**Fuss / Spezialgebiet Kinder - Pieds / Domain spécial enfants (FM 57 – FM 68)**

**FM57 Ponseti Treatment in older and previously treated child using below knee semi-rigid fiberglass cast (SoftCast®): efficiency and limits**

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**Introduction:** Long leg casting is necessary in newborns for proper foot fixation during clubfoot treatment. We use SoftCast® for Ponseti treatment since 2001 and did not appreciate any difference in terms of duration of treatment compared with regular plaster cast. SoftCast® is lighter and easier to remove. To improve compliance we also use fixation below the knee in children older than 2 years allowing the child to walk free during treatment. The purpose of this study is to evaluate the efficiency of Ponseti treatment in difficult situations such as relapsed or previously treated clubfeet in older children using fixation with below knee Soft Cast®.

**Methods:** 38 feet of 28 patients (23 boys, 5 girls) with residual clubfoot deformity were treated by Ponseti technique with fixation with below knee SoftCast® until full correction or no further progression of correction was achieved. In some cases in older children the goal of treatment was just improvement of foot position and joint mobility to reduce operative steps and complications.

**Results:** Mean age at onset of treatment was 4.6 years (2-15). Mean follow up was 3.1 years (0.4-9.7). 3-14 casts (average 7) were needed. Mean treatment duration was 10.4 weeks (5-20.1). Change of casts were usually done after 10 days (6-16). On 27 feet (71%) of 21 patients (75%) full correction could be achieved after 8 casts (9.8 weeks). Of this group 6 feet (22%) on 5 patients (24%) needed additional tenotomy of tendon Achilles during treatment. 11 feet (41%) of 7 patients (33%) of this group developed partial relapse which needed further treatment. 11 feet (29%) in 7 Patients (25%) needed additional limited surgery after Ponseti treatment (tibialis anterior transfer or / and additional bony procedures).

**Conclusions:** Ponseti Method is extremely efficient even in older children and particularly difficult situations. With only exception of feet who showed severe stiffness due to secondary joint deformity (all previously operated) Ponseti Method is powerful enough to reduce deformity completely reduce its severity and improve joint mobility allowing less invasive surgery. We believe that in children older than 2 years fixation below the knee joint, which is allowing free gait, can be as efficient as long leg cast fixation. Perfect modeling around the ankle joint is mandatory.
Freie Mitteilungen V / Communications libres V
Fuss / Spezialgebiet Kinder - Pieds / Domain spécial enfants (FM 57 – FM 68)

FM 58 Quadricepsplasty for congenital dislocation of the knee and congenital contracture

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Introduction: We encountered problems with the Curtis & Fisher technique of quadricepsplasty for congenital quadriceps contracture including wound dehiscence, insufficient lengthening of the quadriceps and instability of the knee. We modified the operative technique to address these three problems. We undertook this study to evaluate the results of the modified technique of quadricepsplasty to determine if we succeeded in overcoming these limitations of the original technique.

Methods: Twenty children (33 knees) underwent the modified Curtis & Fisher quadricepsplasty through a lateral incision; a long tongue of the rectus femoris was raised and the vasti mobilised without dividing the lateral retinaculae till the collateral ligaments. The children were followed up for a mean period of 63 months and evaluated. The healing of the wound, active and passive range of motion of the knee, the stability of the knee, quadriceps power and knee function were assessed.

Results: Primary wound healing occurred in 32 of 33 knees. Adequate lengthening of the quadriceps sufficient to facilitate knee flexion to 90 degrees was possible. Considerable improvement in the range of motion was noted. In non-syndromic congenital dislocation of the knee (CDK) the quadriceps power was Grade 5 but, minor degrees of extensor lag was noted. In a proportion of patients minor degrees of joint instability was present. The majority of children were community walkers. The overall results were better in non-syndromic CDK than in children with arthrogryposis but differences of some variables were not significant.

Discussion: The modifications to the original Curtis & Fisher technique overcame the specific problems they were expected to avoid.
Introduction: A child’s natural gait pattern may be affected by the gait laboratory environment. Wearable devices using body-worn sensors have been developed for 3D gait analysis. The purpose of this study was to validate and explore the use of foot-worn inertial sensors for 3D gait measurement in independently walking children with cerebral palsy (CP).

Method: We performed a case-control study. We analysed 14 children with CP old and 15 controls, aged 6 to 15 years old. Two U-shaped and two 8-shaped trial walks per subject were performed during which accuracy and precision of the foot-worn device was measured using an optical motion capture system (Vicon, Oxford Metrics) as the reference system. All subjects then performed a continuous 200-meter walk wearing the foot-worn inertial sensors (Physilog III, LMAM-EPFL, Switzerland). Limb-related spatio-temporal parameters were compared between paretic and control limbs while bilateral gait characteristics were compared between CP and control subjects, using nonparametric analyses.

Results: Mean accuracy ± precision for both groups was 3.4 ± 4.6 cm for stride length, 4.3 ± 4.2 cm/s for speed and 0.5 ± 2.9° for strike angle. Gait spatio-temporal parameters showed longer stance and shorter swing phases with an increase in double support in children with CP (p=0.001). Stride length, speed and peakswing angular velocity were decreased in paretic limbs, with significant differences in strike and lift-off angles. Children with cerebral palsy showed significantly higher intra-individual variability (measured by their coefficient of variation) for speed, stride length, swing and stance phases. During turning trajectories speed and stride length decreased significantly (p<0.01) for both groups, whereas stance increased significantly (p<0.01) in CP children only.

Conclusion: Foot-worn inertial sensors allowed us to analyze gait kinematics outside a laboratory environment with a good accuracy and precision. The case control comparison yielded results which were congruent with what is known of gait variations in children with cerebral palsy who walk independently. Participants found the system light weight and easy to wear and use. While not substituting for complete 3D gait analysis, portable sensors provide precise information about gait in conditions that are closer to the child’s habitual environment and motor behaviour, and could therefore prove to be a useful complement.
FM60  Analysis of osseous and cartilaginous acetabular angles on MRI in children

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Introduction: In patients with developmental hip dysplasia (DDH) a plain radiography of the pelvis can show an insufficiency of osseous acetabular coverage of the femoral epiphysis but we are not able to quantify the quality of the real coverage of the femoral head consisting of the acetabular bone, cartilage and labrum. The MRI allows a good tissue differentiation between the bone, the cartilage and fibrous tissues. The measure of the cartilaginous angle of Hilgenreiner (HTE) appreciates the morphology of the cartilaginous borders of the acetabulum, which will gradually ossify with growth. This cartilaginous HTE appreciates the theoretical cover at the end of growth.

We performed coxometric analysis of the cartilaginous and osseous limits of the acetabulum on frontal MRI imaging from healthy and dysplasic hips.

Material and Method: We included 30 children (mean age 5y) who had a MRI imagery of both hips. The diagnoses for the 60 hips were 22 healthy hips, 11 hips treated for Perthes disease and 27 hips with DDH. We measured the cartilaginous and osseous angles of Hilgenreiner (HTE) on both hips on T2 weighted frontal images where the centers of the femoral epiphysis were best seen. We calculated then the ratio of the square of cartilaginous HTE (C²) above the osseous HTE (O). This ratio C²/O expresses the residual cartilaginous growing-potential of the acetabulum.

Results: For the healthy hips, the ratio varies from 0.75 to 6.78. 81% of these hips show a ratio lower than 5. The hips with DDH show a ratio from 4.73 to 14.9 with 95% higher than 5, including 23% that have a ratio above 10. The hips with Perthes disease show a mean ratio of 2.75, with only one hip above 5.

Discussion: If we consider a hip at the end of growth, the value of the osseous angle tends towards that of the cartilaginous angle; the ratio C²/O is then equivalent or inferior to the osseous HTE. The mean value of this angle at the end of growth was evaluated by Bédouelle at al. at 12° at the age of 8 – 10 years and for younger children between 15-20°. The trial shows a theorical "normal" value for this cartilaginous HTE inferior to 10° . This angle is corroborated with the average values we obtained from the 22 healthy hips and the 11 hips with Perthes. The hips with DDH in our study have 88% cartilaginous HTE above 10° and a mean value of 14.2°.

Conclusion: The ratio C²/O enables us to classify the hips in 3 categories: Group A includes hips with a ratio inferior to 5. Group B includes hips with a ratio from 5 to 10 and group C includes hips with a ratio above 10. Group A represents the hips with a great potential of standardization with growth. Group B includes hips that have less optimal correction potential, but still have a chance of normalization with growth and Group C represents severely dysplasic hips in which the cartilaginous potential of growth is insufficient and where a surgery of reorientation of the acetabulum is indicated.
In future, estimation of cartilaginous and osseous angles based on MRI imaging could help evaluate the indication of a pelvic osteotomy for acetabular reorientation in children with residual developmental hip dysplasia.
Loss of a condyle of the femur or tibia following septic arthritis in infancy: problems of management and testing of a hypothesis of pathogenesis

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Introduction: The study was undertaken to i) describe the characteristic radiological features and problems of management of the loss of one condyle of the femur or tibia following septic arthritis of the knee in infancy and ii) to test a hypothesis of the cause of the loss of a single condyle.

Methods: Radiographs of eight children with loss of one condyle of the femur or the tibia following septic arthritis in infancy were reviewed. The course and outcome in two of these children who underwent reconstructive operations were studied. Knees of 35 stillborn foetuses were dissected to determine if presence of synovial septae could account for isolated loss of one condyle following infection.

Results: All eight cases showed characteristic features of loss of half the epiphysis, the underlying physis and part of the adjacent metaphysis; the other condyle was totally spared. The two children who underwent elaborate reconstructive procedures had poor outcomes at skeletal maturity despite a series of additional operations. The foetal cadaveric study showed that complete infrapatellar synovial septae are present in some foetuses approaching 40 weeks of gestation.

Discussion: The pattern of loss of a femoral or tibial condyle following septic arthritis is consistent with total preservation of the other condyle. The outcome of surgical reconstruction of the missing condyle is poor. The presence of a complete synovial septum could result in localisation of infection to one half of the joint with destruction of one condyle.
Introduction: Severe postoperative pain or decreased range of motion after temporary hemiepiphysiodesis with plates on the distal medial femur is a condition rarely described in literature. It can lead to prolonged hospitalisation with intensive need for physiotherapy. As the femoral insertion of the medial patellofemoral ligament (MPFL) is located close to the medial femoral epicondyle and physis, this structure potentially is in danger by the surgical approach. We hypothesize a high occurrence of iatrogenic damage to the MPFL or trapped soft tissues by the plate and therefore to be the reason for reduced range of motion or pain.

Methods: In eight cadaveric knees (3 right, 5 left knees, mean age 78y) of six specimens a 3.5mm two-hole one-third tubular plate was implanted under fluoroscopic guidance in the area of the distal medial physis of the femur in a standardized surgical technique. The following dissection revealed trapped tissue by the plate and the integrity of the MPFL. The plate position was classified to be either extra- or intraarticular.

Results: The MPFL was completely cut in 2 of 8 cases. In 4 of 8 cases the MPFL was trapped under the plate. In only 2 cases the MPFL was neither damaged nor trapped and no capsular or synovial tissue was pinged by the plate, which was therefore classified as extraarticular. In 4 knees the plate was placed partially intraarticular by injuring the joint capsule and fixing synovial tissue. 6 of 8 knees showed therefore affection of underlying tissue.

Conclusion: The MPFL is the most common injured or trapped anatomical structure in this cadaveric study. Despite correct plate insertion for hemiepiphysiodesis, these results assume an explication for prolonged postoperative pain and decreased range of motion in patients treated with this technique.
A novel treatment for osteochondritis dissecans of the knee: Introducing the ‘doorstop phenomenon’.

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Introduction: Osteochondritis dissecans (OCD) of the knee in paediatric patients is a relatively common problem that can be difficult to treat. We hypothesised that a key aetiological factor may be instability of the meniscus whereby the free peripheral edge of this meniscus acts as a ‘doorstop’ jamming between the femoral and tibial condyle inducing a repetitive trauma which over time results in the typical OCD lesion. We tested this hypothesis by stabilising the meniscus only as treatment for OCD in 10 knees.

Methods: Prospective case series. 11 knees in 10 patients with a mean age of 13 years with symptoms (mean of 18 months) had an MRI confirmed diagnosis of OCD. At arthroscopy all were found to have an unstable anterior meniscus which was stabilised with an out-in suturing technique. Patients were assessed by functional scoring and radiographically by MRI both preoperatively and postoperatively. Mean follow up was two years.

Results: 4 cases demonstrated complete healing radiographically at 3 months, 3 more cases were healed on MRI by 6 months and all had complete resolution on MRI by 1 year. Subjectively all patient reported their knee as ‘much improved’. The Hughston score improved significantly in all and had reached normal levels by 1 year. 2 complications were reported: 1 infection and 1 traumatic failure of suturing requiring reoperation

Discussion: The aetiology of OCD is unclear but we clearly demonstrate that treating an associated unstable meniscus alone can result in complete resolution radiographically of the OCD along with excellent improvement in patient related outcome measures.
FM64 Rim Instability in Lateral Discoid Meniscus

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Introduction: Rim instability is recognised as an additional problem in treating discoid meniscus. Often this condition leads to a repair of the detached peripheral attachment. The aim of this study was to determine the prevalence of peripheral rim instability in lateral discoid meniscus.

Methods: A consecutive series of 65 knees (53 patients, mean age 10y, range 4 to 16y) underwent arthroscopy for symptomatic lateral discoid meniscus between 1991 and 2013. Intraoperatively the meniscus was classified in size (complete or incomplete discoid morphology). The stability anterior, lateral corpus and posterior was tested with probing to assess evidence of hypermobility. Data were analyzed using the Student t-test for continuous data and the Fisher exact test for categorical data.

Results: 38 (58,5%) were classified as complete discoid lateral menisci (Group A) and 27 (41,5%) as incomplete (Group B). 49% (n=32) of all menisci were instable (17 incomplete). No significant difference was detected between this two groups (p>0,05). The anterior part of the meniscus showed lack of stability in 23 cases (72%), the corpus in 14 (44%) and the posterior part in 20 cases (63%). Thirteen were unstable only in one part of the meniscus (8 anterior, 25%; 5 posterior, 15,6%). Twelve were unstable in two parts of the meniscus (in each case 4, 12,5%; anterior and corpus; corpus and posterior; anterior and posterior), and in seven cases (22%) the whole lateral meniscus was affected. No significant difference were detected (p> 0,05). No age related differences in stability was found (p>0,05).

Conclusion: This study shows a high rate of rim instability in discoid lateral meniscus. According to this findings a precise examination of the rim stability intraoperatively is recommended and therapy of instability is necessary.
**FM65 The Anterior Intermuscular Septum. A suitable guideline in the course of the superficial peroneal nerve**

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**Introduction:** Variable location of the superficial peroneal nerve (SPN), either in the lateral or anterior compartment of the lower leg, and risk of its damage during surgery should be considered. However, we currently lack a clear strategy as to where and how the SPN can be located most effectively. From clinical routine the close proximity of the SPN to the anterior intermuscular septum (AIS) is known, however, the exact relationship between these two structures has not been comprehensively investigated. Thus, the aim of the present study was to view the SPN in relation to the AIS and to determine whether that would be of practical value for a safe technique for SPN dissection.

**Methods:** 164 SPNs were dissected in 137 cadaver legs of 72 specimens. The entire course of each SPN was recorded and described with respect to the AIS at two points on the fibula (x/3 and 2x/3, x being the length of fibula). 1) the distance where the SPN runs adjacent to the AIS, 2) the distance between the point x/3 and the point where SPN pierces the AIS and 3) the distance between the point 2x/3 and where the SPN pierces the AIS were calculated.

**Results:** In 68.6% (94 cases) the SPN coursed in the lateral compartment (lateral leg-type), in 11.7% (16 cases) in the anterior compartment (anterior leg-type) and in 19.7% (27 cases) in both the anterior and lateral compartments (intermediate leg type). 80.5% of the 164 traced SNPs coursed in the lateral and 19.5% in the anterior compartment. At the point x/3 the SPNs were consistently found in close proximity or adjacent to the AIS; 0 to 10mm and 0 to 18 mm respectively. At the point 2x/3 the SPNs coursed a distance of 0 to 26 mm from the AIS.

**Conclusion:** In the majority of patients the SPN can be localised 1/3 of the fibula length proximal to the lateral malleolus adjacent or very closely lateral to the AIS. In the remaining cases the SPN can be found medial to the AIS. The localization of the AIS is a simple procedure and can be achieved even under difficult conditions such as trauma, swelling, or after previous surgery with scarring. Therefore, the AIS can be used as a suitable landmark while performing a dissection of the SPN.
Visualization of the Talar Dome by Anterior versus Posterior Ankle Arthroscopy: A Cadaver Study

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Introduction: Arthroscopy has become a valuable and important diagnostic and therapeutic procedure for treatment of pathology of the tibiotalar and more recently the posterior subtalar joint. Although the safety of portal placement for posterior ankle and subtalar arthroscopy has been shown in anatomic studies, little is now about the visualization and accessibility of the talar dome by posterior ankle arthroscopy. Therefore, the objectives of this study were to (1) assess the visualization of the talar dome through anterior versus posterior arthroscopic approaches with the standard non-invasive distraction, and (2) assess the effect of the minimally invasive calcaneal distraction.

Methods: We used 14 matched fresh cadaveric thigh to foot specimens. The mean age of the cadavers was 54.3 ± 9.0 years (range, 38 to 63 years). The order of the arthroscopic procedure (anterior vs. posterior) and use of a distraction method (non-invasive vs. minimally invasive) has been randomly determined using a computerized random number generation. The visualized area has been marked using a ring curette (anterior ankle arthroscopy) or an electrocautery (posterior ankle arthroscopy). After the arthroscopies the tibiotalar joint was disarticulated and previously marked areas were analyzed.

Results: The mean talar sagittal length was 45 mm (range, 43 to 50 mm), the mean total talar area was 1220 mm² (range, 1043 to 1443 mm²). In specimens with non-invasive distraction the accessibility of the talar dome was greater using anterior approach than posterior approach (P = 0.007). The use of minimally invasive distraction did not change the accessibility of the talar dome in specimens with anterior ankle arthroscopy with 743 ± 180 mm² vs. 716 ± 240 mm², respectively (P = 0.590). In specimens with posterior ankle arthroscopy the use of minimally invasive distraction significantly increased the talar dome accessibility with 480 ± 178 mm² vs. 703 ± 269 mm², respectively (P = 0.031).

Conclusion: Intraarticular pathology in the anterior 60% of the joint can be well addressed via anterior ankle arthroscopy using standard distraction technique. Lesion located more posterior are better addressed via posterior arthroscopy: calcaneal pin distraction may increase the articular visualization.
Foot biomechanics and muscle activation during walking after joint preserving realignment surgery for asymmetric ankle osteoarthritis

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Introduction: Osteoarthritis (OA) of the ankle is often asymmetric with a hindfoot malalignment into varus or valgus. Patients often have partially intact articular cartilage and can benefit from joint preserving realignment surgery with hindfoot and supramalleolar osteotomies. The purpose of this study was to quantify bilateral biomechanical and neuromuscular adaptations during walking in patients with asymmetric ankle OA before and after realignment surgery.

Methods: A 3D gait analysis with bilateral surface electromyography (EMG) of gastrocnemius medialis, soleus, peroneus longus, and tibialis anterior was performed in: 7 patients with asymmetric ankle OA before (P1a) and 12 to 18 months after surgery (P1b), 7 other patients 8 to 9 years after surgery (P2), and 15 healthy subjects (C). For each subject 6 trials were recorded. EMG envelopes of each muscle were analyzed using principal component analysis (input: 101 time points x 432 trials). The first 2 principal components (PC) scores, kinematic, and kinetic parameters were averaged for each leg and subject and compared between the groups using ANOVA (P<0.05).

Results: The range of motion of the affected foot was significantly reduced in hindfoot dorsiflexion (C: 22.6±4.1°; P1a: 15.3±5.3°; P1b: 11.1±5.3°; P2: 13.3±3.7°) and forefoot supination (C: 12.4±2.4°; P1a: 9.5±3.1°; P1b: 7.5±1.8°; P2: 8.7±2.3°) in all patient groups. The peak ankle plantarflexion moment was significantly lower for both legs in P1a (OA ankle: 1.4±0.3 Nm/kg; healthy ankle: 1.5±0.2 Nm/kg) and P1b (1.1±0.2 Nm/kg; 1.3±0.2 Nm/kg) patients than in controls (1.7±0.1 Nm/kg). PC1 of gastrocnemius medialis altered the peak activation and the PC scores were significantly lower than in controls in P1a (both legs) and P1b (affected leg) patients. For soleus, PC1 scores (peak activity) were lower for the affected leg in the P1a patients.

Conclusion: The biomechanical changes were likely related to a reduced mobility of the ankle joint. Long-term follow-up patients (P2) showed fewer changes in their gait pattern, especially for the temporal muscle activation. This could indicate that one year after surgery patients were still adjusting to the altered biomechanics. As clinical results already showed reduced pain and improved quality of life, the present study suggest that realignment surgery is a worthwhile alternative treatment option for patients with asymmetric ankle OA.

Acknowledgement: This study was supported by SNF grant 3200BO-120631.
Timed unilateral vs. simultaneous bilateral hallux valgus correction surgery: Prospective analysis of clinical outcome and socioeconomic considerations.

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Introduction: Hallux valgus correction is one of the most commonly performed procedures in forefoot surgery. Recent surgical methods allow full weightbearing in postoperative follow-up, enabling surgeons to perform simultaneous bilateral surgery. The presented prospective case series aims to analyze short-term follow-ups after unilateral and bilateral bunion correction with special regards to clinical outcome, patient acceptance and cost effectiveness.

Methods: Distal metatarsal ReveL-osteotomy combined with proximal phalanx Akin osteotomy was performed in 130 patients (Group 1: unilateral N=65; Group 2: bilateral N=65). Patients with additional corrective forefoot surgery were excluded from analysis. Preoperative AOFAS scores were compared to scores at 6/12 weeks and 1 year after surgery. Intermetarsal (IM), hallux valgus (HV) and distal articular (DMAA) angles were measured pre- and postoperatively. A 2-years phone follow-up regarding patient satisfaction was performed. Direct and indirect costs were estimated by analyzing hospitalization parameters and postoperative professional incapacity.

Preliminary results (25 patients per group): Improvement in AOFAS was comparable in both groups, group 2 even showing a tendency for quicker recovery at 6 weeks (Δ1: +16.8 ±12.2; Δ2: +24.2 ±16.8; p=.12). Improvement of measured angles did not differ (IM: p=.57, HV: p=.78, DMAA: p=.56). Bilateral bunion correction displayed a tendency to longer hospitalization time (Group 1: 2.3 days ±1.2; Group 2: 2.9 days ±2.2; p=.071) and more opiate requirements in postoperative recovery (Group 1: 7.8mg ±6.3; Group 2: 11.1mg ±9.2; p=.093). Patient satisfaction was high in both groups, with every patient in group 2 willing to undergo bilateral surgery again. While physical duty demands longer away-from-work time than sitting (p<.05) or standing/walking duty (p<.05) in both groups, patients with bilateral hallux correction were not lost to work longer than their unilateral counterparts (p=.27).

Conclusion: Intrinsically stable surgical techniques encourage simultaneous correction in symptomatic bilateral hallux valgus deformity. Bilateral surgery did not affect outcome and displayed a high level of patient acceptance and satisfaction. While being more costly in direct comparison to single sided bunion correction, staged bilateral correction will essentially double unilateral surgery's expenses. Thus, simultaneous hallux correction contributes to direct and indirect cost reduction.