good reliability. But for measuring dorsiflexion the knee and subtalar joint positions are crucial, whereas plantarflexion can be measured with high reliability relatively independently of knee and subtalar joint position. Ankle ROM is significantly influenced by the subtalar joint position. Therefore there must be a dorsi-/plantarflexion component in the hindfoot other than the ankle. Assuming that supination anatomically locks the subtalar and midfoot joints, their component for dorsiflexion is eliminated. Therefore supination of the foot increases the specificity of measuring the ankle ROM but deteriorates the reliability.

P32

Reconstruction of a Large Osteochondral Lesion of the Distal Tibia with an Iliac Crest Graft and Autologous Matrix Induced Chondrogenesis (AMIC) – Case Report

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Purpose: Joint preserving treatment of osteochondral lesions (OCL) in younger sportive patients remains a big challenge for the orthopaedic surgeon. Isolated OCL of the distal tibia are rare and no clear treatment guidelines have been established. We developed a novel surgical treatment method using a stable bone plug harvested from the iliac crest combined with the implantation of a collagen I/III membrane. With this case we report the successful use of Autologous Matrix Induced Chondrogenesis (AMIC) aided reconstruction for OCL of the distal tibia.
Methods: A 29 year old male patient (sports teacher) complained about persisting pain and recurrent swelling of the left ankle joint 12 months after an ankle sprain. Sport activities were no longer possible. Pain measured by the Visual Analogue Scale (VAS) was 4. The AOFAS Ankle-Hindfoot Scale was poor with 61 points. Imaging revealed edema of the subchondral bone and thinning of the cartilage above the osseous defect at the lateral distal tibia. Surgical course: The osteochondral defect was debrided followed by microfracturing of the underlying sclerotic bone. A cancellous bone plug was harvested from the iliac crest and impacted into the defect. A collagen membrane (Chondro-Gide, Geistlich, Wolhusen, Switzerland) was cut to match the chondral defect and fixed on the defect with fibrin glue.
Results: At 12 and 36 months the patient had a VAS of 0 points and returned to a full time job. AOFAS hindfoot score increased from 61 points preoperatively to 100 points after 12 months and remained 100 points after 36 months. At 12 months he returned to full sports. Conventional radiographs at one year showed successful osseous integration of the plug, osseous consolidation of the calcaneal osteotomy and a nearly anatomic shape of the tibial joint line. MRI dGEMRIC scans at 36 months showed intact cartilage layer over the defect and glycosaminoglycan content indicating fibrous cartilage repair.
Conclusion: This case demonstrates AMIC aided reconstruction of large osteochondral lesions of distal tibia to be a promising treatment method. Future research needs to compare this new technique to other available treatment methods in terms of radiological, clinical and histological outcome. Early return to full sporting activity after treatment with AMIC technique is possible.

P33

Ankle joint prosthesis for bone defects – Preliminary Results

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Introduction: Large defects of the talus, i.e. due to tumors, large areas of osteolysis in total ankle replacement (TAR) and posttraumatic talus body necrosis are difficult to manage. The gold standard in these circumstances is still tibiocalcaneal arthrodesis with all the negative aspects of a completely rigid hindfoot. We started 10 years ago to replace the talus by a custom-made, all cobalt-chrome implant (laser sintering). Except for one case the patients showed all subsidence of the metal talus into the tibia due to missing bony edges. Therefore, we constructed a custom-made talus and combined it with a well functioning total ankle prosthesis. These are the preliminary results of the outcome of the latest implantations of ankle joint prosthesis for bone defects.
Material and methods: We constructed a custom-made talus (CT-mirrored from the healthy side) and combined it with a well functioning total ankle prosthesis (Hintegra). So far we have implanted this custom-made implant into 3 patients: the first had a chondrosarcoma of the talus (1 year follow-up), the second had massive osteolysis/necrosis of unknown origin (10 months follow-up) and the third massive osteolysis following a correct TAR (6 months follow-up).
Results: The first patient was practically painless with a good range of movement in the upper ankle joint (D-P flexion 10°-0-15°) but less motion in the lower ankle joint (ROM P-S 5°-0-5°). The implant had to be removed as part of a transtibial amputation due to recurrence of the chrondosarcoma. The second and the third patient were absolutely free of pain with a very good ROM of D-P flexion 10°-0-25° and P-S 5°-0-5°. Particularly, no subsidence was detected radiologically in the tibia or the calcaneus.
Conclusion: The longest follow up is only 1 year but in this period of time excellent radiologic results and good clinical outcome have shown up. Thus, the individually custom-made talus combined with the Hintegra total ankle replacement will probably be an interesting alternative to a tibiocalcaneal arthrodesis in selected cases with massive defects of the talus (tumors, osteolysis, posttraumatic necrosis). However further and longer follow-ups will be necessary to examine the role of the type of prosthesis. Additionally, the right timing and planning as well as the correct designed implants are an indispensable precondition for good clinical results.

P34

Pedobarography for the assessment of outcome after ankle or tibiotalocalcaneal arthrodesis

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Background: Pedobarography is widely used for measurement of foot function. Hundreds of parameters are registered by the pedobarograph usually requiring a research setting for interpretation. The purpose of this study was to evaluate a single and easy to reproduce parameter for foot function.
Methods: We assessed 99 patients in three groups: healthy volunteers, patients after ankle arthrodesis (AA) and patients after tibiotalocalcaneal (TTC) arthrodesis. (AA, n = 57; TTC, n = 42) and 35 healthy volunteers with AOFAS scores, dynamic pedobarography and in the patient groups with radiographs. Median follow up was 4 years.
Results: The midfoot index of load showed approximately equal weights for all four component variables (maximal force/pressure, force/pressure time integral) and was the most important pedobarographic predictor (interquartile range odds ratio [OR] 100.4; 95% confidence interval [CI] 13.1, 770.9) for belonging to the healthy volunteers rather than the AA or TTC patient groups. Similarly, it was an independent predictor for the AOFAS score (interquartile range effect 5.1 points; CI 1.4, 8.8). Healthy volunteers had a deeper midfoot depression in the force/pressure time graphs compared to patients after arthrodesis.

Conclusions: The interpretation of hundreds of pedobarographic parameters can be reduced to the evaluation of the midfoot index of load and to the evaluation of the force/pressure time graphs, facilitating clinical interpretation of pedobarographic data.

P35

Subtaler and naviculocuneiform fusion for extended break-down of the medial arch

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Summary: We show that subtaler (ST) and naviculocuneiform (NC) fusion I-III is an efficient and safe procedure as a treatment for acquired flatfoot deformity with medial arch break-down.
Introduction: Advanced stages of flatfoot deformity are commonly addressed with hindfoot fusions. The most frequently applied technique is a triple arthrodesis. One of the disadvantages of this procedure is that it sacrifices the Chopart joint line. Loss of the motion in the Chopart joint has earlier been associated with arthritis in the adjacent joints. The purpose of this study was to assess the results of an isolated subtalar joint fusion in combination with a fusion of the naviculocuneiform in flatfoot deformity and to report on the clinical outcome.
Methods: We retrospectively analysed 21 patients (22 feet; male 5, female 26; age mean 64.8y (range 44.1–80.4) from 05/2008 to 01/2011 who underwent flatfoot correction with NC and ST fusion. In severe valgus deformity a medial displacement osteotomy was added. Radiological evaluation for the correction included dorsal and lateral tarso-first metatarsal angle (tmt1 dp/lat), talonavicular coverage (tn cov) angle and talocalacaneal (talocalc) angle and assessment of fusion. A modified AOFAS and satisfactory score have been handed out.
Results: A medial displacement osteotomy of the calcaneus was added in XX cases. After a mean follow up of 24.1 (12.0–44.1) months stable correction of the medial arch was achieved in 19 of the 22 feet. Statistically significant improvement of all angles was achieved (table 1). There were three non-unions (1 ST, 2 NC) and two patients had wound healing problems.
Conclusion: We found that subtalar and naviculocuneiforme fusions are powerful in correcting flatfoot deformities, sparing the Chopart jointline. However, in severe valugs deformity an additional calcaneus osteotomy may be necessary to correct hindfoot malalignment.

Table 1

Angle	preOP	lastFU	p
tn cov	37.5 (13.5)	22.1 (13.6)	0.001
tmt1 dp	19.0 (13.9)	3.1 (16.9)	<0.001
tmt1 lat	–22.1 (9.7)	–8.8 (8.2)	<0.001
talocalc	37.2 (8.2)	28.5 (5.3)	<0.001

P36

Epidemiology of extended-spectrum beta-lactamase-producing Enterobacteriaceae in a septic orthopaedic ward

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Objective: Wards cohorting infected orthopaedic patients may be particularly prone to transmitting extended-spectrum beta-lactamase producing Enterobacteriaceae (ESBL-E), due to high antibiotic use and long hospital stays.
Methods: We analyze their epidemic pattern by performing molecular typing of ESBL-E isolated from patients and healthcare workers during 20 months from our septic ward.
Results: Between March 2009 and November 2011, 186 patients were admitted from the community and 1335 transferred from other institutions, totalling 12,401 patient-days with an average length of hospital stay of 27 days. Bed occupancy averaged 83%. Among 565 anal swabs, ESBL-E were detected in 204 samples from 45 patients, suggesting prolonged carriage in affected patients. In six patients two different ESBL-E strains were detected, and 3 patients carried three distinct isolates. Among the 45 positive patients, 29 (64%) were detected during the first three days of admission, the remainder after a median median of 13 days of hospitalisation, range 7–52 d). At the time of sampling, 26 patients received antibiotic therapy without clinical activity against their respective ESBL-E; a further 7 patients were treated with antibiotics which their ESBL-E strains were susceptible to in vitro (carbapenems or quinolones). Most positive patients were asymptomatically colonised with ESBL-E. Two patients had arthroplasty infections due to ESBL-E, of which one was acquired on our ward. We also screened 41 healthcare workers (HCW) on 49 occasions during the study period. Six samples (13%) were positive. None of the ESBL-E detected in HCW were related to any of the patient isolates. Among 60 environmental samples taken at the peak of the epidemic (room floors, beds, curtains, tables, doors, offices, computers, telephones, kitchen, physiotherapy material, and toilets), none revealed ESBL-E.
Conclusion: HCW may also be anal carriers, but their strains might be different from the patients. Second, among 25 cases with identical ESBL-E species and positive epidemiological links, only 9 were really attributable to our service. This underlines that epidemiological attribution of ESBL by simple vicinity, timing, and species identification might grossly overestimate transmission within a given unit.

P37

Short parenteral antibiotic treatment for adult septic arthritis after successful drainage

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Summary: The ideal duration of antibiotic treatment in septic native joint arthritis is unknown. We assessed risk factors for recurrence.
Methods: Retrospective study during a 13-year period.
Results: A total of 169 episodes of septic arthritis in 157 adult patients (median age 63 years; 65 females) were studied. In 21 episodes (21/169, 12%), arthritis recurred after the termination of antibiotic treatment. The multivariate statistical analysis showed that lack of surgical intervention (OR 11.3, 95% CI 2.7–46.2), Gram-negative infection (OR 5.9, 1.4-25.3), and immunosuppression (OR 5.3, 1.3–22) were associated with recurrence while the number of drainages (OR 1.3, 1.0–1.7), arthrotomy vs. arthroscopy (OR 0.5, 0.2–1.8), total duration of antibiotics (OR 1.0, 1.0–1.0), or duration of intravenous antibiotics (OR 1.0, 1.0–1.0) were not. Seven days of intravenous therapy had the same success as 8–15 days (OR 0.4, 0.1–1.7) or (OR 1.1, 0.4–3.1). Two weeks of total antibiotic treatment had the same cure as 2-4 weeks (OR 0.4, 0.1–2.3) or >4 weeks (OR 0.4, 0.1–1.6).
Conclusions: At least one surgical intervention is required for the treatment of septic native joint arthritis. If confirmed in prospective trials, antibiotics might be shifted to oral regimen for a total duration of two-three weeks.

P38

Should the methicillin-resistant Staphylococcus aureus carriage status be used as a guide to treatment for skin and soft tissue infections?

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HUG

Objective: Previous skin carriage of methicillin-resistant Staphylococcus aureus (MRSA) leads frequently to empiric antibiotic MRSA coverage for skin & soft tissue infections.
Methods: Retrospective cohort study of orthopaedic patients hospitalized at Geneva University Hospitals (MRSA prevalence; 30%); community-acquired MRSA excluded.
Results: A total of378 skin and soft tissue infections in 346 patients were retrieved. Overall cure was achieved in 330 episodes (87%) after a median antibiotic administration of 15 days. Among all episodes, 102 revealed a positive current MRSA status (during 2 weeks preceding infection; 27%) and 70 (19%) were MRSA carriers in the past. Sensitivity, specificity, positive and negative predictive values of current MRSA skin carriage to predict abscesses due to MRSA were 0.68, 0.77, 0.19, and 0.97, respectively. Fifty-four current MRSA carriers (54/102, 53%) and 30 past carriers (43%) were successfully treated with a non-MRSA antibiotic agent. In multivariate Cox regression analysis, anti-MRSA coverage (hazard ratio 1.2, 95%CI 0.5-2.8) and duration of antibiotic therapy (HR 1.0, 95%CI 0.96-1.02) did not influence treatment failure among patients with positive MRSA carriage.
Conclusions: Current or past HA-MRSA skin carriage poorly predicts the need for anti-MRSA coverage for the antibiotic treatment of skin and soft tissue infections in hospitalized orthopaedic patients.

P39

Congenital hip luxation and sciatic nerve paresis in a new born due to extreme intrauterine leg position: case report

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Introduction: In literature sciatic nerve palsy in new born has been described as a result of difficult breech delivery due to streching of the lumbosacral plexus or due to damage to the spinal cord. Another

reason described for sciatic nerve palsy is drug injection into the umbilical artery causing arterial spasm, followed by thrombosis jeopardizing the blood supply to the sciatic nerve. We present an interesting case of a new born with sciatic nerve paresis that was given birth by cesarean sectio due to breech presentation. Further, there was no injection to the umbilical cord.
Methods: 2010 a girl was born with an abnormal position of the left lower limb with hyperflexion in the left hip joint and simultaneously fully extended left knee after birth. Moreover, the girl showed a sciatic nerve paresis of the same leg. This case was reviewed regarding the cause and development of the sciatic nerve paresis.
Results: Intrauterine ultrasound showed already the abnormal position of the left lower limb with hyperflexion in the left hip joint and simultaneously fully extended left knee. Directly after birth, the child had the same abnormal position of the left lower limb. In clinical examination the left hip joint was luxated, further the child showed a consecutive sciatic nerve paresis and therefore a lack of muscular stability in the hip joint, so that reposition of the hip joint was very challenging. Several attempts of reposition had to be undertaken and even a temporary fixation with pins was required to bridge the time of lacking stability, till nerve paresis recovered and muscular stability was enough to keep the joint in correct reduced position.
Conclusion: The extreme intrauterine position of the leg during intrauterine development was of grave consequence. First, it was leading to an overextension of the sciatic nerve with consecutive paresis. Second, it was causing a hip luxation and therefore also delayed development of the femur head and acetabulum. Mainly the lacking muscular stability due to nerve paresis was reason for difficult reposition. At the end, the little girl showed complete nerve recovery and at the age of 14 months a normal developed acetabulum and femoral head.

P40

A 21 y.o. patient treated by extra-articular distal femur resection and reconstruction with megaprosthesis for a single metastasis, 9 years after her primary melanoma

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Title: A 21 yo patient with a single bone metastasis, 9 years after her primary melanoma, treated by extra-articular distal femur resection and reconstruction with a tumour prosthesis.
Introduction: Melanoma is very rare in children. Metastases usually develop within 2 years and the course is generally fatal. Bone metastases appear late and extremely rarely as a single lesion.
Case report: A 21 year old woman, with a history of melanoma (Breslow 1.1, Clark III) of her right shoulder 9 years earlier, presented with progressive dull pain and left knee effusion. Imaging revealed a 6x7cm osteolytic mass of her lateral femoral condyle, invading the soft tissues. A biopsy revealed a metastasis of her melanoma. The PET-CT did not show any other lesion, nor did skin investigation. After multidisciplinary discussion, we decided to treat it as a primary bone tumour, with wide extra-articular resection and reconstruction with a custom megaprosthesis. Because of the rapid growth of the tumour, we needed to resect it before the custom prosthesis was built, so we spanned the defect with a cemented unlocked intramedullary nail as a spacer, and did the reconstruction 5 weeks later with a musculo-cutaneous free flap to cover the defect of the vastus lateralis. The patient healed eventless and returned home 14 days after reconstruction. After 1 year follow-up, her knee was was painless; she was walking without limp, with an active flexion-extension reaching 130-25-0° (passive 130-0-0°). She was highly satisfied with the treatment. She had no evident disease and was proceeding with an immune therapy in our cancer centre.
Conclusion: Whenever possible, in single- or oligo-metatstatic patients from cancers that don't respond well to radiation- or chemotherapy, when life expectancy is estimated over 3–6 months, treatment should aim at wide resection of the lesions. This prevents from potentially severe local complications that can adversely affect life quality. Reconstruction with megaprostheses, although more demanding in terms of hospital stay, complications and cost, should be attempted , for it allows for better function and patient satisfaction.

P41

The Importance of 3D planning: Tumor Resection of the Proximal Radius sparing the Radial Head

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Introduction: Sophisticated radiological imaging studies nowadays allow the precise delineation of a musculoskeletal tumor preoperatively. This in turn paves the way for precise resections accepting closer margins with respect to the tumor. Preoperative 3D planning and intraoperative navigation plays therefore an increasingly important role in tumor surgery. Herein, we report our experience with 3D planning for a patient in whom the proximal radius was resected but sparing the radial head.
Results/Case Report: Preoperative CT imaging was used to 3D-print a plastic radius model. Then, the resection margins were determined and a custom made titanium plate as well as a cutting block device including the drill holes were manufactured. The proximal resection margin was chosen that only 1.5cm of the radial head could be preserved. Intraoperatively, the tumor was exposed and the cutting device was mounted. The drill holes were prepared in the radial head such that after resection, it could be fixed in the correct 3D position as before. An allograft was carpentered to precisely fit into the defect, and then the custom made titanium plate was used to fix it.
Conclusions: 3D planning and the manufacturing of a custom made cutting/pre-drill device can be very helpful for tumor resections at anatomically difficult locations and when a remaining bone has to be precisely retained in its original anatomic position.

P42

Allograft with Tibia Compression Nail Rekonstruction after dia- and metaphysealResection of a proximal tibia osteosarcoma

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Introduction: Intercalary reconstruction after wide tumor resection of the tibia remains a challenge because of the bone defect. The allograft using a intramedullary compression nail is one possible option to restore the defect.
Case: We present a 18 year old patient with a periosteal high grade surface osteosarcoma of the right proximal tibia meta-/diaphysis and no metastasis after neoadjuvant chemotherapy. A segmental resection was indicated to keep the tibial tuberosity with the extensor mechanism. Fitting an allograft and fixation with a intramedullary compression nail to restore the bone defect is one option. Because of a radiologically suspected skip lesion distal to the lower tumor pole, a resection length of 17.5 cm resulted while preserving the tibial tubercle. The allograft was fitted and fixed by a nail on the proximal and distal parts of the tibia. Adjuvant chemotherapy could be resumed less than 2 weeks postoperatively. The patient was mobilized with partial weight bearingfor 6 weeks, initially in a cast because of painful plantar flexion, afterwardsin a velcro splint. The tumor was removed with wide margins. The distal osteotomy is healed. At 15 months follow-up, the girl was free of pain. After completion of chemotherapy a dynamization of the nail was performed.
Conclusion: The fixation technique for allograft reconstruction using an intramedullary compression nail may represent a good option for biological reconstruction of a great bone defect of the tibia after tumor resection.

P43

A Pleomorphic Soft Tissue Sarcoma Arising in Burned Area at the Leg

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Introduction: Compared to squamous cell carcinoma which is the most common burn scar neoplasm, other neoplasms are rare but have also been reported. Literature review shows that seventy-one percent of the tumors are squamous cell carcinoma but only 5% were sarcomas. Gernerally these have a longer latency period compared to other neoplasm.
Results/Case Report: A 51-year-old man presented with an increasing lump at the right lower leg, for one month in a burn scar. He gave a history of severe burns over more than 35% of the total body surface11 months previously. Magnetic resonance image showed a well circumscribed mass in the anteromedial lower leg with mostly inhomogeneous isointensity relative to the muscle and scattered, small, hyperintense foci. Fine needle biospy showed a pleomorphic spindle cell sarcoma so we performed tumor resection on the right anterolateral lower leg including the periosteum of the tibia and the crural dorsomedial fascia. Pathology revealed an R0 resection. Together with the immunohistochemistry examination the resected specimen was identified as a myxofibrosarcoma. Now, 6 months postoperatively he recovered well and is free of any recurrence.
Conclusions: The association of a burn injury on a malignant soft tissue sarcoma is not well established. The malignant transformation of burn scars constitutes a long-term complication of burns. Although squamous cell carcinoma is the most frequent burn scar neoplasm the development of soft tissue sarcomas is possible and needs to be treated appropriately.

P44

Tissue engineered nasal cartilage for the regeneration of articular cartilage in goats

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Introduction: As compared to articular chondrocytes (AC), nasal septum chondrocytes (NC) proliferate faster and have a higher and more reproducible capacity to generate hyaline-like cartilaginous tissues. Moreover, the use of NC would allow reducing the morbidity associated with the harvesting of cartilage biopsy from the patient. The objective of the present study was to demonstrate safety and feasibility in the use of tissue engineered cartilage graft based on autologous nasal chondrocytes for the repair of articular defect in goats.
Methods: Isolated autologous NC and AC from 6 goats were expanded and GFP-labelledbefore seeding 4x104 cells/cm2 on atype I/III collagenmembrane (Chondro-Gide®, Geistlich). After 2 weeks of chondrogenic differentiation 2 NC- and 2 AC-based grafts were implanted into chondral defects (6 mm diameter) of the same posterior stifle joint. Repair tissue was harvested after 3 or 6 months and the decalcified samples evaluated according to O'Driscoll. Furthermore, samples from the surrounding fat pad, ligament, synovium, tendon and patellar cartilage were harvested and isolated cells tested for GFP-positivity after expansion using FACS.
Results: No complications or signs of inflammation occurred in any of the animals. GFP-positive cells were detectable in the repair tissue, indicating the contribution of the implanted cells to the newly formed cartilage. The O'Driscoll score of 8.6 and 7.6 after 3 months increased to 14.1 and 12.4 after 6 months for nasal and articular grafts, respectively. Surrounding tissues showed no or very low (fat pad 0–0.36%) migration of the grafted cells.
Conclusion: Our results demonstrate the use of NC as safe and feasible for tissue engineering approaches in articular cartilage repair. The repair tissue-quality generated by NC-grafts was demonstrated to be at least comparable to that of AC-grafts, thus opening the way for clinical test of a novel therapeutic strategy.
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P45

Evaluation of positron emission tomography in preclinical models of osteosarcoma

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Introduction: Osteosarcoma (OS) is the most common malignant bone tumor in children and adolescents characterized by the production of immature bone, osteoid. In normal bone, the resorbtion by osteoclasts is linked to bone formation. In OS, osteolytic and osteoblastic phenotypes, as a result of imbalanced bone resorption and formation, are distinguished radio- and histologically. The different phenotypes, associated with differences in tumor proliferation and hypoxia, determine at least in part the response to chemotherapy and, consequently, the patient's outcome. Novel minimally-invasive diagnostic tools are needed for future more patient-tailored treatment depending on more precisely defined tumor phenotypes. Here, Positrion Emission Tomography (PET) with 18F-FDG, indicating glucose metabolism, 18F-Fluoride, indicating bone remodelling and 18F-FMISO indicating hypoxia, is used in 3 different mouse models with well-defined phenotypes, reflecting OS heterogeneity, to evaluate the respective predictive power of the 3 PET tracers in OS diagnostics.
Methods: 2 human (143B, osteolytic; and SaOS-2, osteoblastic) and 1 mouse OS cell line (LM8-osteoblastic) were intratibially injected in SCID immunosuppressed and C3H immunocompetent mice, respectively. Intratibial primary tumor development was monitored by X-ray. PET was performed at the Animal Imaging Center at ETH-Hönggerberg 3 weeks after tumor cell injection in the 143B and LM8 models and between 2 and 5 months after injection of human SaOS-2 cells in SCID mice. Tracer uptake in the tumor leg was quantified with p-mod software and compared to the control leg.
Results: In the 143B cell line, a significantly higher uptake of FDG and FMISO is observed in the tumor compared to the control leg, but there is no difference in Fluoride uptake which is consistent with the histological results. The SaOS-2 cell derived tumors, on the other hand, display high uptake of FDG, FMISO and Fluoride, reflecting a proliferative and hypoxic osteoblastic phenotype. LM8 mouse OS cell derived tumors show a high tumor selective accumulation of FDG, but only moderate uptake of FMISO and Fluoride consistent with low osteoblastic activity and hypoxia.
Conclusions: FDG, FMISO and Fluoride proofed to be predictive in the 3 intratibial OS mouse models with well characterized phenotypes and therefore suitable for primary tumor monitoring in pre-clinical studies investigating novel phenotype- and histotype-specific treatment modalities.

P46

Gemcitabine significantly inhibits primary tumor growth and metastasis of lacZ-tagged and untagged LM8 osteosarcoma cells in syngeneic C3H mice

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Introduction: Gemcitabine, an analog of cytosine arabinoside, is a standard chemotherapeutic that interferes with DNA synthesis. It shows good antineoplastic activity against a variety of human cancers. So far, gemcitabine has not been clinically tested in osteosarcoma (OS), the most frequent primary malignant bone tumor. In the present study, we pre-clinically investigated the potential of gemcitabine to inhibit primary tumor growth and metastasis in the established murine LM8 OS model.
Methods: C3H mice were subcutaneously inoculated with 1x107 lacZ-tagged or untagged LM8 cells and then treated intraperitoneally with 150 mg/kg gemcitabine or vehicle control on day 7, 14 and 21. On day 26, all mice were sacrificed and lungs and livers removed. For the LacZ-tagged LM8 cells, indigo-blue OS metastases on the organ surfaces were counted after X-Gal staining. For comparison, metastases were counted in H&E stained paraffin sections of lung and liver tissue of mice injected with lacZ-tagged LM8 as well as of those inoculated with the untagged LM8 cells.
Results: Gemcitabine strongly inhibited primary tumor growth in both LM8- and LM8-lacZ-inoculated mice resulting in significantly ($P < 0.01$), ten times smaller subcutaneous tumors as compared to the controls. In LM8-lacZ-inoculated mice, also lung macrometastasis was significantly ($P < 0.0001$) inhibited by over 99% and in the liver, gemcitabine treatment even completely prevented the formation of detectable macrometastases. This impressive antimetastatic effect was confirmed for both LM8- and LM8-lacZ-inoculated mice in H&E stained paraffin sections of lungs and livers.
Conclusions: Our results confirm the general strong antineoplastic efficacy of gemcitabine and indicate that this chemotherapeutic might by suitable for neoadjuvant OS therapy in humans. Furthermore, the data demonstrate that lacZ-tagging of the tumor cells does not interfere with the chemotherapeutic treatment which is an important finding for the testing of new drug in preclinical cancer research.

P47

CD44 overexpression enhances metastatic properties of human osteosarcoma SaOS-2 cells in vitro and in vivo

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Introduction: Pulmonary metastases are the major cause of death in patients suffering from OS, a disease mainly affecting children and adolescents. At the time of diagnosis, up to 15–20% of patients already have detectable metastases. Patients with metastatic or recurrent disease continue to have a poor prognosis, with a 5-year survival rate of 10–20%. Thus, it is of substantial importance to identify molecular markers in OS associated with increased metastatic potential. CD44 is frequently found overexpressed in tumour cells and has been implicated in metastasis of different cancer types. It is a cell-cell and cell-matrix adhesion molecule and the principal receptor for hyaluronan (HA), a major component of the extracellular matrix. CD44 has a wide repertoire of functions in biological processes, including development, wound healing, inflammation, haematopoiesis, immune response and tumor progression. Here, we investigated the effects of stable CD44 overexpression on in-vitro and in-vivo metastatic properties of low metastatic human LacZ-transduced SaOS-2 (SaOS-2/LacZ) OS cells expressing low levels of endogenous CD44.
Methods: To assess the relevance of CD44-HA interaction in promoting metastatic ability of OS cells, we overexpressed both, the standard CD44 isoform CD44s and the HA binding-defective mutant CD44s R41A in SaOS-2/LacZ cells using retroviral gene transfer. Overexpression was examined on Western blots. The biological impact of CD44s and CD44s R41A overexpression was then studied in-vitro in adhesion, transwell migration and proliferation assays. Effects of CD44s and mutant overexpression on tumor progression and metastasis in-vivo were investigated in an intratibial xenograft OS model in SCID mice.
Results: SaOS-2/LacZ cells overexpressing CD44s showed increased adhesion to HA, whereas overexpression of binding-defective CD44s R41A did not affect the adhesion when compared to empty vector (EV) transduced SaOS-2/LacZ control cells. Overexpression of CD44s and CD44s R41A resulted in HA-independent higher migration rates. In the

orthotopic mouse model of OS, CD44s overexpression led to faster primary tumor growth and increased numbers of micro- and macrometastases in the lungs in a HA-dependent manner.
Conclusions: These results highlight the important role of CD44/HA interaction in determining tumor malignancy in experimental OS in mice.

P48

IL-1β modulates in vitro remodeling and in vivo bone formation by endochondral primed human bone marrow mesenchymal stromal cells

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Introduction: The milieu of the fracture site contains many inflammatory cytokines not only during the initial inflammatory phase but also later remodeling phase. We aimed at studying the influence of IL-1β on relatively late events involved in the endochondral bone formation by human bone marrow stromal cells (hBM-MSC) namely the remodeling of the cartilage template and the formation of cortical bone in vivo.
Methods: Expanded hBM-MSC were cultured in collagen sponges, using a previously established protocol (3 weeks with chondrogenic medium and 2 weeks with hypertrophic medium with or without 50 pg/ml IL-1β) and then implanted ectopically in nude mice for 5 and 12 weeks. Constructs were analyzed biochemically (calcium, glycosaminoglycane (GAG)), by RT-PCR (MMP-13), histologically (Safranin-O, Alizarin red) and immunohistochemically (cryptic fragment of aggrecan (Dipen) and with quantitative µCT (total bone volume).
Results: As compared to controls, samples exposed to IL-1β (i) accumulated 38% more calcium resulting in a thicker calcified bone collar, (ii) lost 12% more GAG and (iii) expressed higher levels of MMP-13 mRNA and increased accumulation of DIPEN. After 5 weeks in vivo, IL-1b treated samples contained (i) larger bone marrow areas and (ii) reduced cartilaginous areas and (iii) higher amounts of MMP-13 and DIPEN. After 12 weeks in vivo, IL-1b treated samples showed a thicker outer bone collar with increased, even though not statistically significant, total bone volume.
Conclusion: IL-1b treatment during the in vitro endochondral priming of hBM-MSC resulted in and advanced degree of cartilage remodeling and subsequent more mature bone in vivo. Controlling the inflammatory environment could enhance the success of therapeutic approaches for the treatment of fractures by resident MSC and as well improve the engineering of implantable tissues.
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P49

Identification of Caprin-1 as a new Cyr61-associated protein within stress granules in osteosarcoma cells

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Introduction: Osteosarcoma is the most frequent primary malignant bone tumor in children and adolescents with a high propensity for lung metastasis, the major cause of disease-related death. Recently, we demonstrated that overexpression ofthe extracellular matrix protein Cyr61 promotes primary tumour growth and lung metastasis in an intratibial xenograft mouse model and indicates poor prognosis of patients with Osteosarcoma (Sabile et al., JBMR 2012). In the present study, we identified a new Cyr61-interacting protein, Caprin-1 (cytoplasmic activation/proliferation-associated protein-1).
Methods: We have immunoprecipitated endogenous Cyr61 with specific antibody and performed mass spectrometric analysis to identify Cyr61-interacting proteins. Then, we investigated the subcellular localization of Cyr61 and Caprin-1 using a detailed confocal microscopy analysis.
Results: We identified Caprin-1 as a novel Cyr61-associated protein. Furthermore, we showed that Cyr61 and Caprin-1 form a complex within stress granules (SGs).
Conclusion: Using a proteomics approach, we identified Caprin-1 as a novel Cyr61-interacting protein. Furthermore, we demonstrated that Cyr61 and Caprin-1 form a complex in vivo within cytoplasmic SGs. SGs are a major adaptive cell defense mechanism, particularly to environmental stress such as hypoxia or heatshock. Currently, we are investigating in detail the interplay between Cyr61 and Caprin-1 and their functions in the context of osteosarcoma pathogenesis.

P50

C-MET signal transduction in different human osteosarcoma cell lines

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Introduction: Osteosarcoma (OS) is the most frequent primary malignant tumor of bone typically affecting children and young adults. It is associated with a very poor prognosis particularly for those patients with metastasis at diagnosis. C-MET is a receptor tyrosine kinase with hepatocyte growth factor (HGF) as natural ligand. In a variety of cancers, the activity of C-MET is deregulated. Three major MET-regulated signaling pathways have been identified: 1) The mitogen-activated protein kinase (MAPK) cascades with Erk as one of the terminal effectors; 2) The Phosphoinositide 3-kinase (PI3K)/Akt axis and 3) the Signal Transducer and Activator of Transcription 3 (STAT3) pathway. The purpose of this study was to identify the HGF-dependent signal transduction pathways used in different human OS cell lines.
Methods: C-MET expression of four human OS cell lines (HOS/143-B cells with no HGF expression and MG63/MG63-M8 cells expressing HGF) was determined by RT-PCR and western blot analysis. In additional experiments, the cell lines were starved and afterwards incubated with 100ng/ml HGF for the time periods below. Phosphorylation of Erk1/2, Akt and STAT3 were analyzed by western blots.
Results: Endogenous C-MET expression was found on mRNA and protein levels for all four OS cell lines analyzed. Activation of C-MET by HGF didn't induce the STAT3 pathway in all OS cell lines tested. In both, MG63 and MG63-M8 cells, the PI3K/Akt pathway and especially the MAPK cascade were activated upon HGF incubation with a maximum after 10 to 15 minutes. Also in HOS and 143-B cells, the PI3K/Akt pathway was activated with a maximum after 10 to 15 minutes. In contrast, the MAPK cascade with Erk1/2 as terminal effector was strongly induced and remains activated still after 60 minutes.
Conclusions: Our results indicate that in different OS cell lines signal transduction after C-MET activation is mediated by the MAPK cascade and to minor extent by the PI3K/Akt axis.

P51

Fuctional role of Mapsin regulated by p63 in osteosarcoma progression

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Introduction: Osteosarcoma is the most common type of primary bone cancer. It arises in bone during periods of rapid growth and primarily affects adolescents and young adults. Maspin is a protein of the serpin family of protease inhibitors. It acts as a tumor suppressor capable of inhibiting motility, invasion and metastasis. We are investigating the role of maspin regulated by p63 in osteosarcoma progression. We could show that expression of maspin is up-regulated in p63 isoform TAp63 α, γ and ΔNp63 α while it is down-regulated in ΔNp63γ isoform in p63 stably transfected SaOS-2 cells.
Methods: p63 (TAp63 α, γ and ΔNp63 α, γ) stable SaOS-2 cell lines were generated by retroviral infection. The expression levels of p63 isoforms in stable transfected cell line was analysed by western blot. Maspin expression was analysed by RT PCR, Western blot and immunocytochemistry in p63 stable SaOS-2 cells.
Results: All the isoforms of p63 were expressed in p63 transfected stable SaOS-2 cell lines as revealed by western blot. By RT-PCR and western blot analysis we found that maspin levels were up-regulated in TAp63 α, γ and ΔNp63 α in stably transfected SaOS-2 cells while down-regulation of maspin was seen in the ΔNp63γ isoform. Immunocytochemistry experiments revealed that maspin expression is localised in the nucleo-cytoplasmic region in TAp63 α, γ and ΔNp63α stably transfected SaOS-2 cells in accordance with the results obtained from Western blot and RT-PCR.
Conclusions: Our results indicate that maspin is regulated by the isoforms of p63 (TAp63 α, γ and ΔNp63 α). To further elucidate the functional role of maspin in p63 stably transfected cells, siRNA strategy will be employed. ChIP assays could further reveal the direct binding of p63 isoform to maspin promoter. In vivo analysis of maspin expression in the established intratibial OS model will be performed.

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Evaluation of a robotic apparatus for the analysis of passive glenohumeral joint kinematics

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The glenohumeral (GH) joint has the greatest range of motion in the human body but little intrinsic stability, thereby increasing its susceptibility to excessive translations and injury. Current models used to study shoulder kinematics are limited because they isolate the GH joint, implement dynamic motion patterns with low reproducibility, and track motions discontinuously or with limited accuracy. To overcome these limitations, we have designed a novel system in which the entire shoulder girdle is studied using highly reproducible trajectories created by a robotic actuator to control a full cadaveric torso. High-speed cameras track bone markers and calibrated anatomical scapular landmarks for continuous registration of the center of the GH joint. In this study, we evaluated the system's capacity to capture reproducibly GH translations in intact and pathologic shoulder conditions. We subjected a left and a right shoulder of two anthropometrically different cadaveric torsos to three sequential trials of humeral elevation prior to and after the implementation and restoration of scapular winging as well as a full thickness supraspinatus tear. The system was consistently capable of detecting differences in GH translations as small as 0.5mm between the intact, altered, and restored shoulder presentations. For each condition, three trials were performed. The registration of GH translations was highly reproducible with intraclass correlation coefficients (ICC) of 0.77 to 0.99 ($P < 0.001$) and standard deviations (SD) of 0.16 mm to 0.64 mm. These data illustrate the system's high validity in describing GH kinematics.

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