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Thema: Prothetik 360° von Teil- über Total- bis zur Revisionsendoprothetik

Inhalt Englisch

Titel: Horizontal plane anatomy of the distal femur in different degrees of varus knee deformity - A 3D morphological analysis of the functional rotational axes

Aims and Objectives: In total knee arthroplasty (TKA), while performing the posterior femoral cuts, the horizontal joint line and the rotational alignment of the femoral component is determined. Condylar wear may distort the relationship between the posterior condylar surface and functional axes, such as the surgical transepicondylar axis (sTEA), the anatomical TEA (aTEA), the posterior condylar axis (PCA) or the trochlear anteroposterior axis (TAPA), that are used as a reference when aligning the cutting jigs. This may lead to kinematic abnormalties such as flexion instability or patella maltracking. Therefore, this 3D analysis aimed to assess the variability in the functional horizontal axes in OA knees with different degrees varus malalignment.

Materials and Methods: One hundred fifty (150) CT-based 3D-computer-aided-design (CAD)-bone models of patients with varus knee deformity who had been scheduled for TKA were analysed. All knees were allocated to one of three groups based on the hip-knee-ankle angle (HKA) of the lower limb: mild (0-5°), moderate (>5-10°) and severe (>10°). We determined: sTEA (lateral epicondyle to the center of the medial epicondylar sulcus), aTEA (lateral epicondyle to the highest point on the medial epicondyle), TAPA (highest point of the condylar notch to the lowest point on the trochlear groove), and the PCA (tangent to the posterior condyles) with the femur in the axial view. The posterior femoral angles (PFA) between the sTEA (sPFA), the aTEA (aPFA), or the PCA (tPFA) and a perpendicular to the TAPA were computed. A standard two-tailed t-test assuming unequal variances was used to determine significant differences between the groups.

Results: Each of the three groups of mild, moderate and severe varus osteoarthritis with a mean HKA of 176.7° (SD, 1.2), 172.6° (SD, 1.4) and 167.9° (SD, 1.1), respectively, included 50 patients. On average the sTEA was rotated externally by 1.8° (SD, 1.5), the aTEA by 3.6° (SD, 3.2) and the perpendicular to the TAPA axis by 0.2° (SD, 4.9) in respect to the PCA. No significant difference was observed between the groups of varus deformity for any of the angles. Interestingly, a high level of variability of angular orientation to the PCA was observed between the defined axes (sTEA: from 2.4° internal to 5.6° external rotation; aTEA from 5° internal to 8.9° external rotation; perpendicular to TAPA from 13.1° of internal to 11.3° of external rotation).

Conclusion: No difference in orientation of the sTEA, aTEA or the TAPA relative to the PCA was observed with an increase in varus alignment of the lower leg. These findings suggest that the posterior femoral condylar alignment is unrelated to the coronal malalignment of the knee. Based on present results the large variability of TAPA makes it a rather unreliable landmark for rotational alignment tin TKA surgery. In contrast, the lowest variability was observed for the orientation of the sTEA to the PCA, suggesting the PCA as a reliable reference for guiding rotational alignment in varus knees.

Stichwörter: TKA; varus malalignment; rotational alignment; functional axes

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Thema:	Sonstiges

Inhalt Englisch

Titel:	Mid-term results following traumatic knee joint dislocation
Aims and Objectives:	Although treatment strategies of knee joint dislocations have evolved, there is still no consensus on the best method and timing. New therapeutic concepts suggest that early one-stage treatment with suturing and bracing of the cruciate ligaments in acute Schenck type III and IV knee joint dislocations leads to good clinical results. However, information about mid- and long-term results are still rare. The aim of this study was to evaluate the midterm functional outcome after traumatic knee joint dislocation.
Materials and Methods:	In this single centre retrospective study, 60 patients with Schenck type I-IV knee dislocation were surgically treated at our trauma centre over a ten-year period. At follow-up, various clinical scores (International Knee Documentation Committee (IKDC) Score, Lysholm Score, and Tegner Score) and individual questions about rehabilitation and activity level of 43 patients (72%) were evaluated.
Results:	Mean follow up was 5,6 ± 2,8 years. The average IKDC Score was 66,4 ± 15,9 points, the average Lysholm Score was 71,6 ± 16,7 points and the Tegner score was 4,4 ± 1,7 on average, resulting in a loss of activity at 2 points (range 0-6). The operative revision rate (early and late) was 53%. There were 3 cases of revision for ligament tears, 1 pin tract infection following external fixation, 5 cases of stiff knees and 3 patients requiring supportive surgery after persistent nerve damage, and 1 conversion to arthroplasty. Overweight was associated with more complications and worse outcome, external fixation with arthrofibrosis.
Conclusion:	Knee dislocation is a severe trauma that often leads to a prolonged loss of function and increased knee pain over years, affecting the patient's activity. The use of external fixators should be handled with great care as stiffness is more likely to occur. Obese patients pose a challenge due to higher complication rates and lower postoperative knee function.
Stichwörter:	Knee, Knee dislocation, ACL, PCL, external fixation

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Thema:	Robotik, Sensorik, KI

Inhalt Englisch

Titel:	Lower limb rotation in long-standing radiographs can be determined by patella position
Aims and Objectives:	Lower limb rotation influences radiographic measurements and can lead to incorrect alignment parameters. Therefore, whole-leg long-standing radiographs with centered patella are necessary for correct preoperative planning and postoperative assessment in deformity surgery and arthroplasty. In this study, the relationship between lower limb rotation and change in patella position was evaluated.
Materials and Methods:	3D models of 60 legs without deformities were aligned in neutral position in a coordinate system. The coordinate system was defined by the femoral epicondylar axis, the mechanical femoral axis and the knee joint center. In zero position the epicondylar axis corresponds to the x-axis. Lower limbs were internally and externally rotated in 1° degree increments up to 15° using a Python script-based simulation. For each degree of rotation, the deviation of the patella to the zero position was measured and plotted using a linear regression model.
Results:	Based on the result of the model calculation, an approximately linear relationship between lower limb rotation and patella position can be postulated. Corresponding to a physiological lateralization of the patella, the patella position was on average -8.26 mm (n=60; SD: 5.40mm) at zero position. The patella was more medialized during internal rotation and lateralized during external rotation. The regression model (R^2 =0.99) calculated a change of 1.06 mm per 1° of rotation. Transferred to mechanical lower limb alignment, per 1 mm change of the patella position the hip knee ankle angle changes by 0,03°.
Conclusion:	The discovered correlation between patella position and degree of lower limb rotation allows an easy assessment and correction of image acquisition as well as detection of patella deviation. This enables a standardized alignment with centered patella as a prerequisite for a trustworthy comparison of two X-ray images.
Stichwörter:	Patella position; LSR; X-ray; 3D simulation

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Thema:	Sonstiges

Inhalt Englisch

Titel:	The dependence of the MPFL point on the fluoroscopy position during its intraoperative identification.
Aims and Objectives:	The malposition of the femoral tunnel in medial patellofemoral ligament (MPFL) reconstruction can lead to length changes and an increase in medial peak pressure in the patellofemoral joint. It is the cause of 36% of all MPFL revisions. According to Schöttle et al., the creation of the drill canal should be performed in a strictly lateral radiograph. It was hypothesized that the positioning of the image receptor to the knee would lead to a relevant mispositioning of the femoral tunnel in identifying the MPFL, despite an always adjusted true-lateral view.
Materials and Methods:	10 distal femurs were created from 10 knee CT scans using a 3D printer. First, true-lateral fluoroscopies were taken from lateral to medial (LM) at a distance of 25 cm from the image receptor (Figure 1e), then from medial to lateral (ML) with 5 cm (Figure 1f). Using the method from Schöttle, the femoral origin of the MPFL was determined, and also when the femur was positioned distally, proximally, superiorly, and inferiorly to the image receptor (Figure 1a-d) .
Results:	The Comparison of the selected MPFL insertion points according to Schöttle et al. showed that initial determination of the point in the ML-5cm view resulted in a distal and posterior shift of the point by 5.3mm +/- 1.2mm when the point was checked in the LM-25. In the opposite case, when the MPFL insertion is initially determined in the LM-25 and then redetermined at ML -5cm, there is a shift of the 4.8mm +/- 2.2mm anteriorly and proximally. The further positioning of the femur (distal, proximal, superior and inferior) showed no relevant influence.
Conclusion:	Identifying the femoral MPFL footprint is of great importance in the reconstruction. The preferred way is proposed by Schöttle et al. and adhering to a true-lateral view. In the current literature, a deviation of 5mm from the anatomical approach leads to increased patellofemoral contact pressure. This study shows that when a true-ap-projection is done, the central position of the femur towards the image receptor is of secondary importance. However, according to our data, the position of the image receptor to the knee is of decisive importance. For fluoroscopic identification of the femoral MPFL, according to Schöttle et al., attention should be paid to the position of the fluoroscopy in addition to a true-lateral view.
Stichwörter:	MPFL, x-ray, MPFL reconstruction, patella dislocation

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Thema: Sonstiges

Inhalt Englisch

Titel: The contributions of the lateral soft tissue structures to tibiofemoral stability and the laxity resulting from their deficiency

Aims and Objectives: The purpose of this study was to investigate the relative contributions of the ACL, ALL, Kaplan fibres (KF) and posterolateral meniscus root (PLMR) to translational and rotatory stability of the knee and to measure the increase in knee laxity in case of injury to these structures. It was hypothesized that the KF are the primary restraint against internal rotation and that their injury would lead to the highest grade of anterolateral instability.

Materials and Methods: 10 fresh-frozen human cadaveric knees were tested in a 6-degrees of freedom (DOF) robot system to determine the share of contributions to resist knee laxity. 90N anterior/posterior (AP) force, 5Nm internal/external (IE) and 8Nm valgus/varus (VV) torques were applied in 0°, 30°, 60° and 90° and the kinematics were recorded. The decrease of load/torque reflected the respective contribution of the cut structure to restrain knee laxity. Another 10 knees were tested in a 6-DOF kinematics rig to measure the increase in knee laxity after consecutive cutting of the lateral structures mentioned above (order varied). 90N AP force, 5Nm IE and 8Nm VV torques plus simulated pivot-shift loading (SPS: combined internal/valgus rotation) were applied from 0° to 100° knee flexion and the resulting anterior tibial translation (ATT) and internal rotation (IR) were measured by an optical tracking system. One-way ANOVA with repeated measures was used for the robotic test series and two-way ANOVA with Bonferroni correction was used for the kinematics rig test series, both with $p < 0.05$.

Results: The ACL was the primary restraint of ATT and accounted for 64±8% in 30° knee flexion ($p<0.01$). Internal rotation was mainly constrained by the KF with growing contribution from lower to higher flexion, reaching: 44±23% at 90° and followed by ALL: 14±13% at 90° ($p<0.01$). Cutting the PLMR resulted in a considerable torque decrease for valgus: 33±17% at 90°, but was insignificant in resisting IR. ATT significantly increased after cutting the ACL at all flexion angles ($p<0.001$) and after cutting of the lateral structures from 70°-100° ($p<0.05$). Internal rotation was significantly increased after cutting the lateral structures in the ACL deficient knee from 70° onwards ($p<0.05$). SPS led to an increased ALRI after ACL cut from 0-40° ($p<0.05$) and further after cutting the lateral structures from 0-100° ($p<0.01$).

Conclusion: Anterolateral rotatory stability depends on different soft-tissue structures and the whole complex acts as a functional unit to provide rotatory stability. The ACL is the primary stabilizer for ATT and tibial IR at lower flexion angles. The KF are the most important restraint against IR above 30° knee flexion and KF insufficiency leads to an increase of IR with IR torque and pivot-shift load. The ALL is less important than the KF in an ACL intact knee. Combined injury to KF and ALL resulted in a substantial increase of ALRI while isolated injury of either did not. The lateral meniscus resists valgus, and its deficiency also increases ALRI.

Stichwörter: anterior cruciate ligament, anterolateral ligament, Kaplan fibres, lateral meniscus root, laxity, anterolateral instability

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Thema:	Osteotomie

Inhalt Englisch

Titel:	The influence of the starting point on gap height in high tibial osteotomy
Aims and Objectives:	In open-wedge high tibial osteotomy (OWHTO) preoperative planning softwares are commonly used. Matching the intraoperative alignment correction with the preoperative plan is crucial. The planned correction should therefore be transferred to and controlled in the operating room. In gap measuring techniques, the wedge basis length (osteotomy gap height) is measured. However, there is a lack of knowledge about the effects when choosing the osteotomy-starting-point at a different location intraoperatively than planned preoperatively. Therefore we asked, whether gap-measurement-techniques can be applied regardless of the medial starting-point-location.
Materials and Methods:	25 patients with constitutional varus alignment were planned for OWHTO. Long-leg standing radiographs were obtained and planned with the mediCAD software. OWHTO was planned to 0° Hip-Knee-Ankle angle (HKA). There were two defined osteotomy starting points: 3cm or 4cm distal to the medial joint line. Osteotomy gap height was measured and a group comparison was performed.
Results:	The collective consisted of 18 males and 7 females with a mean age of 62±16.6 years. The mean preoperative HKA was -5.96±3.02° with a mMPTA of 82.22±1.14°. After digital planning to an aimed HKA of 0°, the mean mMPTA was 88.94±3.01°. With mean gap heights of 8.08mm and of 8.05mm when locating the osteotomy 3cm and 4cm distally to the joint line, respectively, there was no statistically significant difference (p=0.702). The mean planned wedge angle was 6.14° for both osteotomy starting points (p=0.692).
Conclusion:	In OWHTO aiming at the tip of the fibula, the osteotomy starting point has no relevant influence on the gap height and does therefore not need to match the planned starting location of the osteotomy exactly. A difference of the starting point 1cm more distal or proximal between the digital planning and the performed operative starting point does not affect the size of the osteotomy gap for the desired amount of correction. However, aspects like surrounding anatomical structures and plate positioning have to be kept in mind when choosing the starting point.
Stichwörter:	frontal malalignment; frontal realignment; correction osteotomy; varus; valgus; osteotomy planning

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Thema: Osteotomie

Inhalt Englisch

Titel: Revision lateralization osteotomy of the tibial tubercle has excellent outcome in patients suffering from previous medial tibial tubercle overcorrection

Aims and Objectives: Tibial tubercle osteotomies (TTO) are common procedures to treat patella alta or lateral patella tracking in patients with patellofemoral osteoarthritis (PFO) or instability (PFI). A number of patients suffering from medial patellar tracking due to previous extensive medialization of the tibial tubercle presented to our clinic. This complication has rarely been reported in the literature. Therefore, the goal of this study was to assess patient-reported outcome measures (PROMs) after revision osteotomy with lateralization of the tibial tubercle (RL-TTO) in order to correct medial patellofemoral maltracking.

Materials and Methods: Between 2017 and 2021, a case series of 11 patients (male/female 1/10; age 35.8 ± 10.5 years) were treated by RL-TTO and were retrospectively evaluated after a mean of 33.9 months (range 18-61 months). The TT-TG and TT-PCL distance was evaluated prior to RL-TTO and the cartilage condition was evaluated during concomitant knee arthroscopy according to the Outerbridge classification. The Kujala anterior knee pain scale, the KOOS patellofemoral (KOOS-PF) subscale and the numeric analogue scale (NAS; 0-10) regarding anterior knee pain (AKP) in resting position and during activity were evaluated from pre- to postoperatively. The data were assessed for normality and are presented as mean ± standard deviation (SD) and range. Paired two tailed t-tests were used to assess differences between the pre- and postoperative data. All analyses were performed using GraphPad Prism (version 9.3.1; GraphPad Software, San Diego, CA, USA). The level of significance was set at 0.05.

Results: The postoperative evaluation was completed for 8 of the 11 patients included. The preoperative mean TT-TG and TT-PCL distance were -6.5 ± 6.5 mm and 0.7 ± 4.6 mm, respectively. The average intraoperative performed lateralization was 10.7 ± 3.6 mm. The cartilage lesion at time of RL-TTO was graded as 2.4 ± 1.9 for the medial trochlea groove and 2.4 ± 1.4 for the medial patella, respectively. The Kujala-Score and KOOS-PF-subscale improved significantly from 33.6 ± 10.1 (23-51) to 94.4 ± 6.2 (82-100, $p<0.001$) and 20.6 ± 13.2 (0-43.3) to 87.3 ± 9.9 (72.8 - 100, $p<0.001$), respectively. Resting pain (5.8 ± 1.9 to 0.8 ± 0.9, $p<0.001$) and pain during activity (8.6 ± 1.3 to 1.6 ± 1.5, $p<0.0001$) were significantly reduced.

Conclusion: Extensive overcorrecting medialization is a complication of TTO resulting in medial patellofemoral cartilage degeneration, AKP and unsatisfying functional outcome. RL-TTO shows encouraging results with adequate pain relief and satisfying PROMs at 18-61 months follow up. Due to the partially severe cartilage damage observed at the time of RL-TTO, uncertainty remains about the long-term outcomes.

Stichwörter: Tibial Tuberosity Osteotomy (TTO), Complication, Medial Overcorrection, Anterior Knee Pain (AKP), Patellofemoral Instability (PFI), Patellofemoral Osteoarthritis (PFO)

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Thema: Robotik, Sensorik, KI

Inhalt Englisch

Titel: Force controlled measurement of mediolateral mobility of the patella in healthy subjects

Aims and Objectives: The mediolateral patellar shift is of interest for several clinical questions. Patellar shift is associated to patellofemoral pain and instability. Proper quantification of patellar mobility is necessary to better understand the pathologies at the patellofemoral joint. Apart from manual shift testing, no uniform technique is currently established. The latter does not allow a precise and reliable assessment of the mediolateral patellar mobility. The aim this study was to establish a standardized and reliable clinical method for quantifying patellar mobility in the coronal plane.

Materials and Methods: A new device for patellar shift measurement was invented. The Patellostabilometer is a new prototype device for objective quantification of patellar displacement in the coronal plane. The measurements with a grip arm were done after knee fixation in extension. Patellar mobility was measured using loading with the mediolateral force increasing up to 10N.
For this experimental study there were 25 (18 male, 7 female) healthy participants with a mean age of 32.32 ± 9.3 years, 1.8m ± 0.2 height, 81,96 kg (BMI 25.22 ± 3.4) recruited. Additionally, parameters like the length, circumference of the knee, upper- and lower leg were documented. The mediolateral patellar mobility was measured with the Patellostabilometer three times bilaterally, with an average interval of 11,68 ± 5,15 days in-between.
All of these procedures were performed by the same tester. The test-retest variability of the acquired variables was assessed. For evaluating the statistical correlation between the measurements Pearson-Test was used.

Results: The mean differences between the measurements of the patellar mobility were respectively 1,97mm for right leg lateral shift (SD 1,46), 2,62mm for right leg medial shift (SD 2,63), 2,23mm for left leg lateral shift (SD 1,76) and 2,47mm for left leg medial shift (SD 2,47). The lateral patella shift was 18.27 ± 3.76mm (Q1Q3 interquartile range (IQR) of (4.79) 15.85-20.64) and a larger medial displacement of 24.47 ± 6.59mm (IQR of 10.47 (19.29-29.76)) was observed. The test-retest measurement error was 2.32 ± 1.76mm with an IQR of 2.38mm, with five outliers. Body height, weight, circumference of the knee, upper- and lower leg as well as the length occurred to have low correlation coefficients indicating no clinical significance.

Conclusion: There was larger measurable medial than lateral shift of the patella. Conducting two tests on the different days determined the greater test-retest variability between the measurements of the medial shift comparing to the lateral one. Nevertheless, this difference occurs still considerably low. Further investigations on reasons for outliers are necessary.
Patellostabilometer was shown to be very reliable in measuring patellar mobility in the coronal plane, which can be related to pain, instability and functional limitations. Due to the low measurement variability the device appears to have potential in future examinations on the patients with knee diseases.

Stichwörter: patella, shift, mobility, anterior knee pain, displacement, device

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Thema: Prothetik 360° von Teil- über Total- bis zur Revisionsendoprothetik

Inhalt Englisch

Titel: Mid- to long-term clinical and radiographic outcome of trabecular metal cones in revision total knee arthroplasty

Aims and Objectives: Severe metaphyseal bone defects are a challenge in complex revision total knee arthroplasty (TKA). Several studies have been published with promising results about the use of trabecular metal cones (TMC) and sleeves, but long-term data are rare. The aim of this study is to present the clinical and radiographic results of TMC after a mean follow up of 6,1 years.

Materials and Methods: A single center retrospective review included 80 consecutive patients (44 female, 36 male), who underwent revision TKA surgery with 113 TMC (TMT©, Zimmer, USA) for tibia and/or femur. In six cases a double-cone technique was performed. The reason for revision surgery were aseptic 64 (80%) and septic 16 (20%) failures. At the time of revision all knees showed large bony defects AORI Type 2a (18%), 2b (36%) and 3 (46%). Except of 2 cases all revision implants (CCK, RHK or megaprosthesis) were fixed with cementless stems in hybrid technique. Perioperative and postoperative complications, reoperations and re-revisions were documented. Pre- and post-op clinical outcome was valued using KSS; ROM, VAS; WOMAC. Any loosening or osteolysis of the TMC or revision implants were evaluated according to a modified knee society radiographic evaluation system.

Results: After an average FU of 6.1 years (5-9) all implanted TMC (n=113) showed no radiographic signs of loosening or osteolysis and were clinical stable. There were 3 (4%) periop complications with wound healing problems and 11 (14%) post-operative complications including deep infections (n=3), periprosthetic fracture (n=2), aseptic loosening of components without TMC (n=2), instability (n=2) und one hinge dislocation (n=1). There were 5 reoperations (2 inlay change, 2 DAIR and 1 patella) and 8 re-revisions including one arthrodesis and 1 amputation. In 4 cases the well osteointegrated TMC had to be removed. The estimated 9-year Kaplan Meier survival rate for aseptic loosening was 95 %. All clinical parameters showed significant (p< 0,001) improvement from pre- to post OP.

Conclusion: Our study demonstrates excellent metaphyseal fixation of TMC with hybrid stems, excellent survivorship, and outcomes in treatment of severe femoral and tibial metaphyseal bone defects in complex revision TKA's. The stable fixation could also be confirmed after an average of 6,1 years FU with a 9 year survival rate of 95 % for aseptic loosening.

Stichwörter: tantalum metal cones, revision total knee arthroplasty, knee society score

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Thema: Frakturen rund ums Knie

Inhalt Englisch

Titel: Treatment of complex tibial plateau fractures - standardized concept?

Aims and Objectives: Treatment strategies for tibial plateau fractures have increased in recent years, due to the introduction of new classification systems, establishment of 360° treatment and others.
The aim of this study is to evaluate the level of standardization in the treatment of complex tibial plateau fractures at trauma centers of different level.

Materials and Methods: Three complex tibial plateau fractures with thin-slice CT including 3D reconstruction were presented to consultants in traumatology/orthopedic surgery. Afterwards, a standardized survey on fracture morphology and treatment strategy was performed.

Results: A total of 23 surgeons from 7 hospitals (level of care 1-3) were included. 69.6% (n=16) of the participants had treated at least 50 tibial plateau fractures in their professional career.
All three fractures were most frequently classified as Schatzker type V (fracture I: 52.2%, II: 56.5%, III: 60%). The number of affected segments in the ten-segment classification showed the highest agreement in fracture III with 8 segments selected (50% of the answers given). An additional preoperative MRI examination was requested by 30.4% for fracture I, 56.5% for II and 40% for III.
43% of the participants chose the same surgical position for fracture I (prone position with transfer to supine position), 52% for fracture II (supine position) and 70% for fracture III (prone position with transfer to supine position).
The most frequently chosen surgical approach for all three fractures was the combination of posteromedial and anterolateral approach (I: 39% kappa=0.23, II: 39% kappa=0.39, III: 50% kappa=0.41).
A double plate osteosynthesis was favoured for the surgical treatment of all fractures (I: 65%, II: 87%, III: 60%). The majority of surgeons planned an additional screw osteosynthesis (I: 70%, II: 61%, III: 60%).
In level 3 clinics, primary treatment was more often done with an external fixator (83.3% vs. 71.9%). Perioperative a 3D scan (62.5% vs. 37.5%) and/or fracturoscopy (37.5% vs. 9.4%) was used more frequently in addition to x-ray for reduction control in these clinics.

Conclusion: There are major differences in the classification and treatment strategy of complex tibial plateau fractures.
The 360° treatment is performed in all clinics regardless of the level of care, but without further standardization in terms of preoperative imaging, first-line treatment, surgical approach, (plate-) osteosynthesis and reduction control. Great differences can be seen even within the levels of care.
A lack of standardization should be taken into account when evaluating patients outcome after tibial plateau fractures.

Stichwörter: Tibial plateau fracture, treatment strategy, standard of care

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Thema: Indikationen in der Revisionschirurgie

Inhalt Englisch

Titel: "Posterior Tibial Slope Does Not Affect Patient-Reported Outcomes And Graft Failure Rate After Isolated Primary ACL Reconstruction"

Aims and Objectives: Graft failure following isolated primary anterior cruciate ligament (ACL) reconstruction is an event influenced by intrinsic and extrinsic risk factors. This study evaluates the effect of the posterior tibial slope (PTS) on patient reported outcomes (PROs) and ACL graft failure following primary isolated ACL reconstruction as a potentially modifiable risk factor. It was hypothesized that an increased PTS is associated with an increased risk for ACL graft failure and inferior PROs.

Materials and Methods: All consecutive patients who underwent isolated primary ACL reconstruction between January 2011 and December 2019 were retrospectively reviewed and patient-, injury- and surgery-related data were collected. Medial PTS was measured on preoperative lateral knee radiographs. Following a minimum follow-up of 2 years, the number of ACL graft failures was evaluated. Validated PROs, including the International Knee Documentation Committee subjective knee form, Lysholm score, Tegner Activity Scale, and Visual Analogue Scale for pain, were collected at follow-up. An unpaired t-test was used to compare the PTS in the groups with vs. without ACL graft failure. A binary logistic regression analysis was performed to stratify the risk of transplant failure, in which the following variables were included: PTS, age, gender, BMI, injury mechanism (atraumatic vs. contact vs. non-contact) and injury to surgery time. A correlation analysis was performed to evaluate the relationship between PTS and PROs.

Results: In total, 353 patients with a mean age of 36.5 ± 11.4 years and a mean follow-up of 75.5 ± 30.4 months, with current ACL-status determined, were included. In addition, PROs could be collected from 274 of those patients. The overall graft failure rate was 15.9% (n = 56). The mean PTS of patients who experienced graft failure was 11.3° ± 3.2° compared to 11.3° ± 3.1° for patients without ACL graft failure ($p = 0.897$). Younger age ($p < 0.001$) and male sex ($p = 0.012$) were the only statistically significant risk factors associated with a higher graft failure rate. Patients who experienced graft failure were, on average, about 6 years younger than those without revision surgery (31.3 vs. 37.5 years). The other factors included in the regression analysis did not have a statistically significant impact on graft failure. There were no significant correlations between PTS and PROs.

Conclusion: The results of this study did not show an association between increased PTS and a higher risk for ACL graft failure following isolated primary ACL reconstruction. There was also no impact of increased PTS on PROs at short- to mid-term follow-up. There was, however, a significantly increased risk for graft failure in younger and male patients.

Stichwörter: ACL, ACL-Revision, Tibial Slope, Patient-Reported Outcomes

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Thema:	Osteotomie

Inhalt Englisch

Titel:	Anterior tibial closing wedge osteotomy often results in decreased medial proximal tibial angle
Aims and Objectives:	Increased tibial slope (TS) has been proven to be an anatomic risk factor for primary anterior cruciate ligament (ACL) rupture as well as for re-ruptures of the ACL graft or ACL graft insufficiency. Surgical techniques to correct an increased TS have been described. As well as other osteotomies, anterior tibial closing wedge osteotomy (ATCWO) has the potential to result in an accidental change outside the planned osteotomy plane. The purpose of this investigation was to evaluate the effects of ATCWO for correction of a pathologic TS on coronal plane alignment using an infra-tuberosity surgical approach.
Materials and Methods:	We are reporting on a single center series of ATCWO for TS correction from January 2021 until March 2022. During this period 31 ATCWO were performed in our institution to correct the TS. The study group consisted of 11 women and 19 men, mean age at index procedure 32,57 years (SD ±9,32 years). In 15 patients ATCWO was combined with a one-stage ACL revision reconstruction. The remaining patients received an ATCWO in combination with a two-stage revision procedure with allogenic bone grafting for tunnel augementation. In all cases an infra-tuberosity approach was used with angle stable anteriomedial plate fixation. To evaluate the effect of ATCWO on TS and coronal plane alignment, pre-and post-operative x-rays were examined retrospectively to detect changes in the sagittal and coronal plane alignment.
Results:	There was a mean reduction in TS of 6,83° (SD ±2,27°) comparing pre- and post- operative straight lateral X-ray of the knee. The medial proximal tibial angle decreased significantly by 1,34° (SD ±1,41°, p=0,0073). The mean length of the osteotomy measured 64,00mm (SD ±5,65mm). There were no significant changes of MPTA in correlation to pre-operative MPTA, amount of TS reduction or osteotomy length.
Conclusion:	ATCWO results in a secure reduction of the tibial slope in the sagittal plane. It has to be acknowledged that the reduction in TS accidentally resulted in a significant decrease of the MPTA in coronal plane. This has to be taken into account for surgical planning in patients requiring a slope-reducing osteotomy.
Stichwörter:	osteotomy, tibial slope, ACL

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Thema: Indikationen in der Revisionschirurgie

Inhalt Englisch

Titel: Peripheral knee instability is a significant risk factor for ACLR failure

Aims and Objectives: Patients with revision anterior cruciate ligament reconstruction (ACLR) are known to be associated with inferior clinical outcome compared to primary ACLR. A direct clinical and radiological comparison between patients with primary and revision ACLR is rare.
The purpose of this study was to evaluate differences between patients with primary and revision ACLR.

Materials and Methods: Between 2017 and 2020, we conducted a retrospective study of 825 patients (311 women, 514 men; mean age 33.3 ± 12.4 years, range 18-63 years) undergoing primary or revision ACLR. Clinical and radiological data were collected and evaluated to determine possible differences between patients with primary ACLR (n=578) in comparison to patients with revision ACLR (n=247).

Results: Patients with revision ACLR showed significant elevated preoperative high-grade anterior (Lachman grade 3, 15.3% vs. 8.1%, p=0.003) and rotational (pivot-shift grade 2/3, 29.6% vs. 9.6%, p<0.001) instability compared to patients with primary ACLR. Also, preoperative peripheral ligamentous instability was significantly elevated in patients with revision ACLR (medial knee instability 30.8% vs. 12.8%, p<0.001; lateral knee instability 29.1% vs. 6.3%, p<0.001). While medial (50.6% vs. 32.2%, p<0.001) and lateral (17.1% vs. 24.6%, p=0.020) meniscus lesions occurred significantly more often in revision ACLR than in primary ACLR, also osteoarthritis was detected more often in revision ACLR (29.2% vs. 9.1%, p< 0.001). A pathological elevated posterior tibial slope (PTS >12°) was seen in 35.4% of the cases in revision ACLR whereas 23.3% of patients with primary ACLR had an increased PTS (p<0.001).

Conclusion: Revision ACLR is associated with an elevated risk of preoperative high-grade anterior and rotational instability, as well as peripheral instability, meniscus lesions, osteoarthritis and an elevated PTS compared to primary ACLR.

Stichwörter: Peripheral knee instability , revision ACLR, posterior tibial slope

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Thema:	Knorpelchirurgie

Inhalt Englisch

Titel:	Comparison between gel-based and collagen-based autologous chondrocyte implantation
Aims and Objectives:	Collagen-based autologous chondrocyte implantation is an established treatment for cartilage defects in the knee joint. The chondrocytes are implanted in a biphasic collagen scaffold. Gel-based autologous chondrocyte implantation is being used more and more frequently, since arthroscopic application is also possible. The aim of this study is to compare the clinical results of gel-based autologous chondrocyte implantation (NOVOCART® Inject) with the results of collagen-based autologous chondrocyte implantation (NOVOCART® 3D).
Materials and Methods:	A total of 50 patients were included in the study. The data from 25 patients per treatment group were compared in a matched pair study over 2 years. The parameters for the matched pair analysis were sex, number of defects and location. Groups were compared based on visual analog scale (VAS) scores and subjective IKDC scores.
Results:	Significant improvements in both clinical scores were seen in both groups after two years of follow-up. When comparing the groups, it was shown that the gel-based group already had significant improvements in the IKDC score after 6 months. In the collagen-based group, a significant improvement in the IKDC score was only seen after 12 months. However, a significant difference in the clinical scores between the groups could not be determined.
Conclusion:	Both gel-based and collagen-based autologous chondrocyte implantation lead to comparable good clinical results after two years postoperatively. Significantly improved clinical outcomes were seen earlier with gel-based autologous chondrocyte implantation than with collagen-based cautologous chondrocyte implantation.
Stichwörter:	ACI, Cartilage, Inject, Hydrogel

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Thema:	Frakturen rund ums Knie

Inhalt Englisch

Titel:	Locked plating of patella fractures - a multicentric case series of 24 patients with one year clinical and radiological follow-up
Aims and Objectives:	Patella fractures make up to 1,4% of all bony injuries. Nevertheless, this rare injury could lead to severe lack of knee function. The up to date treatment in Germany still remains the classical tensioning band wiring, but complications are not infrequent. Locked anatomical-based plates are more and more popular. Biomechanical studies have shown their superiority. The presented investigation examines the clinical and radiological results after locked patella plating in 24 cases from two major trauma centres.
Materials and Methods:	23 patients (12 female / 11 male) with 24 patella fractures (12 right / 12 left) were included. The mean patient age was 59,6 years (range 20-82). Classification of Speck & Regazzoni was applied: 1x type A2, 1x type A3, 1x type B2, 7x type B3, 2x type C2 and 12x type C3. An additional CT-scan was performed in 21 / 24 cases besides conventionel x-rays, which were done in all cases. All patients were treated with an anterior locked patella plate (VISOSS standard-plate, Mahe Medical, Emmingen-Liptingen, Germany).
Results:	The clinical results are displayed here (items shown after 6 weeks, 3, 6 and 12 months): ROM: 88°, 113°, 128.5°, 137°. Kujala-Score: 48.9, 65.2, 73.2, 83. Lysholm-Score: 68.2, 77.7, 83.8, 90.9. Tegner-Score: 1.3, 2, 3.2, 3.5. VAS-r: 0.8, 0.2, 0.2, 0.1. VAS-a: 3, 2.7, 1.9, 1.2. PS: 1.6, 1.8, 1.5, 1.4. (ROM = range of motion, VAS-r = visually analogue scale for pain at "rest", visually analogue scale for pain at "activity", PS = patient satisfaction from 1 (very good) to 6 (unsatisfactory). 12 months after surgery all fractures were healed radiologically and all plates were still in place. In one case a revision surgery was needed two weeks after the initial surgery, because of a displacement of the distal patellar pole. One patient did not turn up for the shedulded follow-up and therby was canceled from the study cohort.
Conclusion:	In the one year follow-up good to very good clinical and radiological results were gained by anterior locked patella plating in this case series. Patella plating is an expedient surgical procedure with few complications. The cohort will be investigated in the long-term follow-up.
Stichwörter:	patella fracture, locked plating

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Thema: Indikationen in der Revisionschirurgie

Inhalt Englisch

Titel: Patellofemoral arthrosis following unicondylar partial knee joint replacement (OxfordTM) - a rarity that does not exist?

Aims and Objectives: Unicompartmental arthroplasty is a bone-sparing and ligament-preserving procedure that is established primarily for gonarthrosis of the medial compartment. Performing indication using the "Oxford radiological decision aid" (Hamilton et al.), the not-weightbearing medial facet of the patellofemoral joint is neglected and whole-layer cartilage- and even bone-loss is tolerated. In a large follow-up study by Pandit et al., a 1000 case-series of UKA were observed over 15 years and no case of clinically relevant medial patellofemoraler osteoarthritis after unicondylar partial knee replacement (OxfordTM) was reported. We would like to report a case and suggest a possible therapeutic approach.

Materials and Methods: The case was analyzed retrospectively and literature was reviewed.

Results: In June 2022, an 83-year-old normal weight male presented with retropatellar pain in the left knee over the past six months after implantation of a medial unicondylar knee arthroplasty (UKA) (OxfordTM) in November 2011. At implantation of the UKA, there was only moderate medial patellofemoral chondromalacia and osteophyte attachments while the trochlea was not dysplastic. According to the current "Oxford Decision Aid" there was no contraindication for UKA implantation. Upon presentation the left knee had a range of motion of 0-5-110° in extension/flexion and the patient had no relevant underlying medical history. 11 years after implantation of the UKA, radiological findings revealed an end-stage medial patellofemoral osteoarthritis with medialization of the patella, elimination of the joint space, loss of bone substance, and excessive bony cysts. A patellofemoral joint replacement (PFJ Smith & Nephew) was implanted on 6/1/2022. Intraoperative findings revealed extensive sclerosis with cystic degeneration of the trochlea as well as the posterior surface of the patella. Defects of the trochlear bearing were filled with homologous cancellous bone and bridged with the implant. During operation the UKA appeared regular and implanted without femoral protrusion. No wear was visible when the femorotibial onlay was routinely replaced. The ACL as well as the lateral femurotibial joint appeared intact intraoperatively.

Conclusion: After UKA, medial patellofemoral osteoarthritis may develop in a few patients, which should be considered if the knee is painful and may lead to revision or further surgery. Implantation of a PFJ prosthesis for patellofemoral osteoarthritis is a ligament- and cartilage-preserving treatment option. It remains unclear why the presented patient developed excessive cyst formation in the patellofemoral joint, especially on the femoral side.

Stichwörter: Patellofemorale Arthrose, Revision, UKA, Oxford Decision Aid

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Thema: Physiotherapie und Rehabilitation

Inhalt Englisch

Titel: One-leg vertical jump, side-hop and the Y-Balance test measured with a wearable sensor correlate significantly with subjective knee joint function 3 and 6 months after ACL reconstruction

Aims and Objectives: One of the most often used and validated measuring tools for subjective knee function is the IKDC SKF (International Knee Documentation Committee Subjective Knee Form). However, in the assessment of functional outcomes a great heterogeneity during rehabilitation following anterior cruciate ligament reconstruction (ACLR) exist. As the IKDC SKF is limited to the subjective perception of patients, a standardized, objective, quantitative measurement tool and the respective tests to determine and monitor rehabilitation progression is needed.
The aim of this study was to identify the tests with the highest predictive power in estimating the functional knee status following ACLR in early(3mo) and mid-stage(6mo) rehabilitation with an all ready validated sensor-based digital medical device(DMD).

Materials and Methods: This study is a prespecified investigation of an ongoing single-center, prospective, randomized controlled trial with the primary endpoint of optimized rehabilitation with a DMD after ACLR.
All continuous variables were examined for normal distribution (Kolmogorov-Smirnov test), while non-normally distributed data was compared by the Wilcoxon or Friedmann test. Spearman's correlation coefficients were calculated for the DMD tests and the IKDC SKF at 3 and 6 months. Multivariate regression analysis(ANOVA) was performed to detect independent predictors of the IKDC SKF score at 3 and 6 months respectively.
Minimal clinically important difference(MCID) was calculated for vertical jump using previously calculated threshold values for IKDC SKF at 3 month FU as anchor.

Results: From July 2019 to December 2020, 67 patients planned for primary ACLR (70:30% m:f,age 25y[21-32],IKDC SKF 47[31-60],Tegner 6[4-7],Lysholm 57[42-72]) were included. At 3 months, significant correlations were detected for the vertical jump(r=0.43,p=0.011), side-hop(r=0.37,p=0.042)and for the Y-Balance test(r=0.58,p<0.0001) regarding the IKDC SKF.
For the secondary endpoint at 6 months, strong correlation was detected for side hop(r=0.54,p=0.004), vertical jump(r=0.44,p=0.018) and Y-Balance(r=0.50,p=0.008).
By multivariate analysis, vertical jump(ß=0.48, T=2.9) independently correlated to the IKDC SKF score at 3 months(p=0.003)and the side-hop(ß=0.45,T=2.5,p=0.022) at 6 months' time. MCID for vertical jump was 2 cm(AUC:0.71,CI:0.49-0.94).
No adverse events related to the DMD were reported.

Conclusion: One-leg vertical jump and side-hop test, as independent predictors of functional knee recovery, should be implemented as an objective measurement tool in the early and mid-stage rehabilitation phase after ACLR. A DMD enables therapists to easily integrate this testing into their daily practice.
Y-Balance test significantly correlated with the functional knee status at 3 and 6 months time, but was no independent predictor and should therefore be used as part of a test compilation.
Further, this study provides a first orientation regarding the MCID for the vertical jump, which has previously not been described for this patient group.

Stichwörter: early-/ mid-stage rehabilitation, ACLR, wearables, sensor, one-leg vertical jump, MCID, DMD

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Thema: Osteotomie

Inhalt Englisch

Titel: The influence of open-wedge hight tibial osteotomy on joint kinematics of the knee

Aims and Objectives: Medial open-wedge high tibial osteotomy (OWHTO) is a widely used treatment option in patients with varus malalignment and early medial osteoarthritis of the knee. However, overall understanding of the effect of corrective osteotomy on joint kinematics and joint contact mechanics remains inadequate, and further research in this field is essential for predicting surgical outcomes. Therefore, the aim of this study was to investigate the relationship between OWHTO of various degrees of coronal correction and biomechanics of the knee joint using a multi-body simulation model.

Materials and Methods: OWHTO with an open tibial wedge of 6mm to 12mm (at 1mm intervals) was virtually performed on each of eight three-dimensional CAD-models derived from CT-scans of full-leg cadaver specimens.
A multi-body simulation model of the native knee was derived based on an existing force- and kinematic-validated model of TKA (Asseln, 2019). Relevant modifications such as adjusting the pressure module to model the contact mechanics of the native knee surfaces, or the inclusion of the ACL were performed. For each patient and each OWHTO version, an individual biomechanical simulation model was built, based on the surface models provided. With each model, a knee bend from 10° to 90° of knee flexion was simulated.
Tibio- and patellofemoral kinematics were derived and deviations from the kinematics of the "preop" model were calculated. Mean values of those deviations were calculated for each kinematic parameter and each HTO version, in order to identify which parameters are most affected by HTO.

Results: A total of five tibiofemoral and five patellofemoral kinematic parameters were evaluated for each OWHTO simulated. Of all parameters assessed, an increase in the degree of coronal osteotomy had the greatest effect on tibiofemoral internal-external rotation. A decrease in the degree of tibial internal rotation during knee flexion of approximately 0.5° was observed for each 1-mm increase in coronal correction.
In addition, an increase in the degree of coronal osteotomy resulted in abnormal medial translation of the tibia.
Of all the patellofemoral parameters studied, an increase in the degree of osteotomy showed the greatest effect on mediolateral translation and the tilt of the patella to the lateral side.

Conclusion: The simulation of different degrees of OWHTO showed a multidirectional influence on joint kinematics, which may affect joint stability and contact pressure. Improving multibody simulation models for the OWHTO may increase the understanding of the multidirectional effects of surgical intervention and thus improve the predictability of surgical outcomes.

Stichwörter: HTO; open-wedge; osteotomy; multi-body simulation; kinematics

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Thema: Knorpelchirurgie

Inhalt Englisch

Titel: Mid- to long-term results of autologous chondrocyte implantation combined with autologous bone grafting to treat osteochondral defects of the knee joint

Aims and Objectives: Treating osteochondral defects of the knee joint is challenging. The combination of autologous chondrocyte implantation with autologous bone grafting is an established procedure. At this point there is a lack of data on the functional postoperative outcome. This study presents mid- to long-term results after this combined technique.

Materials and Methods: 37 patients (22m, 15f; mean age: 31.5 years, range: 18-55 years, mean follow-up: 3.7 ± 1.96 years, range: 1-7.25 years) have been included. The mean chondral lesion size was 4.5 cm2 ± 2.8. 3D-instrumented gait analysis (Motion Capture System, Vicon Nexus) was used to assess lower extremity kinematics and kinetics. The functional outcome was assessed with the IKDC score, the Lysholm score, the PROMIS 29 profile v2.0 score and a patient satisfaction survey.

Results: All clinical scores showed statistically significant improvement compared to the preoperative condition (IKDC: 56.5 ± 17.0 vs. 73.6 ± 10.3, p<0.01; Lysholm: 64.6 ± 17.6 vs. 75.2 ± 14.3, p<0.01). The PROMIS 29 profile v2.0 score showed significant improvement in the categories pain intensity (4.9 ± 2.5 vs. 2.6 ± 2.0, p<0.01), physical function (45.3 ± 6.8 vs. 50.6 ± 5.9, p<0.01), pain interference (55.0 ± 6.7 vs. 49.5 ± 6.7, p<0.01) and social roles and activities (50.2 ± 8.4 vs. 54.7 ± 6.6, p=<0.01). The patients reported a high satisfaction rate (94.6%). Kinetics, kinematics and ROM of hip and ankle were not statistically significantly different to the contralateral limb, nor were significant differences in step length, step width, stance time and swing time observed. We found a significant smaller knee flexion (9.58° ±7.33 vs. 13.65° ±6.67, p=0.02) and a significantly lower knee extension moment (0.08Nm/kg ±0.25 vs. 0.22Nm/kg ±0.19, p=0.01) during loading response phase compared to the contralateral knee joints. There were no significant differences in the knee adduction moment during initial contact, loading response and toe off, compared to the contralateral side. The joint-power of the operated knees was significantly reduced during initial contact (0.15W/kg ± 0.22 vs. 0.26W/kg ± 0.2) compared to the contralateral knee joints.

Conclusion: The combination of autologous chondrocyte implantation and simultaneous bone grafting showed a significant improvement in the IKDC score, the Lysholm score and the PROMIS 29 profile v2.0 score at mid- to long-term follow-up in patients with osteochondral defects of the knee. 3D-instrumented gait analysis showed no affection in the adjacent joints. At a mean follow-up of 3.7 years there were significant differences in kinematics and kinetics of the operated knees compared to the contralateral side, such as a smaller knee flexion and a lower knee extension moment during loading response phase compared to the contralateral side.

Stichwörter: autologous chondrocyte implantation, ACI, cartilage repair, osteochondral defect

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Thema: Sonstiges

Inhalt Englisch

Titel: Prevalence of combined ACL and anteromedial retinaculum injuries

Aims and Objectives: Little is known on the involvement of anteromedial knee structures in anterior cruciate ligament (ACL) injured subjects. However, it's speculated, that anteromedial injuries may result in excess anteromedial rotatory knee instability (AMRI). The purpose of the study was to analyze retrospectively the injury pattern with respect to medial sided knee structures in ACL injured subjects.

Materials and Methods: 120 patients aged 18 to 25 years and diagnosed with a primary ACL injury were included in this retrospective study. Patients were excluded if the period between the injury and MRI was longer than 28 days or if a knee dislocation or fracture was present.
The MRI-data were analyzed by an orthopaedic surgeon and a musculoskeletal radiologist. Injuries were classified according to the degree of severity. To classify the injuries, a modified classification system presented by Rasenberg et al. was applied. The grading system differed between periligamentous edema (Grade I), partial fiber disruption of less than 50% (Grade IIa), partial fiber disruption of more than 50% (Grade IIb) and complete tear (Grade III). The superficial medial collateral ligament (sMCL), deep MCL (dMCL), posterior oblique ligament (POL) and the anteromedial retinaculum. Moreover, lesions of the medial and lateral meniscus as well as bone bruise patterns were analyzed.
For detecting significant injury patterns, Fisher's exact test or Pearson's-chi-square test were used ($p<0.05$).

Results: An injury of the anteromedial retinaculum was detected in 72.5% to 73.3% of the cases and in 22.5% to 24.2% the retinaculum was completely torn. Injuries of the sMCL and dMCL were detected in 50% and 77.5% of the cases, respectively. Any injury to the POL was observed in 31.7%. However, only in 5.8% of the cases a Grade III injury was seen. No significant (n.s.) correlations were detected between the injury pattern and the age, sex or type of sport (high-risk vs. low-risk). A bony edema adjacent to the femoral dMCL insertion was frequently observed in dMCL injuries.
Medial meniscus injuries were associated with lesions of the sMCL and the anteromedial retinaculum ($p<0.05$), while lateral meniscus injuries were significantly more often seen in patients with a dMCL rupture ($p<0.05$).

Conclusion: Data of this study suggest that injuries to the anteromedial knee structures are much more frequent compared to posteromedial lesions in subjects with an ACL injury. However, current diagnostic tools and reconstructive techniques do not account for anteromedial injuries and an AMRI. Whether these injuries are associated with excess AMRI is still unclear.

Stichwörter: ACL, VKB, anteromedial retinaculum, medial side, AMRI, sMCL, dMCL, POL, Bone bruise,

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Thema: Physiotherapie und Rehabilitation

Inhalt Englisch

Titel: Return to sport following ACL reconstruction - A test manual for everyday clinical practice

Aims and Objectives: Rehabilitation and return to sport (RTS) after anterior cruciate ligament reconstruction (ACLR) is a topic very controversially discussed in the current literature. It however is of great concern to every clinician. Due to space, time and financial limitations, only few clinicians utilize objective data to assess their patients' functional abilities following ACLR. The purpose of this study was to identify validated and feasible RTS tests, that could reliably estimate the risk of re-injury after ACLR but still be implemented in everyday clinical practice.

Materials and Methods: To achieve this aim, a focus review was performed by experts of the committees for Ligament-Injury and Prevention/Rehabilitation of the German Knee Society (DKG). RTS functional tests, their re-injury prognostic values, reliabilities and implementation capacities were extracted from original articles written in English or German examining the re-injury risks/rates following ACLR and RTS. These details were not only extracted from studies on the RTS gold standard test set-up, but also for the less resource-consuming, yet still validated and in everyday practice implementable test alternatives, hereafter termed silver and bronze test manuals.

Results: A total of 35 studies involving 8,689 patients were identified. In the final analysis, 19 studies involving 7,513 patients were included. From these, a total of 21 RTS tests were retrieved. Strength tests, functional tests with different movement patterns in the horizontal and vertical planes, tests regarding the dynamic knee valgus moment and patient-reported functional outcomes were taken into account. Finally, 11 validated RTS tests, mirroring functional and psychological readiness with regard to RTS and reduction of ACL re-rupture rates, were included into the gold standard test manual (isokinetic knee extension/flexion quad/hamstring torque ratio, distance jump, triple hop, triple crossover hop, 6 m timed hop, vertical jump, drop jump, speedy hop, running T-Test, KOOS-Sport/Rec and ACL-RSI scores). The silver (8-RM knee-extension test, distance jump, vertical jump, drop jump, speedy hop, KOOS-Sport/Rec and ACL-RSI scores) and bronze (elastic-band test, distance jump, speedy hop, KOOS-Sport/Rec and ACL-RSI scores) test manuals are less time and money consuming. Furthermore, cut-off and reference values were extracted from the literature to facilitate the evaluation of the test results.

Conclusion: With the test manuals provided and their potential summary in gold, silver or bronze, accompanied by comprehensible cut-off and orientation values, physicians will be able to test patients' functional abilities in clinical non-instrumented settings.
Herewith a broad basis of healthcare professionals is enabled to implement RTS monitoring and release into their everyday practice and, therefore, reduce the risk for ACL re-rupture rate.
(https://deutsche-kniegesellschaft.de/downloads/)

Stichwörter: return to sport, rehabilitation, ACL reconstruction, rehabilitation management, RTS test, RTS testing, test battery, test manual

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Thema: Prothetik 360° von Teil- über Total- bis zur Revisionsendoprothetik

Inhalt Englisch

Titel: 3D-analysis of distal femoral osteophytes in the varus osteoarthritic knee: A morphological analysis to determine effect of malalignment severity on size and distribution.

Aims and Objectives: In total knee arthroplasty (TKA) of varus malaligned osteoarthritic knees the removal of femoral osteophytes is crucial. Therefore, the objective of this study was to assess differences in osteophyte formation based on their size and location on the distal femur in knees with different degrees of coronal varus malalignment.

Materials and Methods: Computed tomography (CT) scans of the distal femur of 150 patients who had been scheduled for customized TKA were retrospectively analyzed, and knees were allocated to one of 3 groups based on the severity of the varus deformity as measured by the hip-knee-ankle-angle (HKA): mild (0-5°), moderate (>5-10°) and severe (>10°). The distal femur was divided into 12 segments on the CT-scans, six on the medial condyle (medial anterior, middle, or posterior; and mesial anterior, middle or posterior) and six corresponding segments on the lateral condyle. An osteophyte grading system to assess the degree of osteophyte expression was established based on osteophyte size, defined as the largest perpendicular distance from the cortical line to the outer margin of the osteophyte in that segment: 0 = 0-1mm; 1 = >1-4mm; 2 = >4-7mm; 3 = >7-10mm; 4 = >10mm. An overall osteophyte score and individual scores for the medial and lateral femoral condyle were computed and statistically analysed (two-tailed t-test; and regression analyses).

Results: The three alignment groups included 31 patients with mild (average HKA 176.8°, SD 1.3°), 44 with moderate (average HKA 172.7°, SD, 1.4) and 30 with severe varus osteoarthritis (average HKA 167.5°, SD, 1.0). Regression analysis revealed a positive correlation of osteophyte size with an increase in malalignment (p= 0.001); osteophyte scores increased from an average of 18.5 (SD, 5.9) in the group of mild, to 20.3 (SD, 5.8) in the moderate and 23.4 (SD, 6.5) in the severe varus malalignment group, with the latter increase being statistically significant (p= 0.04).
Individual comparison of the medial and lateral condyle revealed increase in osteophyte formation on both condyles with increasing varus deformity. However, this correlation was found stronger on the medial femoral condyle comparted to the lateral one (p= 0.0002 vs. p= 0.02).
Interestingly, osteophyte analyses on femoral segments showed strongest correlation between and malalignment and osteophyte formation in the posterior segment of the medial posterior femoral condyle (p= 0.00009). In this area of the femur the increase in osteophyte expression was already found significant between the groups of mild and moderate varus deformity (p= 0.05).

Conclusion: The present findings show an asymmetrical increase in osteophyte expression with an increase in coronal varus deformity, which is most pronounced in the medial posterior femoral condyle. Insights into differences in osteophyte expression with respect to overall varus malalignment and femoral location may contribute to improved understanding and treatment of TKA patients with coronal varus deformity

Stichwörter: TKA; varus malalignment; osteophytes; osteoarthritis

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Thema: Robotik, Sensorik, KI

Inhalt Englisch

Titel: Functional clustering of knee kinematics after tibial plateau fractures to determine rehabilitation outcomes based on unsupervised machine learning algorithms

Aims and Objectives: Gait analyses are beneficial to assess the functional outcome of lower extremity injuries, particularly complicated knee trauma, in order to customize follow-up care to the patients' needs. Even though well-trained non-medical professionals can perform motion analysis properly, substantial professional expertise is important to comprehend collected multidimensional gait studies effectively and not every healthcare practitioner is capable of conducting these sophisticated interpretations. Therefore, the aim of the study was to utilize a machine learning approach to cluster, analyze and extract therapeutically useful information from joint kinematics profiles of the knee as well as other medically relevant outcome measures.

Materials and Methods: Six months postoperatively, 34 patients with surgically treated tibial plateau fractures underwent a video-assisted 3D gait examination using the Noraxon Myomotion System. Range of Motion (ROM) profiles of all joints of the lower extremities were calculated as an average of 10 steps. A skilled physician additionally determined passive ROM and collected the PROMs WOMAC, Tegner, and Lysholm Knee Score. Efficient Sparse Clustering was then applied to knee kinematics data, and the generated clusters were compared using modified Student's t-tests. The efficient sparse clustering method is an unsupervised machine learning algorithm based on functional principal component analysis and gaussian mixture models that has a high potential in pattern recognition of functions and time serial data.

Results: Two specific patient clusters were found using the model-based efficient sparse clustering approach (G1: n = 24, G2: n = 10). Patients in G2 demonstrated less substantial knee flexion during the loading response phase of the gait cycle and had a reduced extension during the presumed terminal stance phase and pre-swing phase, when compared to G1. In contrast, patients in G1 showed a stronger expression of two flexion peaks divided by one extension maximum during pre-swing in knee kinematics. G1 had significantly higher values in both knees for passive ROM ($p<0.05$). The mean maximum flexion for G1 was 140°, while G2 was just 135°. G2 had a lower mean Lysholm-Score of 75 points compared to 80 points in G1. G2 had a higher mean WOMAC-Score of 14 than G1 with only 10. There were no significant differences for Tegner and the other demographic variables obtained.

Conclusion: This pilot study illustrates the efficacy of efficient sparse clustering in aggregating kinematic data from a patient collective into clinically relevant clusters, allowing therapeutically useful conclusions to be reached. According to the collected outcome metrics, we were able to identify a patient cluster that is more akin to a healthy, physiological walking pattern and has a better rehabilitation outcome. In the future, these technologies might be used in a broader variety of application domains to more precisely portray complex kinematic patterns and automate the process using AI.

Stichwörter: AI, Clustering, tibial plateau fractures, gait analysis, 3D sensing, unsupervised learning

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Thema:	Innovationen der Frakturversorgung rund ums Knie

Inhalt Englisch

Titel:	Technical advantages of modern patella plates - a case report
Aims and Objectives:	Modern patella plate implants promise consistent stability, more possibility of anatomic reduction in comminuted injuries and improved biomechanical characteristics in comparison to present fixation methods like tension band wiring. This case reports shows an example of variable locking patella plate fixation with pre-, intra- and postoperative radiological findings, close clinical post-surgery monitoring and documented mid-term follow up examination.
Materials and Methods:	A 76-year-old, so far fit woman with full mobility got diagnosed with an acute fracture of the left patella after low energy trauma (ground level fall). Pre-operative x-ray and CT showed a comminuted patella fracture type AO 43.C3. Two days after trauma surgery with open reduction and variable angle locking anterior patella plate fixation took place. In addition, open bursectomy and a McLaughlin cerclage of the knee were performed. Intra- and post-operative radiological findings, including DVT, demonstrated sufficient fixation with anatomical fracture reduction. On the first day after surgery the patient could be discharged. A liberal physiotherapeutic scheme was induced with full weight bearing and limited range of motion (ROM) 0-0-30° for two weeks, 0-0-60° for two weeks and 0-0-90° for two more weeks. After that unlimited ROM was permitted. Six weeks follow-up radiographics showed sufficient bone healing without complications. Six months post-operative the patient is pain free with full ROM.
Results:	This case report demonstrate through detailed radiological and clinical documentation a successful treatment of a complex patella fracture with a modern patella plate fixation.
Conclusion:	Modern variable locking patella plate implants show advantages in high biomechanical stability and anatomical reduction in complex patella fractures with the chance of early functional postoperative treatment. Due to significant failure rates in tension band wiring of comminuted patella fractures the use of these modern implants should be considered.
Stichwörter:	comminuted patella facture, anterior locking plate fixation, tension band wiring, case report

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Thema: Sonstiges

Inhalt Englisch

Titel: The Bone Bridge for Tibial ACL Graft Fixation - A Mechanical Analysis of Different Fixation Methods

Aims and Objectives: The tibial fixation is considered as the weak link in anterior cruciate ligament (ACL) reconstruction and conflicting findings in terms of biomechanical stability of different fixation techniques have been reported. Thus, the aim of this study was to investigate the bone bridge as a novel technique for ACL graft fixation. It was hypothesized that tibial graft fixation with BB is equivalent compared to established fixation devices.

Materials and Methods: In a porcine knee model, fourty fresh-frozen tibiae were equally divided into four groups of ten tibiae evaluating the bone bridge for tibial ACL graft fixation. One half underwent extracortical fixation using bone bridge (BB) or endobutton (EB) fixation, while the remaining half underwent hybrid fixation utilizing an 9 x 28 mm interference screw (Megafix® CP, KARL STORZ, Tuttlingen, Germany) in addition to bone bridge (IFS/BB) and endobutton (IFS/EB). Porcine flexor tendons (length 80 mm, diameter 9 mm) served as ACL grafts and were stitched with two braided composite sutures (FiberWire® #2, Arthrex, Florida) using Krackow locking stitch technique. A tibial tunnel (diameter 9 mm) was drilled into the tibia at the native ACL footprint using a tibial aiming guide (KARL STORZ, Tuttlingen, Germany). For creating a bone bridge, a second hole (diameter 4 mm) was drilled 15 mm distally to the tibial tunnel providing a cortical socket for the ACL sutures, which were shuttled around the post and knotted 10 times. Simulating early rehabilitation phase, the reconstructions were subjected to a cyclic load test (1500 cycles, 50-200 N, 1 Hz) using a servohydraulic testing machine (Model 8874, Instron GmbH, Darmstadt, Germany) and elongation was determined. Then, in a load-to-failure test (displacement rate 25mm/sec), load to failure and stiffness were examined. One-way analysis of variance (ANOVA) was to determine statistical differences ($p < 0.05$).

Results: The mean elongation of BB and IFS/BB was 16.8 ± 2.9 mm and 6.1 ± 0.9 mm, respectively. Fixation with BB and IFS/BB demonstrated no significantly higher elongation than SB (14.5 ± 3.4 mm, n.s.) and IFS/SB (7.5 ± 0.8 mm, n.s.). The mean load to failure of BB and IFS/BB was 557.3 ± 98.7 N and 1166.9 ± 99.1 N, respectively. No significant differences could be observed for BB and IFS/BB compared to SB (684.3 ± 139.3 N, n.s.) and IFS/SB (962.7 ± 119.8 N, n.s.). The stiffness for IFS/BB (175.3 ± 16.6 N/mm) was significantly higher than for IFS/SB (144.9 ± 20.1 N/mm, p=0,0042). For SB (126.6 ± 13.1 N/mm) the stiffness did not show a significant difference to the BB group (112.8 ± 38.7 N/mm, n.s.).

Conclusion: In terms of biomechanical stability, tibial graft fixation with a BB, as an extracortical fixation, and IFS/BB, as a hybridfixation, are equivalent compared to a suspension button based graft fixation. The clinical use of the bone bridge for tibial graft fixation could therefore reduce the cost for ACL reconstruction and lower the rate for implant-associated problems.

Stichwörter: ACL, Tibial graft fixation, Bone bridge, Hybrid fixation

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Thema: Sonstiges

Inhalt Englisch

Titel: All-Arthroscopic Cartilage Repair with AMIC versus Minced Cartilage. A minimum 2-years follow up.

Aims and Objectives: There are various procedures for the treatment of cartilage defects, for example the AMIC procedure with a microfacturing of a cartilage defect and a following application of a membrane or the minced cartilage technique which is gaining in popularity. In the minced cartilage technique, cartilage tissue is re-implanted in one session.
In this study, both methods are compared. Are there differences between these two techniques?

Materials and Methods: In this study 21 patients who were treated with AMIC and 21 patients who received a minced cartilage treatment were examined and compared. Inclusion criteria were focal cartilage damage of the femoral condyles, trochlear, patella, or tibia, and any concomitant injuries to the menisci. Exclusion criteria were injuries to the ligamentous structures or degenerative cartilage damage. The mean lesion size in the AMIC group was 1,7 cm² in the Minced Cartilage group 2.0 cm².
Both procedures used here are performed completely arthroscopically. In the minced cartilage technique, cartilage tissue is removed via a shaver, minced, and mixed with autologous plasma. This plasma is also used to produce an autologous fibrin material with which the cartilage cells are fixed in the defect. In the AMIC technique evaluated here, the cartilage defect is microfractured and then covered with a Shitosan scaffold.
The patients were followed up preoperatively, 2 weeks, 3 months, 6 months, 9 months, 1 year and 2 years postoperatively. At these timepoints the pain (VAS) and functional scores (Tegner, SANE and KOOS) were recorded.

Results: At this time, there were no significant differences in the scores to date, for example the VAS score in the AMIC group (group one) was 3.3, in the Minced Cartilage group (group two) 4.0 preoperatively. Two weeks postoperatively it was 3.0 in group one to 2.2 in group 2. After two years the pain on the visual analog scale decreased to 1.7 and stagnated by 2.2. The Tegner score differed from 4.1 and 4.2 preoperatively and 3.7 against 4.6 after two years between the groups. The SANE score showed the greatest difference from 45.07 to 72.17 in group one and from 45.5 to 76.31 in group two. Preoperatively the mean KOOS Score was 63.31 and 61.0. It increased similarly to 75.63 and 76.72 in both groups.

Conclusion: Both procedures are equally effective for treating focal cartilage damage at two years, showing no significant difference in outcomes. Further long-term studies are necessary.

Stichwörter: Cartilage, Minced Cartilage, AIMIC

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Thema:	Physiotherapie und Rehabilitation

Inhalt Englisch

Titel:	Patient survey on the implementation of a prehabilitative intervention between surgery information and surgery procedure in orthopaedic-surgical trauma care
Aims and Objectives:	Prehabilitation, or prehab for short, is to be understood as training for an upcoming surgical intervention and not as purely preventive care. Patients receive a training plan adapted to the joint about the operation, which can be carried out in rehabilitation centres or at home or via smartphone. Interventions do not necessarily have to be carried out in person or independently. In addition, it has already been shown that patients feel better informed and develop less anxiety during pre-op. The goal of prehab is for patients to reduce the loss of strength through increased mobility. Secondary goals would be early mobility after surgery and bridging the waiting time until surgery. Several studies have already been able to show that the complication rate after an orthopaedic-surgical intervention was also reduced by certain "pre-training". The aim of this study is to determine a deviation of interest to develop a prehab concept.
Materials and Methods:	A total of 183 patients participated in this survey over a period of 3 months. Inclusion and exclusion criteria were waived at this stage of the survey. We have developed a questionnaire which is available at the registration desk in an orthopaedic practice. Patients can fill out this questionnaire voluntarily and anonymously in the waiting room. The anonymous results are classified into 3 categories: socio-demographic, surgical and training.
Results:	Of the 183 participants, 53.9% were male and 46.1% female. The cumulative age group over 50 years was the largest with 63%, of which the subgroup of 51-60 years has the largest share in this survey with 35.8%. In terms of formal education, the groups "Completed apprenticeship" with 27.2% and "Higher education entrance qualification" with 33.3% are the largest group. There was a tendency for 71.2% of the participants to be waiting for an operation on the joint. More than 80% of the respondents would even postpone the operation if they received training beforehand. More than 90% of the respondents are willing to do this training at home or in the gym. When it comes to carrying out the training itself, about 25% of the respondents would do it digitally or analogue, but 50% would like to use both. When asked about the benefits of such a measure, 20% of the patients said that they hoped that the duration of their hospital stay could be reduced and that they hope to have a better physical performance after the operation. When asked about the disadvantages of such a measure, 37% fear that pain levels would be worse. However, 43% of the respondents say that there are no disadvantages.
Conclusion:	With this survey, we could show that there is a great interest in a prehab concept for preparation with specialized training for orthopaedic elective surgery. This encourages us to continue our research in this field.
Stichwörter:	prehabilitation, orthopaedic, surgery, training, excerice

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Thema: Sonstiges

Inhalt Englisch

Titel: Unicompartmental knee arthroplasty with mobile-bearing technique. What characterizes satisfaction after 1 year?

Aims and Objectives: Based on the 2021 EPRD report, out of 290,420 documented procedures, 111,365 initial knee implantations were performed in the calendar year 2020 (38.3%), of which 14,700 were initial unicondylar procedures (13.2%).
Some studies show that unicompartmental knee arthroplasty (UKA) is a successful procedure that produces high levels of function and satisfaction in patients. However, the EPRD 2021 report shows that the failure rate of unicondylar prostheses is about twice that of total knee prostheses, which also has an impact on satisfaction.
The aim of this study is to find out what may characterize satisfaction and what depends on success.

Materials and Methods: In this cumulative study, 446 patients were evaluated for satisfaction during the first year after surgery. All patients received a medial Oxford mobile-bearing unicompartmental knee replacement. The following parameters were used for subdivision: BMI, age, and gender. These criteria were compared using linear multivariate regression and tested for comparability. For this period, the following 2 scores were recorded in our Patient-Related Outcome Measure System (PROMs): Visual Analogue Scale of Pain (VAS), and the Knee injury and Osteoarthritis Outcome Score for Joint Replacement (KOOS JR.).

Results: Of the 446 patients, 375 (84.1%) were satisfied (29.8%) or even very satisfied (54.3%) with their operated knee after one year. 59 patients (13.2%) are rather dissatisfied (12.1%) or even very dissatisfied (1.1%) after the first year. 12 patients (2.7%) are neither satisfied nor dissatisfied with the result after one year. Satisfaction after the first year generally correlates significantly with VAS and KOOS Jr at different time points. Age is found to negatively correlate with satisfaction. Dissatisfied patients had the highest KOOS Jr score pre and the lowest KOOS Jr score post. Satisfied patients gave the lowest VAS value pre. The satisfied patients are on average the oldest 62.32 (SD 9.55) and have a lower BMI 28.81 (SD 5.25) in comparison. The neutral patients have the highest BMI 31.76 (SD 5.2). The male gender accounted for the greater proportion at the two extremes of "very satisfied" or "very dissatisfied".

Conclusion: In our analysis, we were able to show what satisfaction and success can depend on. Age plays a significant role in this. The older the patient, the more satisfied they are in the first year after surgery. It may be that younger patients have higher demands and are more likely to be disappointed. Expectations should be considered more closely here. It is also interesting that men tend to make more extreme statements than women. In general, it can be shown that more satisfied patients also have a better subjective outcome. One limitation is that a retropatellar replacement was not considered.

Stichwörter: unicomaprtimental knee arthroplasty, satisfaction, Clinical pathway, influence, algorithm, novel guide

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Thema: Knorpelchirurgie

Inhalt Englisch

Titel: Comparison of minced cartilage implantation with autologous chondrocyte transplantation in an in-vitro inflammation model

Aims and Objectives: Symptomatic focal cartilage lesions can be treated with cartilage regenerative procedures, depending on the size and co-pathologies. The current gold standard of large cartilage defects is the autologous chondrocyte transplantation (ACT). As a new surgical method of cartilage regeneration, minced cartilage implantation (MCI) is increasingly coming into focus. The procedure is characterized as purely autologous, one-step, less invasive and cost-effective and shows a promising biological potential. The aim of this study was to investigate the chondrocyte biology in isolated and cultured chondrocytes compared to cartilage chips in an inflammation model with the proinflammatory cytokine TNF α .

Materials and Methods: Bovine articular chondrocytes were cultured according to the ACT method to passage 3 and transferred to pellet culture. As a control, a pellet culture was performed without further cultivation (P0). At the same time, cartilage was fragmented (<1 mm^3). TNF α (20 ng/ml) was supplemented to simulate an inflammatory process. Gene expression of anabolic (collagen 2, aggrecan, COMP, PRG4), catabolic (MMP3, MMP13), dedifferentiation (collagen 1), hypertrophy (collagen 10) markers and the inflammatory cytokines IL-6 and IL-8 were determined by RT-PCR. Culture medium was analyzed for the inflammatory markers IL-6 and NO and for GAG as non-physiological degradation products. The non-parametric Mann-Whitney U-test was used for statistical analysis. Statistical significance was defined as $p<0.05$.

Results: On gene expression level, TNF α induced a downregulation of anabolic markers, whereas catabolic markers were upregulated. IL-6 and NO production was increased under the influence of cytokines and showed a dynamic with peak values on day 4-5. TNF α showed a stronger influence in when comparing isolated chondrocytes and cartilage chips on P0 and P3 constructs, especially in the gene expression profile of collagen 2, PRG 4 and aggrecan (reduction) as well as MMP 3 and MMP 13 (enhancement). The expression of the inflammation markers IL-6 and IL-8 was also less strongly influenced by TNF α in the MCI model. These effects could be confirmed in the biochemical analysis by a reduction in IL-6 release (P3 pellet culture vs. cartilage fragment culture, $p<0.001$) and NO release ($p = 0.003$). The negative influence of the cytokine was greater in the passaged pellet cultures (P3) than in the unpassaged (P0) constructs.

Conclusion: This study demonstrated the negative influence of TNF α on chondrogenesis in a pellet culture and cartilage fragment model. Passaged chondrocytes are more sensitive to cytokine influences compared to non-passaged cells and chondrons. Consequently, regeneration potential of MCI may be superior to ACT in osteoarthritic surroundings. Further investigations are necessary for translation into the clinic.

Stichwörter: MCI, ACT, Chondron, Chondrocyte

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Thema: Innovationen der Frakturversorgung rund ums Knie

Inhalt Englisch

Titel: Preoperative mixed reality imaging and 3D printing in complex tibial plateau fractures - an advantage to CT?

Aims and Objectives: CT imaging including 3D reconstruction represents state-of-the-art imaging for complex tibial plateau fractures. Systems for three-dimensional fracture visualisation on mixed reality (MR) glasses or as 3D prints are commercially available. The aim of this work is to clarify if these technologies provide benefit in fracture understanding and treatment strategy of complex tibial plateau fractures.

Materials and Methods: Three complex tibial plateau fractures were selected and the existing thin-slice CT prepared for 3D imaging. Afterwards, the fractures were presented to consultants in traumatology/orthopedic surgery using CT (including 3D CT reconstruction), MR glasses (hardware: Microsoft HoloLens 2; software: mediCAD MIXED REALITY) and 3D prints. After each imaging session, a standardised survey on fracture morphology and treatment strategy was completed. None of the participants in the survey had previously used MR visualisation and/or 3D printing as standard in the management of tibial plateau fractures.

Results: A total of 23 surgeons from 7 clinics were interviewed. 69.6% (n=16) of the participants had treated at least 50 tibial plateau fractures in their professional career. Objectively 7.1% changed fracture classification according to Schatzker and 78.6% changed ten-segment classification after fracture visualisation on MR goggles. Furthermore 16.1% changed planned surgical position, 33.9% surgical approach and 39.3% planned osteosynthesis.
Subjective results showed that 82.1% of the participants reported an advantage of the MR-glasses compared to the CT. A further benefit of 3D print, compared to MR glasses, was seen by 57.1% of the surgeons (five-point Likert scale).
Understanding of fracture morphology (+28.6%) and subjective confidence of the planned treatment strategy (+33.9%) increased after visualisation of the fracture using MR glasses.

Conclusion: For the majority of specialists in this study, three-dimensional visualisation of complex tibial plateau fractures provides subjective benefit compared with CT imaging. That refers to the understanding of fracture morphology as well as to confidence of the planned surgically treatment. The benefit is also shown in an adjustment of fracture classification and treatment strategy. It seems like the MR glasses can not replace the haptic perception of a 3D printed model but they provide a similarly good three-dimensional fracture visibility with lower financial, time and material effort.
The preoperative three-dimensional visualisation of complex tibial plateau fractures enables the surgeon to precise his treatment strategy for this challenging injury.

Stichwörter: VR/MR glasses, 3D printing, tibial plateau fracture

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Thema:	Sonstiges

Inhalt Englisch

Titel:	The Influence of distribution, severity and volume of posttraumatic bone bruise on short-term functional outcome after ACL reconstruction for isolated ACL injuries
Aims and Objectives:	Posttraumatic Magnetic Resonance Imaging (MRI) of anterior cruciate ligament (ACL) tears shows a high prevalence of bone bruise (BB) without macroscopic proof of chondral damage. Controversial results are described concerning the association between BB and outcome after ACL injury. Aim of this study is to evaluate the influence of distribution, severity and volume of BB in isolated ACL injuries on early functional outcome, quality of life and muscle strength following ACL reconstruction (ACLR).
Materials and Methods:	Posttraumatic MRI of n=122 patients treated by ACLR between 06/2016 and 04/2019 without concomitant pathologies were evaluated. BB was differentiated by four localizations: medial/lateral femoral condyle and medial/lateral tibial plateau (MFC/LFC/MTP/LTP). Severity was graded according to Costa-Paz classification. BB volumes of n=46 patients were quantified via software-assisted volumetry. Outcome was measured by Lysholm Score (LS), Tegner Activity Scale (TAS), International Knee Documentation Committee (IKDC) form, isokinetic testing and Short-Form 36 (SF-36) questionnaire. Measurements were conducted preoperatively (t0) and six weeks (t1), 26 weeks (t2) and 52 weeks (t3) after ACLR.
Results:	The overall prevalence of BB was 91.8%. LTP was present in 91.8%, LFC in 64.8%, MTP in 49.2% and MFC in 28.7%. 18.9% were classified Costa-Paz I, 58.2% II and 14.8% III. The total BB volume was 21.84±15.27ml. The highest volume within the localizations was found for LTP (14.31±9.93ml). LS, TAS, IKDC, SF-36 and isokinetic strength improved significantly between t0 and t3, irrespective of BB characteristics (LS: $Chi^2(4)=194.0$, $p<.001$; TAS: $Chi^2(4)=130.1$ $p<.001$; IKDC: $Chi^2(4)=240.3$, $p<.001$; SF-36: $Chi^2(4)=27.6$, $p<.001$; isokinetic strength: $F(2)=29.96$, $p<.001$, $F(2)=6.67$, $p<.001$). Distribution, severity and volume had no influence on LS, TAS, IKDC, SF-36 and isokinetic testing on t0-t3 (n.s.).
Conclusion:	No impact of BB characteristics after ACLR on early functional outcome, quality of life and muscle strength was shown for isolated ACL tears, unaffected by concomitant pathologies that have been excluded systematically in this study. Previous data regarding prevalence and distribution of BB in ACL injuries is confirmed. These results may help surgeons in counselling patients regarding the interpretation of extensive BB findings in isolated ACL tears and its limited implication for the timing of ACLR and rehabilitation. Long-time follow-up studies are mandatory to evaluate a possible negative impact of BB on knee function due to secondary arthritic changes.
Stichwörter:	ACL injury; bone bruise; bone marrow edema; MRI; outcome

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Thema: Osteotomie

Inhalt Englisch

Titel: Use of a silver-coated plate to treat a postoperative infection after high tibial osteotomy - a case report

Aims and Objectives: Unilateral osteoarthritis of the knee can be treated by osteotomy. Since the evolution of internal plate fixators, open wedge procedures have become state of the art to fix most of these osteotomies. With an incidence of up to 5%, postoperative infections are rare but severe complications. Because implant removal will lead to a complete loss of the corrected leg axis, open-wedge osteotomies need to be accompanied by additional fixation methods to stabilize the leg. So far, only external fixation seems possible. However, complete consolidation of an open-wedge high tibial osteotomy (HTO) for example can need 12 to 18 months. For this reason, implants that can be used in an infectious situation would be useful. Silver-coated implants were developed to reduce the perioperative infection risk. However, so far, they were not used to treat active infections. In addition, antimicrobial plates, which could be used for HTOs, are currently not available.

Materials and Methods: A 47-year-old male patient suffering from a medial gonarthrosis combined with a pathological varus alignment was treated by HTO using internal plate fixator. After a painless interval and irritation-free wound conditions, in postoperative week seven, the patient presented with wound secretion and pain in the knee. Classic clinical signs of a late onset infection were recognized including a highly elevated C-reactive protein (CRP). Therefore surgical revision with antiseptic lavage vacuum-assisted closure was performed. In addition, intravenous anti-infective therapy was started. Bacterial culture revealed presence of multi-sensitive staphylococcus aureus. Despite multiple debridements, the infection ultimately could not be controlled.

Results: After consideration and active informed patient consent, one-step implant exchange with an off-label-use of a newly developed silver-coated plate (Loqtec® antibacterial 3.5, aap Implantate AG, Berlin, Germany) was performed. Ultimatively, the surgical wound healed sufficiently, and infection control was achieved, with laboratory infection parameters returned to normal values. The patient was discharged to postoperative rehabilitation on postoperative day six. One year later, while the osteotomy had healed completely, the painless and satisfied patient returned to have HTO of the other leg.

Conclusion: Silver-coated implants were developed to prevent postoperative infections after osteotomy. However, so far, they have not been used for treatment of active infections yet. In a situation of an infected implant after HTO and an unstable leg axis once the implant is removed, this new approach could be considered as an option to prevent the patient from a long and uncomfortable course of combined surgical and anti-infective treatments including prolonged treatment with external fixation devices. Further studies should be performed regarding this treatment option once silver-coated implants for internal plate fixation are readily available on the market.

Stichwörter: infection, high tibial osteotomy (hto), silver-coated plate fixation

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Thema: Physiotherapie und Rehabilitation

Inhalt Englisch

Titel: An innovative approach by guiding the physiotherapy after TKA through an muscle activity based protocol

Aims and Objectives: Correct physiotherapy after joint replacement is an important part of the success of the patient treatment. It's a known fact,that up to 20% of the patients are dissatisfied after TKA although the radiological result is good or very good.
The increasing importance of physiotherapy is mainly related to the strong interaction between the implant, passive and active structures around the joint, especially since the importance of the soft tissue envelope, which must be respected in the postoperative treatment, is often underestimated.
The aim of the present activity is to propose and evaluate the efficacy of a postoperative therapy that is guided by an objective method of valuating the muscle activity, using transcutaneous EMG, which supports the physiotherapist to improve the coordinative abilities as well as the individual strength of the muscles.

Materials and Methods: We have developed a standardized protocol over the last 5 years in a single center cohort of about 400 patients. The protocol contains an EMG testing procedure, performed on the following motor tasks: walking on a treadmill, climbing the stairs, force the muscles against resistance, coupled with a gait analysis enabling the analysis of the kinematics and load distribution together with subjective evaluation of 3 different PROMs (OKS,AKSS,FJS). The FU examinations were performed pre- and postop, after 3 and 6 weeks, 3 months and 1 year, followed by FU every year to look for changes in long term.
All data are stored in a dedicated database, where we have the possibility to print out reports, which help the therapist to adapt it to the individual needs.

Results: FFollowing our around 400 patients over this 5 years, we could evaluate the PROMs, as well as the muscle activity status. The duration of the recovery process of initial 8 to 12 weeks could be reduced to 5 to 6 weeks till the patient is able to return to business, is independent for daily life and doesn't need any support. The muscle activity numbers show an average increase of 25 to 35%.
Regarding the PROMs we saw a statistically significantly higher score, around 10-15%, in the OKS, AKSS and FJS. The overall satisfaction rate was around 95%.
Also in cases where the radiological result doesn't seem to be perfect, even in some cases described as bad, the individualized therapy compensated for the deviation of the axis and sometimes misbalance, to reach a satisfactory outcome.

Conclusion: The individualization of the therapy helped us to reduce the recovery time significantly, as well as the therapy is custom adapted to every person itself. Also, the dissatisfaction rate could be reduced significantly, which shows the strong correlation of proper implantation with the function of the soft tissue envelope.
Respecting both aspects will increase the outcome after TKA. Technical support is also needed in the postoperative treatment period as well as during the surgery (navigation, robotic..)
This is one possibility to measure the progress as well as the outcome in an objective way.

Stichwörter: Rehabilitation, EMG, TKA, physiotherapy, fast track protocol

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Thema:	Frakturen rund ums Knie

Inhalt Englisch

Titel:	Incidence for posterolateral tibial plateau fracture in the setting of knee dislocation
Aims and Objectives:	Biomechanical studies have shown that an impression of the posterolateral tibial plateau (PLIF) that is more than 2 mm deep and more than 50% of the lateral meniscus wide leads to increased rotational instability in the knee joint with simultaneous ACL rupture. While therapeutic algorithms of the "apple-bite" fracture are already discussed for ACL injuries, no current literature exists on the incidence PLIF and concomitant soft tissue injuries in the context of KD. The aim of this study was a comprehensive analysis of combined ligamentary and bony lesions in patients suffering from acute KD
Materials and Methods:	A retrospective multicenter study was conducted to analyze the incidence and treatment of PLIF in acute KD. KD and all soft tissue injuries were classified using MRI and CT and analyzed for the presence of associated bony injury. PLIF were classified according to Menzdorf et al. and Bernhold et al..
Results:	A total 131 knee dislocations from 3 study centers were included. In 25,2% of the cases a PLIF and in 21.4% a "femoral notch sign" could be detected. According to Menzdorf et al, there was an indication for surgical treatment of the PLIF in 45,5%. There was a significantly more frequent occurrence of the PLIF in Schenck III medial dislocations in comparision to all other types ($p < .001$). Additionally, there was no significant difference in vascular and nerval damage in relation to the PLIF. Lateral meniscus (LM) injury was present in 54.8% of the cases showing a PLIF. In 30.3%, a LM injury and an PLIF with indication for surgery occurred together, but there was no relationship with surgical indication to treat PLIF ($p=0.197$). A medial meniscus injury occurred together with a PLIF in only 21.2% of the cases. 78.8% of the PLIF had a medial collateral ligament (MCL) injury. While there was a significant association of MCL rupture with PLIF ($p= <.001$), there is no association to surgical indication. The PLIF co-occured with LCL ruptures in only 25.8%. LCL ruptures occured significantly more often without PLIF ($p=.007$). In 6%, there was an injury to the tendon of the biceps muscle and a PLIF. In none of the cases there was an injury of the tractus iliotibialis and a PLIF, but in 9% there was a simultaneous injury of the popliteus muscle.
Conclusion:	Analysis of concomitant bony injuries showed a significantly higher incidence of PLIF at 23.7%. Compared to ACL ruptures, where only 6-8% of the fractures are in need of surgery, 45,5 % of the KD showed an indication for surgical treatment. The Femoral notch sign is reported in the literature in ACL ruptures with an incidence of 25-26%. Here, KD shows only a minimally reduced value of 21.4%. The significantly lower incidence of PLIF together with an LCL rupture confirms its origin theory in which there is an impact of the femur on the tibial head. In addition, PLIF occurs most frequently in Schenck III medial. In conclusion, this study suggests that concomitant bony injuries in KD are more relevant than previously thought.
Stichwörter:	"apple-bite" fracture, knee dislocation, multiligament knee injury, posterolateral tibial plateau fracture

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Thema: Sonstiges

Inhalt Englisch

Titel: Cortical Desmoid of the distal femur - incidentaloma or insertional tendinopathy?

Aims and Objectives: The Cortical Desmoid (DFCI, Distal Femoral Cortical Irregularity) of the posteromedial femoral condyle is considered to be an asymptomatic incidental finding in radiological diagnostics of the knee joint in adolescents without clinical relevance. The age peak is 10-15y (m:f = 3:1). Some authors report an accumulation in ambitious athletes, a possible explanation is an insertional tendinopathy of the medial head of the gastrocnemius muscle.
These patients are also regularly presented in the outpatient department of tumor orthopedics to exclude a malignant bone tumor.
On request, a large proportion reports load-dependent knee pain.
The aim of this study is to evaluate the clinical relevance of DFCI by a case series of patients with knee pain and DFCI of the posteromedial femoral condyle, from both a tumor orthopedic and sports medicine point of view.

Materials and Methods: This is a retrospective case series study of currently n=11 patients (f:m = 9:2, age 14.8±1.6y) with DFCI of the posteromedial femoral condyle from the outpatient department.
Symptom duration to initial presentation, concomitant pathologies, number of MRI, type of sports and exercise intensity, downtime, duration and extent of conservative therapy and subjective improvement of symptoms are documented. In addition, Tegner Activity Scale and Lysholm Score are collected.
At initial presentation, a clinical correlation is made with regard to localized posteromedial pain in contrast to non-specific knee pain.

Results: n=11 reported knee pain at the time of initial presentation, and localized posteromedial strain pain was documented in 72.7%. Above average, the patients were physically highly active in sports with repetitive activation of the calf muscles (swimming,
dancing, field hockey), with high training intensities and sports at a high performance levels.
Symptom duration to initial presentation was 9.3mo (min 1, max 48). Up to 4 MRI examinations (2 on average) were performed as part of the diagnostic workup. Structural knee damages could regularly be excluded. In n=4 (36.3%) additional functional concomitant pathologies were diagnosed.
All patients received physiotherapy as basic therapy from initial presentation on.

Conclusion: In MRI diagnotics of the adolescent knee joint, the examiner will recurrently encounter the DFCI as a pathognomonic image finding. Knowledge of this entity is essential in order to spare the patient from uncertainty and overtreatment. Histopathological sampling is usually not required, but MRI follow-up examinations are optional.
Contrary to the data available to date, it appears that - particularly in the physically highly active patient with
localized pain on exertion - the DFCI seems to be clinically relevant. Concordant to treatment concepts for other insertional tendinopathies, a structured conservative treatment with
physiotherapy as basic therapy is recommended.

Stichwörter: Cortical Desmoid; DFCI; competitive sports; bone tumor; insertional tendinopathy

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Thema:	Frakturen rund ums Knie

Inhalt Englisch

Titel:	Patient reported outcome after surgical treated Tibial Plateau Fracture - What can we expect?
Aims and Objectives:	Tibial plateau fractures often require surgical treatment. Postoperative partial weight-bearing and limited motion result in impaired knee function in the short term, and the risk of osteoarthritis is increased in the long term. The aim of this study was to evaluate midterm postoperative outcomes,focusing on patient-reported outcomes.
Materials and Methods:	Patients with a tibial plateau fracture who underwent surgery between 2014 and 2019 at a Level I trauma center were included in this study. The minimum follow-up was 12 months. Several patient reported outcome measures were obtained (International Knee documentation Committee Score(IKDC), Lysholm Score, Tegner Score, Visual Analog Scale (VAS) for pain). Fractures were classified according to Schatzker, Moore and OTA/AO.
Results:	A total of 57 patients (60% women (n=34); 40% men (n=23)) with a mean age of 50.8 ± 11.9 years and a mean follow-up time of 3.9 years participated in this study. Schatzker II fractures were present in 50% and Schatzker VI fractures in 38% of patients (Schatzker III 6%, Schatzker IV 6%). All scores collected showed significant improvement between the first year after surgery and the last follow-up VAS for pain decreased 1.9 points to 0.9 ($p<0.01$), IKDC score increased by 20.1 to 82.5 ($p<0.01$). In addition, there were significant improvements in return to sport/work: Tegner score increased 1.6 points to 4.5 ($p<0.01$), Lysholm score increased 18 points to 91.0 ($p<0.01$). Furthermore, all scores showed significant differences between preoperative status and final follow-up (VAS + 0.6; IKDC -11.35; Tegner -0.67; Lysholm -7.41). Within the classifications, Shatzker type II fractures show significant better subjective outcomes on the long term compared to Schatzker type VI fractures.
Conclusion:	There is a significant improvement between one-year post-surgery and the final follow-up examination. However, the statistically significant differences between the pre-injury state and the post injury examinations demonstrate the complexity of tibial plateau fracture and its treatment. Nevertheless, the results demonstrate good to excellent midterm results.
Stichwörter:	Tibial plateau fracture, Return to sports, patient-reported outcome

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Thema:	Knorpelchirurgie

Inhalt Englisch

Titel:	Low postoperative complication rate and high survival rate & good clinical outcome 9 years after Autologous Chondrocyte Transplantation of the knee joint
Aims and Objectives:	To investigate postoperative complications and associated risk factors for failure following Autologue Chondrocyte Transplantation ("ACT") as well as its long-term survival and clinical function. It was hypothesized, that ACT is a secure technique for cartilage repair with a low incidence of postoperative complications and rare rates of revision surgery combined with a high long-term survival and good to excellent clinical outcome in long-term-follow-up.
Materials and Methods:	All patients undergoing ACT-Cs of the knee joint between 2006 and 2012 at the author's institution were included in this retrospective study. Concomitant procedures had been performed if necessary. Early postoperative complications, revision surgeries, failure and risk factors for those events were evaluated 6 months after the surgery. Long term clinical outcome was assessed using the Lysholm Score, the Tegner Score, a 10-grade scale for satisfaction and the Visual Analogue Scale (VAS) at a minimum follow-up of 9 years postoperatively. Long term survival was calculated using revision surgeries, clinical failures and conversion procedures to create a Kaplan-Meier-analysis. A subgroup analysis for different defect locations was performed. 139 patients were included in this study (27% female/ 73%male; age 26.7 [21.7;35.2] years). The median defect size was 4.0 [3.0;6.0] cm² (40% medial femoral condyle (MFC), 17% lateral femoral condyle (LFC), 36% patella, 19% trochlea). 97 (70%) of the patients had undergone previous surgery and 84 (60%) underwent concomitant procedures.
Results:	Postoperatively, 8% of patients had complications (4% bleeding, 2% arthrofibrosis, 2% infection), 7% of patients needed revision surgery. 12% of patients had a prolonged deficit in ROM, that did not require revision surgery. No significant difference in terms of complications was found between the patellofemoral and femorotibial group. Patients demonstrated good patient reported long-term outcomes 9-15 years after the index surgery (Tegner: 4.7 ± 1.8; VAS: 2.4 ± 2.1; Lysholm: 80 ± 14; satisfaction with operation: 7.3 ± 1.9). Survival rates were 88% at 9 years, 85% at 11 years, and 85% at 13 years after the index procedure. Reasons for failure included debridement of ACT (n=4; 5%), revision ACT (n=3, 3%), conversion to total knee arthroplasty (n=3, 3%) and conversion to HTO(n=1; 1%)).
Conclusion:	The present study indicates ACT-Cs as an effective treatment option for femorotibial- as well as patellofemoral cartilage defects with a high long-term survival and low conversion rate as well as good long-term results regarding knee function and satisfaction. Postoperative complications needing revision surgery are rare. Prolongated deficits of range of motion appear frequently up to six months especially in patellofemoral defects, but can often be successfully addressed by intensified physiotherapy without requiring an arthrolysis.
Stichwörter:	ACI; ACT; Autologous Chondrocyte Transplantation; Autologous Chondrocyte Implantation

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Thema:	Sonstiges

Inhalt Englisch

Titel:	Sustaining a very severe sports injury leads to at least one year of earlier retirement in professional male UEFA football players
Aims and Objectives:	It is generally presumed that very severe sports injuries (eg, anterior cruciate ligament ruptures, Achilles tendon ruptures, intraarticular fractures) negatively affect the career duration of professional football players. However, professional athletes can rely on high-level medical care, and return to sport after injury is commonly seen. In addition, sporting and financial pressure can force them to play with tissular damage. The effects of severe football injuries on career duration are not well investigated, but evidence is needed in the context of injury prevention and future healthcare planning.
Materials and Methods:	Professional male football players from the top five European leagues who participated in the 2009/10 season were considered for a ten-year dataset-driven follow-up. Injury history details from all players were evaluated and very severe injuries (defined as return to competition after more than 180 days) were identified by using the database www.transfermarkt.com. Also, the age of the players at retirement was identified (defined as no longer participating in any professional football matches). Descriptive statistics, age-matching, and cox regression were used for statistical analysis.
Results:	Overall, 2754 players from the top five European male football leagues were included in this analysis. Until the end of the follow-up period, 1424 players (51.7%) had retired. Of these, 309 players (21.7%) had at least one reported very severe injury during their sports career and mean age of retirement in this group of players was 34.3 ± 3.1 years. In contrast, 1115 players ended their career without a documented very severe injury and their mean age at retirement was 35.4 ± 3.1 years ($p < 0.001$).
Conclusion:	A sports injury with an absence of more than 180 days negatively affects career longevity in professional male UEFA football players. A greater awareness of long-term health issues in professional football players may be in order.
Stichwörter:	Soccer, health, career

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Thema: Knorpelchirurgie

Inhalt Englisch

Titel: Open Flake Refixation with significantly better radiological outcome than Debridement following Acute Patella Dislocation and Concomitant Flake Fractures - both groups with excellent Clinical Outcome

Aims and Objectives: To investigate clinical and magnetic resonance (MR) imaging results of patients undergoing patella stabilization with either open flake refixation (oFR) or debridement (Deb) and concomitant soft tissue patella stabilization after sustaining primary, acute patella dislocation with confirmed chondral and/or osteochondral flake fractures. It was hypothesized that refixation will lead to better results than debridement at mid-term follow-up.

Materials and Methods: A retrospective chart review was conducted to identify all patients undergoing oFR or debridement after sustaining (osteo-)chondral flake fractures and concomitant soft tissue patella stabilization following primary, acute patella dislocation between 01/2012 and 09/2018 at the author's institution. Patients were excluded if they were aged < 14 years or >30 and had previous knee surgeries at the index knee. MR images were assessed using the Magnetic Resonance Observation of Cartilage Repair Tissue (MOCART) 2.0 kneescore. Clinical outcomes were assessed using the Tegner activity score, Kujala score, subjective IKDC score, and the KOOS score at a minimum follow-up of 24 months postoperatively. 29 patients were included in the study, with sixteen patients assorted to the oFR group and thirteen patients to the debridement group.

Results: Demographic data did not show significant group differences (oFR: 6 female, 10 males; age 26.9 ± 5.6 years, FU: 57 months (27-97 months); Deb: 6 female, 7 male; age 24.5 ± 5.1 years, FU: 63 months (29-96 months); n.s.). Defects in the oFR group were significantly larger (2.58 cm2 vs. 1.34 cm2; p=0.028), while defect location was similar in both groups (oFR: 12 x patella/ 4 x lateral femoral condyle; Deb: 10/3; n.s.). The MOCART 2.0 score showed significantly better results for the oFR-group (68.2 ± 11.1 vs. 54.1 ± 11.6, p=0.012). Both groups showed excellent clinical outcomes, with no statistically significant difference between both groups. (oFR-group vs. Deb-group: Tegner: 5.1 ± 1.8 vs. 6.0 ± 1.8; Kujala: 86.1 ± 12.6 vs. 88.2 ± 8.4; IKDC: 83.8 ± 15.0 vs. 88.0 ± 11.3; KOOS: 83.3 ± 14.0 vs. 87.3 ± 8.1; n.s.).

Conclusion: Open refixation of (osteo-)chondral fragments in patients after sustaining acute patella dislocation with (osteo)-chondral flake fractures shows excellent clinical results and significantly better radiological results compared with debridement, even though the defect size is larger, showing that it is a good surgical option in the treatment algorithm. Debridement shows excellent clinical results for smaller defect sizes, showing that patients that are not eligible for refixation or ACI and are treated with debridement can show excellent results.

Stichwörter: ACI; ACT; Flake Fracture; Autologous Chondrocyte Transplantation;Autologous Chondrocyte Implantation; Patella lunation

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Thema:	Robotik, Sensorik, KI

Inhalt Englisch

Titel:	Unsupervised clustering of gait analysis sensor data to determine outcome after tibial plateau fractures
Aims and Objectives:	Gait analyses allow to objectify gait pathologies and to detect deviations from the norm that are not detectable by the human eye. Especially in the assessment of functional range of motion, sensor-based 3D gait analyses are becoming increasingly important. The aim of this study was to evaluate the rehabilitation success of patients with tibial plateau fractures objectively and automatically by means of an AI-supported evaluation of postoperative gait analyses and to identify interindividual differences in this patient cohort. In this context, it was investigated in detail to what extent a multidimensional cluster analysis of the data from the joint kinematics is helpful in order to better identify patients with rehabilitation delays and to be able to correlate the results with clinically recorded findings.
Materials and Methods:	In 34 patients with a surgically treated tibial plateau fracture, a video-assisted 3D gait analysis was performed 6 months postop using the Noraxon Myomotion System. Mean range of motion (ROM) was calculated averaged over 10 steps during gait cycle. The respective ROM data for the ankle joint, knee joint, and hip joint were measured individually. In addition, ROM was passively determined and the PROMs WOMAC and Lysholm Knee Score were collected. Subsequently, a K-Means cluster analysis was performed and the clusters were compared using adjusted Student's t-tests. The K-Means method is an unsupervised machine learning algorithm that offers great potential in pattern recognition, especially when a large number of parameters need to be considered synoptically.
Results:	34 patients were divided into two groups based on the siluette score (group 1 = 13 subjects, group 2 = 21 subjects). Statistical comparison of the two groups revealed highly significant differences ($p<0.001$) in ROM data of flexion-extension in the knee joint and in the WOMAC score. Pain and stiffness also showed significant differences in the subcategories of the WOMAC ($p<0.01$).
Conclusion:	The fact that the motion data clusters differ considerably in the clinical outcome measures WOMAC and ROM of knee flexion illustrates that K-Means clustering can produce clinically relevant clusters. The study can be thought of as a pilot study in which a machine learning-based analysis of a standardized gait analysis following a tibial plateau fracture automatically discovers clusters that exhibit differences in rehabilitation outcome and hence in individual rehabilitation potential. In the long run, the goal is to refine these algorithms with a greater number of instances in order to create AI that can assist clinicians in better interpreting gait analysis data and making clinically meaningful decisions on the further therapy procedure.
Stichwörter:	AI, tibial plateau fractures, gait analysis, 3D sensing, unsupervised machiene learning

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Thema: Prothetik 360° von Teil- über Total- bis zur Revisionsendoprothetik

Inhalt Englisch

Titel: How does Varus Malalignment of the Lower Limb effect the Joint Line Orientation of the Osteoarthritic Knee? A Morphological Analysis using 3D-CAD-Imaging

Aims and Objectives: For the treatment of osteoarthritic varus deformity (OVD) with total knee arthroplasty (TKA), attention to the alignment of the tibial and femoral joint lines is critical since the geometric relationships of the native knee change with disease progression and malalignment due to condylar wear and osseous deformity. The objective of this study was to investigate the relationship between the femoral and tibial joint line orientation with an increase in coronal varus deformity using three-dimensional (3D), computer-aided design (CAD) bone models.

Materials and Methods: 3D-CAD-bone models of 150 knees of patients with varus osteoarthritis who had been scheduled for customized TKA were retrospectively analyzed. Based on the hip-knee-ankle angle (HKA) of the lower limb, patients were allocated to one of three groups of mild (0-5°), moderate (>5-10°) and severe (>10°) varus deformity. Joint line orientation was measured based on the femoral (FMA) and tibial mechanical angle (TMA), as well as the joint line congruency angle (JLCA). Lastly, all OVD knees were allocated to functional phenotypes as proposed previously. A standard two-tailed t-test assuming unequal variances was used to determine significant differences between the groups.

Results: The three alignment groups included 50 patients each, with an average HKA of 176.7° (SD, 1.2) in the mild, 172.6° (SD, 1.4) in the moderate, and 167.9° (SD, 1.1) in the severe OVD group. With an increase in malalignment average FMA values decreased from 92.3° (SD, 1.9) in the mild to 91.4° (SD, 1.5) ($p= 0.01$) in the moderate and further to 89.5° (SD, 2.1) ($p< 0.0001$) in the severe varus group. Compared to the distal femur, a stronger positive association of tibial deformity and coronal alignment was observed with a decrease in average TMA values from 86.6° (SD, 2.2) to 84.6° (SD, 2.1)($p< 0.0001$) and further to 82.9° (SD, 1.9)($p= 0.0002$) in the three groups respectively. Based on performed measurements of the JLCA, lateral joint opening increased significantly with an increase in HKA from an average of 2.2° (SD, 1.7) in the group of mild to 3.5° (SD, 1.8)($p= 0.0003$) in the moderate group and 4.5° (SD, 1.9) ($p= 0.007$) in the severe varus group.

Conclusion: Results of this study show that joint line orientation alters with increasing varus deformity and wear. On average, as varus deformity increased, the femoral condylar valgus decreased, while the tibial varus and the JLCA increased. As a result, the femoral joint line shifted from an oblique to a more neutral orientation relative to the femoral mechanical axis and, at the same time, the obliquity of the tibial joint line increased relative to the tibial mechanical axis. This is agreement with the concept of functional knee phenotyping (Hirschmann et al.). Findings of this study contribute to a better understanding of the coronal joint line variability in OVD which should be considered during surgical joint line restoration.

Stichwörter: TKA; osteoarthritis; varus malalignment; joint line orientation

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Thema:	Prothetik 360° von Teil- über Total- bis zur Revisionsendoprothetik

Inhalt Englisch

Titel:	Circadian analysis of metal ion levels in blood samples following knee arthroplasty.
Aims and Objectives:	Increased metal ion levels in the blood of affected patients can sometimes be detected following total knee replacement. The extent to which blood metal values can be used as a surrogate parameter for the wear of implanted endoprostheses has been subject of scientific analysis and controversial discussions for years. Clear definitions of max. metal concentrations in laboratory chemical parameters are pending; rather, consensus decisions of experts serve as rough guidelines for threshold values for metal ion concentrations in blood samples after joint replacemtn. This study aimed to investigate the circadian rhythm as well as possible fluctuations of metal values in blood samples of patients and to analyze whether the time of taking the blood sample during the course of the day influences the measurement result obtained.
Materials and Methods:	Fifteen subjects were included in the study: 5 healthy controls, 5 patients with one cruciate retaining (CR) total knee replacement and 5 patients with one rotating hinge (RH) knee replacement. Blood samples were taken throughout the course of one day (day 1: 8am, 12am, 4pm and 8pm) and in the following two weeks (at the timepoint of the highests value measured on day 1). The following metals were measured using inductively coupled plasma mass spectrometry (ICP-MS): chrome, cobalt, nickel and titanium. Activity levels of all subjects were measured using ActivPal Motion Sensors (PAL Technologies Ltd, Glasgow, UK). Gait analyses of the participants were performed using an OptoGait device (Microgate Corporation, Bolzao, Italy). The following patient related scores were used: Lysholm, IKDC, KSS, Oxford knee, IQ5D and Tegner.
Results:	Regarding outcome scores, patientes following RH arthroplasty were found to have the least favorable score results. Gait analysis showed compromised gait patterns in patients following knee replacement. Movement profiles showed differences between the three groups with the lowest activity in healthy controls and the highest the RH group. Metal ion levels of the study participants with total knee replacements were significantly higher than those of the healthy control group (chromium, cobalt). No circadian variation of metal ion levels was detected, neither in the healthy reference group nor in patients following joint replacement. Further, there were no differences in the analysis over the course of three weeks.
Conclusion:	High activity levels of included patients might be a possible cause for elevated metal levels. Based on the presented findings, metal levels in blood samples do not appear to be subject to any circadian or medium-term (weeks) rhythm. However, since the number of participants in the study is overall limited, we recommend to take blood samples of affected patients at the same time of day whenever possible.
Stichwörter:	metal ion, endoprosthetic wear, cobaltism

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Thema: Sonstiges

Inhalt Englisch

Titel: How does the medializing osteotomy of the tibial tubercle influence the measurable parameters of patellofemoral tracking? - a dynamic MRI-controlled study

Aims and Objectives: A lateralized tibial tubercle is one of the most common causes for lateral patellar maltracking. The purpose of this study was to investigate the influence of medializing tibial tubercle osteotomy (TTO) on measurable parameters of patellar tracking, using dynamic Magnetic Resonance Imaging (MRI).

Materials and Methods: Patients who were treated with a medializing osteotomy of the tibial tubercle due to patellofemoral instability (PFI) and maltracking (PM) between December 2019 and October 2021 were included. Inclusion criteria were recurring patellar dislocation, a positive (reverse) J-sign and preoperative measurement of PM using dynamic MRI. In all cases, a lateralized tibial tubercule was identified to be the sole reason for patellar maltracking. Exclusion criteria were higher-graded anatomical risk factors, a limited range of motion or open physes . Patients were examined using an established dynamic MRI protocol. During repeated active movement of the affected knee, dynamic mediolateral patellar translation (dMPT) and dynamic patellar tilt (dPT) were measured. The examination was performedpreoperatively and 3 months postoperatively. The tibial-tuberosity-to-trochlear-groove-(TT-TG) and tubercle-to-posterior cruciate ligament (TT-PCL)-distances were measured on static MRI sequences.

Results: 13 Patients (2 males, 11 females, average 21 years) were treated by medializing TTO and additional MPFL-reconstruction, performing an average medialization of 7.4 ± 2.0 mm. After three months, no redislocations were observed. Postoperatively, the TT-TG and TT-PCL had improved significantly (TT-TG: 17,3 ± 3,46 mm to 9,37 ± 3,54 mm; p<0,001); TT-PCL: 22,66 ± 4,09 mm to 14,39 ± 4,88 mm; p<0,001). Furthermore, significant improvement of patella maltracking was found (dMPT: 12.5 ± 5.8 to 5.6 ± 0.3; p<0.001 and dPT: 16.9 ± 11.2 to 8.5 ± 7.5; p<0.001). Correlation analysis showed a strong correlation between the extent of medialization with the preoperative dMPT (r=0.49, p=0.02) and dPT (r=0.5, p=0.02) as well as with the postoperative dPT (r=0.45, p=0.04). There was a relevant, yet non-significant correlation with the postoperative dMPT.

Conclusion: Pathological lateralization of the tibial tubercle is associated with measurable lateral PM in patients with PFI. Medializing TTO leads to a normalization of dynamic parameters for patellar tracking. While preoperative dPT and dMPT strongly correlate with the extent of medialization, postoperative patellar tracking is influenced mainly in terms of the dPT.

Stichwörter: patellofemoral instability, TT-TG, TT-PCL, patellofemoral maltracking, dynamic MRI

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Thema: Physiotherapie und Rehabilitation

Inhalt Englisch

Titel: The digitally measured single-leg vertical jump is a valid tool for documenting early rehabilitation progress after knee joint surgery

Aims and Objectives: Functional tests in postoperative rehabilitation are used in a standardized manner to document success and make treatment decisions, including return to work and sports. The single-leg vertical jump (SLVJ) is used to assess functional stability of the knee joint and maximum strength only in a later rehabilitation phase. To date, there is a lack of data to use the SLVJ in the early postoperative rehabilitation phase. However, these can be obtained from a registry.

Materials and Methods: Primary raw data were analyzed from a decentralized, digital, multinational European registry of a sensor-based medical device (Orthelligent, OPED) to quantify mobility, coordination, muscle strength, and dynamic exercise. Data were obtained by patients themselves in a home setting (n= 482, 76% isolated anterior cruciate ligament (ACL) rupture, of which 24% had concomitant injuries) or by therapists in an outpatient setting (n=250). The measurement results of the SLVJ at defined time points after knee joint injuries were analyzed in detail. Time points were evaluated as surrogate parameters for individual readiness and fitness and jump height in early rehabilitation specific to the indication to test validity. The safety of the SLVJ was consistently recorded in the tests.

Results: Data from a data collection period from 2018 to 2020 of 138 patients after knee joint surgery were available for analysis (median 26-30 years; < 16 years: 4%; >51 years: 14%, 63% male). The results showed that patients already have the confidence to perform this test at a very early rehabilitation phase (4.2 weeks postoperatively, Kaplan-Meier: CI 95% 3.5 - 4.8). The time to use the test by 50% and 75% of the patients was 2 and 6 weeks, respectively, indicating inhomogeneous rehabilitation progress among patients. The jump height of the SLVJ was significantly higher (12.9 ± 6.1 vs. 10.4 ± 5.1, p=0.036) in patients in the early rehabilitation phase (8-10 weeks postoperatively) after intervention of a ACL rupture, (n=129) than in patients after ACL rupture with concomitant injuries (n=121) indicating the validity of the sensor-based measurement tool. There were no adverse events when performing the SLVJ in these patients in the early postoperative rehabilitation period.

Conclusion: Based on the data of this sensor-based measurement tool ("app") obtained in the everyday life of the patients, it becomes clear that many patients perform a SLVJ safely at a very early stage after knee joint surgery and that the collected measurement values are valid. The timing of SLVJ performance can be interpreted as surrogate parameters for individual patient readiness and fitness. The results of the SLVJ provide an easily measurable and reproducible endpoint for functional knee stability.

Stichwörter: anterior cruciate ligament; Rehabilitation; Vertical Jump

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Thema:	Osteotomie

Inhalt Englisch

Titel:	Automated measurement of lower limb alignment using a software-based algorithm (mediCAD®)
Aims and Objectives:	Several studies have proposed deep learning Convolutional Neural Networks (CNN) to facilitate radiological measurements, including lower limb alignment in long standing radiographs (LSR). This study evaluates an algorithm implemented in a popular planning software and focuses in particular on the accuracy in case of deformity or total knee arthroplasty (TKA).
Materials and Methods:	Pre- and postoperative bilateral images of 90 patients with posttraumatic knee arthritis were analyzed, resulting in 360 LSRs. All alignment parameters relevant to knee arthroplasty and deformity correction were tested against manual measurement. Mean absolute error and intraclass correlation (ICC) were used to evaluate the accuracy.
Results:	The CNN evaluated demonstrates high consistency in leg length (ICC>0.99) and overall lower limb alignment (mechanical/anatomical femoro-tibial angle ICC>0.93). Accuracy at specific joint angles (MPTA, mLDFA) varies between lower limbs with deformity, with and without TKA, with the difference being greatest for TKA (ICC 0.22-0.85).
Conclusion:	This software-based algorithm for fully automated analysis of LSR shows highly accurate results for lower limb alignment, even in patients with deformities or TKA. However, the automatic detection of landmarks around the knee joint still demonstrates some deviations, but manual readjustment is easily possible with the software.
Stichwörter:	limb alignment, automated analysis, CNN

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Thema: Osteotomie

Inhalt Englisch

Titel: Additional Plate Fixation of Hinge Fractures after Varisation Distal Femoral Osteotomies Provides Favorable Torsional Stability - A Biomechanical Study

Aims and Objectives: In addition to obesity and smoking, hinge fractures (HF) after varisation distal femoral osteotomy (DFO) are considered to be a reliable risk factor for delayed or non-union of the osteotomy gap. In the current literature, limited evidence exists regarding the osteosynthetic treatment of HFs after DFO. Thus, the aim of this study was (1) to examine the effect of HFs on the torsional stability of the bone-implant construct and (2) to evaluate the biomechanical advantages of an additional fixation of HFs after varisation osteotomies of the distal femur.

Materials and Methods: Twenty fresh-frozen human distal femurs were equally divided into two groups. A medial closed wedge DFO (MCW-DFO) and lateral open wedge DFO (LOW-DFO) were stabilized with a locking plate system and the following conditions were serially tested: 1) hinge intact (native), 2) hinge fracture (HF), 3) hinge fracture fixed with lag screw (HF_LS) and 4) hinge fracture fixed with locking plate (HF_LCP). Using a servo hydraulic testing machine, each construct was subjected to a cyclic loading test (10 cycles) of axial compression (400 N, 25 mm/sec, 1 Hz) and torsional load in internal and external rotation (10 Nm, 1 °/sec, 0,2 Hz evaluating the stiffness. While cyclic loading testing, regional shift and strain patterns across the osteotomy plane were recorded using an 3D optical measuring system (GOM Aramis, GOM GmbH, Braunschweig, Germany). An one-way analysis of variance (ANOVA) was used to determine statistical significances ($p<.05$).

Results: After varisation DFO, an intact cortical hinge provides the highest stability of the bone-implant construct compared to the different test conditions ($p < 0.001$), while the mean torsional stiffness was significantly higher for MCW-DFO (12.7 ± 2.1 N/°) than LOW-DFO (8.5 ± 1.9 N/°, $p < 0.01$). Hinge fractures lead to an increased rotational dislocation across the osteotomy gap (2.23 ± 0.5 mm an 3.34 ± 0.06 mm) after MCW- and LOW-DFO compared to the native group (0.05 ± 0.01 mm, $p < 0.0001$ or 0.06 ± 0.01 mm, $p < 0.0001$). Additional plate fixation of hinge fracture showed significant increase in torsional stiffness after LOW-DFO (3.0 ± 0.7 N/°, p 0.001 and 5.8 ± 1.3 N/°, $p < 0.0001$) compared to the HF group, whereby a higher torsional stiffness (4.1 ± 0.9 N/°, $p < 0.001$ and 7.2 ± 1.4 N/°, $p < 0.0001$) could be shown for the MCW-DFO. Compared to the native group, additional plate fixation of hinge fractures could not restore the rotational stability of the bone-implant construct after MCW- (6.6 ± 1.8 mm, $p < 0.01$) and LOW-DFO (5.8 ± 1.6 mm, $p < 0.001$).

Conclusion: An intact hinge ensures the highest biomechanical stability of the bone-implant construct after MCW and after LOW-DFO. Hinge fracture lead to dramatic torsional instability, while the axial stability is nearly preserved. An additional plate fixation of hinge fractures provides favorable torsional and axial stability, whereby the primary stability of the bone-implant construct with a preserved hinge could not

be restored.

Stichwörter: -

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Thema: Knorpelchirurgie

Inhalt Englisch

Titel: Matrix-associated autologous chondrocyte implantation (MACI) in the knee - clinical results of patients with and without concomitant knee pathologies

Aims and Objectives: MACI has been used effectively for the treatment of cartilage defects in the knee for several years. The application is restricted by accompanying damage to the internal knee structures, axis misalignments and osteochondral defects, which must be corrected parallel to or in temporal proximity of the MACI. A large number of the studies currently available only included patients with "optimal" knee conditions, i.e. without the need for additional interventions. The aim of this study was to determine the current status of the treated knee in patients with and without additional interventions and to determine their subjective assessment of the surgical success. In addition, we searched for possible influencing factors on subjective surgical success.

Materials and Methods: 124 patients who received a MACI in the period 2011 up to and including 2019 were included in the study. Data was collected using questionnaires and patient files. Subjective surgical success was assumed when people rated the postoperative knee condition as "better". The chi-square test and Mann-Whitney U test was used for group comparisons, and correlations were calculated using the t-test or binary logistic regression.

Results: Patients with and without additional interventions did not differ significantly in the following scores: KOOS (66.7 without vs. 66.5 with; p .878), Lysholm (69.8 without vs. 72.0 with; p .417), TAS (3.5 without vs. 3.6 with; p .949) and IKDC (63.8 without vs. 64.3 with; p .963). In the group with additional interventions, 32 of 70 people (46%) rated the postoperative condition as "better", in the group with no additional interventions it was 30 of 52 (58%), this difference was not significant (p .191). In the study population, age was weakly positively correlated with damage size (r .245; p .007). There was a negative correlation between rating the postoperative condition as "better" and the damage size, this was statistically significant (OR .795, 95% CI [.646 - .978]), the influence of age was not (OR .971, 95 %CI [.941 - 1.002]). Nevertheless, the group with the greatest damage (≥ 6.0 cm^2) rated the condition as "better" significantly more often than the other groups ("≤ 3.0 cm^2" p .016; "> 3.0 - < 6.0 cm^2" p .022) did. A subgroup analysis showed that people ≥ 50 years rated their condition as "better" significantly more often than the groups "< 35 years" (p .006) and "≥ 35 - < 50 years" (p .046) did.

Conclusion: In this study population, similarly good results were achieved in patients with and without additional surgery. Despite the limitations of this study, this coincides with the results of other studies, nevertheless future studies should compare patients with and without concomitant pathologies in a more targeted manner. It is interesting that older people and those with greater damage rated their postoperative knee condition significantly more often as "better". A possible explanation is that greater damage may be more impairing and older people tend to have lower functional demands.

Stichwörter: MACI, Matrix-associated autologous chondroyte implantation, cartilage, cartilage repair, knee

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Thema:	Sonstiges

Inhalt Englisch

Titel:	The impact of anatomical predisposition and mechanism of trauma on dislocation of the patella: a retrospective analysis of 104 cases
Aims and Objectives:	The aim of this study was to determine whether traumatic dislocation of the patella in children and adults is provoked by the presence of predisposing factors and examine the role of the mechanism of injury.
Materials and Methods:	Cases encoded with the diagnosis "dislocation of the patella" and covered by the german statutory accident insurance were collected from internal medical records. The study was designed as a retrospective cohort study, level of evidence III. Subjects were divided into two age-specific groups (Cut-off 18 years of age). We evaluated descriptive demographical aspects, general information pertaining to the accident and treatment, as well as anatomical aspects. We subdivided the mechanism of trauma into four groups: direct impact, insufficient trauma, fall, and rotational trauma. Data was gathered from the Form F1000, imaging studies, and physician's documentation and was analyzed using Microsoft Excel.
Results:	Our sample size comprised 104 cases, consisting of 54 children (median age: 14 years) and 50 adults (median age 30 years). The mechanism of injury showed the following distribution in children: Rotational trauma 42%, direct impact 19%, insufficient trauma15%, and falls accounted for 13 %. The adult group showed the following distribution: Rotational trauma 52%, direct impact 10%, insufficient trauma 20%, and falls accounted for 8 %. The proportion of recurring dislocations of the patella was greatest for the category "insufficient trauma", irrespective of age. All other categories exhibited a first-time dislocation proportion of greater 75%. In respect to anatomical predisposing factors, children exhibited valgus deformity of the knee joint in 39%, minor torsional abnormality, a high-riding patella in 41% and pathological shape of the trochlea in 57% of cases. Adults showed valgus deformity in 20%, minor torsional abnormality, high-riding patella in 28%, and a pathological shape of the trochlea in 36% of the cases. 20% of the children and 21% of the adults exhibited none of the above-mentioned predisposing factors. Falls accounted for the highest number of cases exhibiting none of the defined anatomical predisposing factors.
Conclusion:	The ratio of predispositions in patients suffering a dislocated patella is high. Patella dislocations documented to have been caused by insufficient trauma, or any dislocations recorded as a recurrent event, are more closely tied to a certain predisposition than the trauma itself. A fall, direct impact, or rotational trauma can be viewed as an adequate mechanism of trauma. In order to successfully treat the underlying cause, it is paramount to properly analyze the exact mechanism of trauma and to consider any underlying predispositions.

Stichwörter:	Dislocation of the patella, predisposition, patellofemoral joint, patellofemoral dysbalance

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Thema: Sonstiges

Inhalt Englisch

Titel: Influence of Quadriceps Muscle Activity on the Patellofemoral Contact Mechanism in Patients with Low Flexion Patellofemoral Instability after MPFL Reconstruction.

Aims and Objectives: The importance of the patellofemoral cartilage contact area (CCA) in patients with patellofemoral instability (PFI) has not been fully accessed. There is a lack of high-quality in vivo data on how MPFL reconstruction affects patellar kinematics and, in particular, the influence of quadriceps activity on the patellofemoral contact mechanism. In the present study, the influence of quadriceps activation on the CCA in patients with PFI before and after stabilizing surgery by MPFL reconstruction and in a control group of volunteers with healthy knees was investigated using 3D models via high-resolution in vivo 3 Tesla MRI images in different flexion positions (0-30°).

Materials and Methods: In a prospective cohort study, 13 healthy volunteers and 13 patients with low flexion patellar instability matched via the transepicondylar axis distance (TEA) were analyzed before and after surgical treatment by MPFL reconstruction. We used MRI scans in a custom-designed loading device to determine the patellofemoral CCA with (5N) and without (0N) load. By using a Moiré phase tracking system via a prepatellar fixed tracking marker motion artefacts were suppressed. Comparative measurements using 3D cartilage and bone meshes were generated to compare the CCA of both groups with and without quadriceps activation in 3 positions of low knee flexion (0°, 15° and 30°).

Results: With activation of the quadriceps muscles, the increase in CCA in volunteers with healthy knees was 1.5 ± 16.1mm2 in extension, 0.4 ± 42.1mm2 in 15° flexion and 38.0 ± 44.1 mm2 in 30° flexion (p=0.009). Patients with PFI showed a change in CCA of 6.6 ± 35.0 mm2 in extension, -6.4 ± 30.7 mm2 in 15° flexion and 10.8 ± 32.9 mm2 in 30° flexion. Postoperatively, with activated quadriceps muscles, the CCA change was -5.3 ± 14.5 mm2 in extension, 19.8 ± 80.6 mm2 in 15° flexion, and 23.0 ± 47.7 mm2 in 30° flexion (p=0.10).

Conclusion: The influence of quadriceps muscle activation on patellofemoral CCA is most pronounced in knee healthy subjects in 30° flexion (p=0.009). No significant change is observed in extension and 15° flexion. The influence of the quadriceps is diminished in patients with PFI. Although the greatest increase in CCA is seen at 30° flexion, it is not statistically significant. Postoperatively after MPFL reconstruction, the greatest CCA increase is also seen in 30° flexion in terms of a statistical trend, while there is no significant change in extension and 15° flexion.
Activation of the quadriceps musculature does not result in relevant enlargement of the patellofemoral CCA in patients with PFI pre and postoperativ. In subjects with healthy knees, the effect of quadriceps activation is apparent only at 30° flexion.

Stichwörter: dynamic MRI, patellofemoral instability, MRI, MPFL, CCA, quadriceps

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Thema: Sonstiges

Inhalt Englisch

Titel: Anterior knee instability increases over time after primary ACL ruptures

Aims and Objectives: To date, little is known about the correlation between the degree of anterior instability and the time since the previous ACL injury in patients with primary ACL lesions.
The purpose of this study was to evaluate a possible correlation between anterior knee laxity after primary ACL tears and the time between the accident of the ACL tear and the presentation in our clinic.

Materials and Methods: Between 2021 and 2022, we conducted a prospective study of 94 patients (41 women, 53 men; mean age 36.48 ± 13.2 years, range 16 - 62 years) presenting themselves in our clinic with primary ACL lesions without prior surgery. Clinical, radiological and functional data were collected and evaluated to determine possible differences between the anterior knee laxity (side-to-side difference (SSD) in Rolimeter) and the time of the prior accident < 1year (n=59, group A) in comparison to an accident >1 year (n=35, group B).

Results: The mean objectively measured anterior knee instability (SSD) after primary ACL rupture was 5.6 ± 2.5mm (0-13) and the mean time since the ACL trauma was 27.94 ± 53 months (0-312) in our study population. The SSD was significantly elevated in patients with the ACL trauma >1 year compared to patients with the ACL trauma within 1 year (6.49mm ±2.45 vs. 5.14mm ±2.38, p=0.01). When only considering the SSD >6mm group B showed significantly more often a high-grade anterior knee instability compared to group A (SSD >6mm, group A: 40.7% vs. group B: 65.7%, p=0.045). A pivot-shift grade 3 occurred in 13.6% of the cases in group A and in 28.6% of the cases in group B (p=0.066). Medial collateral instability was seen in 52.5% of the patients in group A and in 65.7% of the patients (p=0.281), whereas lateral collateral instability was present in 10.2% of the cases in group A and in 14.3% of the cases in group B (p=0.741).

Conclusion: The mean anterior knee instability increases over time after primary ACL injury. One year after primary ACL injury, patients showed increased anterior knee instability compared to patients with an ACL injury within one year.

Stichwörter: anterior knee instability, time after primary ACL rupture, ACL injury

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Thema: Osteotomie

Inhalt Englisch

Titel: Knee preservation of the middle-aged patient - two-staged treatment combination of patient specific metal implant and osteotomy. A case series.

Aims and Objectives: Bei fokaler fortgeschrittener unikompartimenteller Arthrose im mittleren Lebensalter (40. - 60. Lebensjahr) ist eine Achskorrektur mittels Umstellungsosteotomie häufig die Therapie der Wahl. Bei Patienten mit einer gleichzeitig bestehenden fokalen Knorpelläsion der femoralen Belastungszone des ansonsten gesunden Kompartimentes ist eine Achskorrektur jedoch kontraindiziert und ein biologischer Knorpelaufbau führt erfahrungsgemäß zu schlechten Ergebnissen. Für diese Patienten besteht somit eine Versorgungslücke, da ein bicondylärer Oberflächenersatz zwar kurz- bis mittelfristig funktionieren kann, bei diesen Patienten jedoch sicher ein oder mehrere Prothesenwechsel mit den damit verbundenen erhöhten Komplikationsrisiken zukünftig nötig werden würden.
Die vorliegende Fallserie stellt die Verfahrenskombination eines patientenspezifischen fokalen Metallimplantates (Episealer - Fa. Episurf Medical, Schweden) mit einer achskorrigierenden Osteotomie vor.

Materials and Methods: Anhand von einem MRT-Datensatz werden patientenindividuelle zementfreie Mini-Metallimplantate zur Behandlung von fokalen (osteo-)chondralen Läsionen des distalen Femur hergestellt.
6 Patienten mit fokalen (osteo-)chondralen Kniegelenksläsionen im Bereich der Trochlea und an der medialen oder lateralen Femurcondyle wurden mit insgesamt 8 patientenspezifischen Implantaten versorgt und im weiteren Verlauf jeweils eine valgisierende oder varisierende Umstellungsosteotomie durchgeführt, da klinisch wie radiologisch eine unicondyläre Arthrose mit einer zusätzlichen fokalen Chondromalazie IV.° des ansonsten arthrosefreien Gelenkkompartiments vorlag. Neben den demographischen Daten wurden folgende Scores erhoben: VAS (Schmerzen und Patientenzufriedenheit) und KOOS. Die Patienten wurden nach 3, 6, 12 und 24 Monaten nachuntersucht.

Results: Die Mittelwerte für die KOOS Unterkategorien zeigten sich im Kurzzeit Follow-up deutlich verbessert. Der summierte präoperative Wert für den KOOS (35) verbesserte sich im Mittel auf 60 nach 24 Monaten.
Der mittlere VAS Score Wert (Schmerz) verbesserte sich von 7.4 präoperativ auf 2.1 nach 24 Monaten, der mittlere VAS Score (Patientenzufriedenheit) verbesserte sich von 3.1 auf 8.5 nach 24 Monaten.

Conclusion: Patientenorientierte und -spezifische Behandlungsmethoden rücken immer mehr in den Fokus der Medizin. Vor allem für den Patienten des mittleren Lebensalters stellt die individualisierte fokale Implantation eines Mini-Oberflächenersatzes eine effektive Möglichkeit zur Therapie der lokal fortgeschrittenen Knorpelläsion dar. In Kombination mit der Umstellungsosteotomie erweitert man das Indikationsspektrum der beiden jeweiligen Operationsverfahren und verfügt somit über mehr Optionen zur Vermeidung einer frühzeitigen Implantation einer Totalendoprothese am Kniegelenk.
Die ersten klinischen Studien-Ergebnisse der Episealer Implantation zeigen exzellente Werte. Nachuntersuchungsergebnisse und größere Patientenkollektive der oben genannten Verfahrenskombination bleiben abzuwarten.

Stichwörter: knee preservation; osteotomy; cartilage; middle-aged patient; osteoarthritis

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Thema: Sonstiges

Inhalt Englisch

Titel: Semitendinosus PCL reconstruction with suspensory cortical fixation and closed socket drilling. A minimum 5 year follow up.

Aims and Objectives: This study aimed to evaluate the clinical and function outcome of patients receiving an all-inside single-bundle posterior cruciate ligament reconstruction. Is this procedure a valid technique after a minimum follow-up of 5 years?

Materials and Methods: In this preliminary study 43 patients (11 female, 32 male) with an isolated posterior cruciate ligament (PCL) injury underwent single bundle PCL reconstruction using a quadrupled semitendinosus tendon, which is inserted into a femoral and tibial closed socket. Both ends were fixed with cortically with cortically applied buttons. The scores for sport and leisure activity (Tegner), the Single Assessment Numerical Evaluation (SANE), the functional score Knee Injury and Osteoarthritis Outcome Score (KOOS) as well as the Visual Analogue Scale (VAS) of pain were recorded preoperatively, 3 months, 6 months, 1 year, 2 years and 5 years postoperatively. Furthermore, a postoperatively occurring instability, adverse events or a reinjury of the PCL were recorded. The semitendinosus graft is harvested through an incision above the Pes anserinus. To fixate the adjustable buttons, the graft is quadrupled and stabilized with sutures. The sockets are created by all-inside drilling with an individually chosen diameter depending on the graft. The compressed graft is fixed press fit into the socket to reduce the immigration of synovial fluid and fixed with cortically applied buttons.

Results: At this time, no adverse events or retears were recorded, three patients developed an increasing postoperative posterior tibial translation (6,97%). All scores improved postoperatively. The KOOS was preoperatively 60.0 (SD 13.7), 2 years postoperatively 82.3 (SD 16.0) and 5 years postoperatively 79.5 (SD 8.6). The Tegner increased from 4.1 (SD 2.4) preoperatively to 4.5 (SD 1.9) 2 years and 3.3 (SD 0.58) 5 years postoperatively. The SANE Score was preoperatively 42.3 (SD 19.8), 2 years postoperatively 78.6 (SD 14.1) and 5 years postoperatively 80.3 (SD 16.1). The VAS value decreased from 2.7 (SD 2.1) preoperatively to 1.3 (SD 1.4) after 2 years and to 1.1 (SD 1.7) after 5 years.

Conclusion: The treatment of posterior cruciate ligament injuries using a quadruple semitendinosus tendon with all-inside drilling is a valid technique. After 5 years, a slight decrease in functional scores is seen. As described in other studies, there may be increased posterior tibial translation 5 years after PCL reconstruction compared to early postoperative stability. This may result in a reduced functional outcome over time.

Stichwörter: PCL, posterior tibial translation, knee

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Thema:	Frakturen rund ums Knie

Inhalt Englisch

Titel:	3D print-assisted presurgical management of tibial plateau fractures
Aims and Objectives:	Complex tibial plateau fractures represent a major challenge in clinical practice and are associated with a poor postoperative outcome. Detailed preoperative diagnostics and structured surgical strategy are essential for optimal surgical management of the fracture. 3D printing has already shown initial evidence of benefit in fracture management of large joints (acetabular fracture, tibial plateau fracture) as part of preoperative planning. The aim of the current study was to investigate the impact of 3D printing (3DP) on the preoperative surgical strategy in comparison to conventional computed tomography (CT) and 3D CT reconstruction (3DCT).
Materials and Methods:	During data collection, 25 raters with different levels of experience (12 experienced vs. 13 inexperienced surgeons (<6 years of experience) were asked to evaluate 22 tibial plateau fractures (AO B & C fractures) using a CT, 3DCT, and using a 3DP to evaluate a surgical concept (positioning, access selection, plate selection and placement). Subjective certainty of these decisions was assessed using a five-point Likert scale. The CT & 3DCT were uploaded to a dedicated homepage and linked to a questionnaire. The 3D models were segmented using 3D slicer and printed using a dual head printer (Ultimaker S5). The layer thickness was 1.5 mm using PLA & PVA. Statistical analysis was performed using Cohens Kappa and Kruskal Wallis testing.
Results:	Regarding patient positioning, the application of 3DP showed a change in OR positioning in 26% of the cases, especially in the inexperienced surgeons group (uCh); in the experienced surgeons (eCh) group, only 12% changed the OR positioning. Interobserver reliability increased in the uCh group compared with CT and 3DCT (0.19 vs. 0.23 vs. 0.32) with respect to OR positioning. In the context of access selection, the use of the 3DP showed a change trend of 33% in the uCh and 22% in the eCh. In particular, for less complex fractures (AO B fractures), the 3DP resulted in increased interobserver reliability in the uCh group compared with CT and 3DCT (0.19 vs. 0.2 vs. 0.31) and increased overall subjective safety to 63%. Regarding osteosynthesis material selection, there was an overall 64% agreement (uCh & eCh) compared to the intraoperative osteosynthesis material used (plate selection & placement).
Conclusion:	The addition of 3D printing to the preoperative planning of complex tibial plateau fractures shows an improvement in interobserver reliability with regard to positioning and access selection, especially in young, inexperienced surgeons, and could significantly increase subjective safety. 3D printing has an impact on the surgical approach to complex tibial plateau fractures, especially in inexperienced but also in experienced surgeons.
Stichwörter:	3D printing, tibial plateau fractures, presurgical management,

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Thema: Osteotomie

Inhalt Englisch

Titel: Meniscal forces remain unaffected after tibial slope increasing high tibial osteotomy

Aims and Objectives: Research identified a positive association between posterior tibial slope (PTS) and the incidence of medial meniscal tears. The purpose of this study was to quantify the effect of increasing the PTS on knee kinematics and the resultant medial and lateral meniscal forces.

Materials and Methods: This was a controlled laboratory study approved by the local institutional review board. A 6 degrees of freedom robotic testing system was used to apply the following external loading conditions to 7 fresh-frozen human cadaveric knees: (1) 200-N axial compressive load, (2) 5-Nm internal tibial + 10-Nm valgus torque, and (3) 5-Nm external tibial + 10-Nm varus torque. Knee kinematics and the resultant medial and lateral meniscal forces were acquired for two PTS states: (1) native PTS and (2) increased PTS. An anterior opening wedge high tibial osteotomy was performed to increase the PTS. Resultant forces in the medial and lateral meniscus were calculated using the principle of superposition. A two-way ANOVA was conducted to determine the effects of PTS and knee flexion on knee kinematics and resultant meniscal forces. Level of significance was set at $p < 0.05$.

Results: Increasing PTS resulted in increased anterior (1.7 mm; $p < 0.05$) and proximal (0.5 mm; $p > 0.05$) tibial translation at 60° flexion in response to 200-N axial compressive load. There was no significant difference in resultant forces in the lateral meniscus between the increased and native PTS state at all loading conditions and all flexion angles (all $p > 0.05$). In response to 5-Nm external tibial + 10-Nm varus torque, the resultant force in the medial meniscus at 60° flexion was significantly less (32.8%, $p = 0.02$) in the increased (55.9 ± 19.9N) compared to the native (83.2 ± 19.1N) PTS state. No further significant differences in resultant medial meniscal forces between the native and increased PTS state were observed for the other loading conditions and flexion angles (all $p > 0.05$).

Conclusion: Increasing the PTS in a native knee affected the resultant forces in the medial meniscus at 60° flexion in response to combined rotatory loads, but had no effect on the resultant forces in the lateral meniscus at any loading condition. Consequently, increasing PTS during high tibial osteotomy does not affect the load transmitted by the menisci and thus will not expose the menisci to increased risk of injury.

Stichwörter: Tibial Slope; Meniscus; Osteotomy; Forces; Load Transmission

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Thema: Sonstiges

Inhalt Englisch

Titel: Unicompartmental knee arthroplasty with mobile-bearing technique. Is there a perfect patient in the first 5 years after surgery?

Aims and Objectives: According to the Endoprosthesis Register Germany (EPRD), 111,365 initial knee implantation were performed in the calendar year 2020 (out of 290,420 documented procedures). Of these, 13.2% (14,700) were unicondylar first procedures. There has been some change in care over the last 5 years, with the use of mobile platforms decreasing by 15 percentage points (from 71.6% to 56.1%) and the proportion of cemented anchorage rising to 89.9%, more than three percent higher than 5 years ago. The aim of this study is to find out whether there are patients who respond best to these surgical procedures and what characterizes these patients.

Materials and Methods: In this cumulative study, 533 patients were analyzed in closer detail and the results were evaluated in the first 5 years after surgery based on 6 criteria. All patients received a medial Oxford mobile-bearing unicompartmental knee replacement. The parameters used for the analysis were BMI, age, gender, smoking, insurance as well as type of anchorage. These 6 criteria were compared using linear multivariate regression and tested for comparability. 100 patients have already participated in the 5-year follow-up. The following 4 scores were recorded in our Patient-Related Outcome Measure System (PROMs) for this period: VAS, KOOS JR., OKS and Tegner.

Results: It is worth mentioning that the scores in the overall recording have developed positively over the years. A closer look at the individual groups shows the following:
BMI was classified according to WHO criteria (< 18.5/18.5-24.9/25.0-29.9/30.0-34.9/35.0-39.9/ >40) and showed no difference between groups at any time but generally showed a negative influence with increasing BMI in the domain of sporting and recreational activity (Tegner).
Age was categorized into 6 stages of life (< =29/30-39/40-49/50-59/60-69/ >=70) where it can be shown that older patients (>60 years) have a significantly better VAS and KOOS Jr. score after 6 months.
In terms of gender, we have only distinguished between the two biological sexes (male, female). There were no significant differences between the sexes in any scores. However, it can be shown that male subjects show a more positive trend in sports and leisure activities (Tegner) after 6m and 1y.
No significant difference could be shown between the groups of smokers and non-smokers at any time. It should be mentioned that non-smokers show a more positive trend than smokers after 1y (Tegner), 2y (VAS) and 3y (KOOS Jr.).
In the case of anchorage, there was no difference between cemented and cementless at the different points in time. An interesting finding is that age probably has a significant positive influence on the function of the cementless group (KOOS JR.).

Conclusion: In our analysis we were able to show that, according to current data, there is no one perfect patient for surgery with a partial prosthesis. Depending on the time, age and BMI have a decisive influence on the subjective feeling. It is recommended to re-evaluate this analysis with objective data.

Stichwörter: unicomaprtimental knee arthroplasty, cemented, Clinical pathway, influence, algorithm, novel guide

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Thema: Knorpelchirurgie

Inhalt Englisch

Titel: Long-term cost-effectiveness of matrix-associated chondrocyte implantation in the German health care system: a discrete event simulation

Aims and Objectives: Cartilage defects in the knee can be caused by injury, various types of arthritis, or degeneration. As a long-term consequence of cartilage defects, osteoarthritis can develop over time, often leading to the need for a total knee replacement (TKR). The treatment alternatives of chondral defects include, among others, microfracture, and matrix-associated autologous chondrocyte implantation (M-ACI). The aim of this study was to determine cost-effectiveness of M-ACI in Germany with available mid- and long-term outcome data, with special focus on the avoidance of TKR.

Materials and Methods: We developed a discrete-event simulation (DES) that follows up individuals with cartilage defects of the knee over their lifetimes. The DES was conducted with a status-quo scenario in which M-ACI is available and a comparison scenario with no M-ACI available. The model included 10,000 patients with articular cartilage defects. We assumed Weibull distributions for short- and long-term effects for implant failures. Model outcomes were costs, number of TKRs, and quality-adjusted life years (QALYs). All analyses were performed from the perspective of the German statutory health insurance.

Results: The majority of patients was under 45 years old, with defect sizes between 2 and 7 cm2 (mean: 4.5 cm2); average modeled lifetime was 48 years. In the scenario without M-ACI, 26.4% of patients required a TKR over their lifetime. In the M-ACI scenario, this was the case in only 5.5% of cases. Thus, in the modeled cohort of 10,000 patients, 2700 TKRs, including revisions, could be avoided. Patients treated with M-ACI experienced improved quality of life (22.53 vs. 21.21 QALYs) at higher treatment-related costs (18,589 vs. 14,134 EUR/patient) compared to those treated without M-ACI, yielding an incremental cost-effectiveness ratio (ICER) of 3376 EUR/QALY.

Conclusion: M-ACI is projected to be a highly cost-effective treatment for chondral defects of the knee in the German healthcare setting.

Stichwörter: Cartilage; total knee arthroplasty; autologous chondrocyte implantation

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Thema: Frakturen rund ums Knie

Inhalt Englisch

Titel: Reduced fulfillment of expectation in patients with complex proximal tibial fracture

Aims and Objectives: In musculoskeletal surgery, patient-related outcome measurement and "shared decision making" have taken hold, so that also in this field the expectation attitude, as well as the expectation fulfillment of patients towards medical treatment are increasingly queried. The aim of the present study was to investigate individual expectation fulfillment after surgical treatment of a complex proximal tibial fracture.

Materials and Methods: Individual expectations of surgical treatment for complex proximal tibial fracture (AO-B, AO-C) were measured in total in 114 patients in a prospective patient population using the Hospital for Special Surgery-Knee Surgery Expectations Survey (HFSS-KSE) and an individual expectations questionnaire. This study took place in 2017-2018, and after completion of treatment, expectation fulfillment was determined by asking each patient their individual preoperative expectation of surgical outcome. Fulfillment or non-fulfillment of expectation was recorded in a graduated manner in the individually designed questionnaire. The postoperative pain score at rest/stress as well as the graduation of physical work load (REFA) was also evaluated and correlated with these expectations.

Results: Follow-up to date has been answered by 34 women and 27 men with a mean age of 50 years. Complete expectation fulfillment of items from the HFSS-KSE was shown to be 53% on average. The worst outcomes were evaluated for regaining a normal walking ability and twisting/blocking away and slowing down while running. Patients with a higher pain score at rest/stress, as well as patients with higher physical work load (REFA>2) showed a significant negative correlation with a lower fulfillment score in the HFSS-KSE. Age and gender had no significant influence on fulfillment of expectation.

Conclusion: Expectations for surgery for a complex proximal tibial fracture are high, regardless of fracture type, and often cannot be fully met postoperatively. Functional limitations may occur, so that the initial mobility in the knee joint cannot always be achieved. Therefore, when educating patients, it is imperative to clearly articulate realistic goals and successes of surgical treatment for a proximal tibial fracture. Fulfillment of expectations is particularly reduced in patients with persistent pain and higher physical work load, so special consideration should be given to this patient population.

Stichwörter: expectation, fulfillment, PROMs, functionality

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Thema: Frakturen rund ums Knie

Inhalt Englisch

Titel: Patients underestimate impact of proximal tibia fracture on duration of incapacity to work and return to sport

Aims and Objectives: Complex proximal tibial fractures represent severe injuries of the lower extremity and may lead to reduced weight-bearing capacity and functional limitations. This is associated with a not inconsiderable period of incapacity for work and possibly limitation of sports ability. Realistic surgical results must be discussed with the patient in order to prevent disappointment and dissatisfaction. Here, patient-related outcome measurement can provide important information for the subjective surgical outcome by determining the expectations and fulfillment of expectations.

Materials and Methods: In a prospective study, patient expectation of surgical treatment of complex proximal tibial fractures in 114 patients (AO-B: group B, AO-C: group C) was queried regarding the duration of incapacity to work and their return to sports ability before surgical intervention. This was evaluated in 2017-2018. 83% in Group B and 67% in Group C expected a full return to work without any limitations. Patients with low physical work intensity (REFA<3) expected to be unable to work for 8 and 9 weeks, respectively, in both groups. 71% in group B and 60% in group C expected return to sports with at most minor limitations.
Follow-up on expectation fulfillment and their return to initial work and sports ability has been answered by 61 patients to date.

Results: 29 patients with AO-B and 32 patients with AO-C fracture with a mean age of 50 years answered the follow-up. The mean duration of incapacity to work was 16 weeks in AO-B and 19 weeks in AO-C ($p>0.05$). In the AO-B group, n=16 (55%) reached their full original working capacity, in AO-C n=17 (53%). Original sports ability was regained in n=8 (28%) in AO-B and in n=7 (22%) in AO-C ($p>0.05$). Gender, age, and level of physical work load showed no significant correlations with these outcomes.

Conclusion: Expectations for surgery for a complex proximal tibial fracture are high regardless of fracture type and often cannot be fully met. Patients must be educated that incapacity to work may occur for significantly longer than expected. It is equally important to inform them that it may not be possible to regain the initial level of performance at work or in sports.

Stichwörter: return to work, return to sports, fulfillment, expectation

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Thema: Frakturen rund ums Knie

Inhalt Englisch

Titel: Complications after surgical treated proximal Tibial plateau fracture: analysis of 462 cases

Aims and Objectives: With increasing incidence of tibial plateau fractures, a more accurate understanding of fracture morphology and individualized surgical therapy has evolved over the past decade. The purpose of this study is to evaluate certain risk factors for complications in the surgical treatment of tibial plateau fractures.

Materials and Methods: This retrospective single center study includes all surgically treated TPF between January 2011 and December 2020 in a level I trauma center in Central Europe. Cases were analyzed according to fracture classification (Schatzker, AO/OTA, Moore), surgical approach, duration of surgery, and resulting complications.

Results: 462 patients underwent surgery during the above period, with 26.1% (n=121) experiencing a complication. The most common complications were structural defects (15.1%), infections (9%) and compartment syndromes (4.1%).
In patients with initial external fixator, compartment syndromes occurred in 14.2% and infections in 12.2%. Anterolateral surgical approach leads to complications in 21.15%, posterior in 22.5%, and medial in 43.5%. Combined approaches lead to complications in up to 70%. In addition to the choice of surgical approach the operation time significantly influence the infection rate.

Conclusion: When interpreting the data, it must be taken into account that more complex fractures are more frequently treated with combined approaches and external fixators. Nevertheless, the treatment strategy has a significant impact on the risk of complications, and this study points out certain risk factors that should be considered when performing 360° treatment of the proximal tibia.

Stichwörter: Tibial plateau fractures · Complications · 360° approaches

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Thema: Sonstiges

Inhalt Englisch

Titel: Intra-Articular Vancomycin-Concentrations in Synovial Fluid Do Not Reach Chondrotoxic Thresholds Following Vancomycin-Soaking of Autologous Semitendinosus Grafts for Anterior-Cruciate Ligament Reconstruction

Aims and Objectives: A feared complication of anterior cruciate ligament (ACL) reconstruction is postoperativ septic knee arthritis. Studies revealed that in vancomycin-soaking of hamstring autograft can drastically reduce the incidence of postoperative infections following ACL-reconstruction, however, it remains unclear whether chondrotoxic thresholds of vancomycin in the synovial fluid are reached. Several studies investigated the chondrotoxic concentration of vancomycin in in-vitro experiments and described 1000 µg/ml as critical threshold. Therefore, the aim of the present study was to measure the Vancomycin-concentration in the synovial fluid following ACL-reconstruction with vancomycin-soaked autografts.

Materials and Methods: This prospective observational study included 10 patients undergoing an ACL-Reconstruction using four-strand semitendinosus tendon autografts. Each graft was intraoperatively wrapped in 5 mg/ml vancomycin-soaked gauze swabs prior to implantation. Following wound closure an aspirate of 5 ml synovial fluid was taken of each patient. Time was measured from soaking to implantation and from implantation to aspiration. In addition, the graft size was noted and whether remnant ACL tissue was preserved. The aspirates were analyzed using high performance liquid chromatography and mass spectrometry (HPLC/MS) regarding the vancomycin-concentration. Spearman-Rho correlation coefficients were used to identify relations between the parameters. A p-value of < 0.05 was considered statistically significant.

Results: 10 patients (2 women, 28.4 ± 11.6 years; 8 men, 31.7 ± 12.4 years) were included in the study. The mean concentration of Vancomycin measured in the synovial fluid was 21.44 µg/ml (± 22.37 µg/ml) with a minimum concentration of 2.32 µg/ml and a maximum concentration of 71.56 µg/ml. Significant positive correlation ($r = .644$ $p < 0.05$) was observed between the concentration of Vancomycin and the duration (13.4 min ± 6 min) from Vancomycin soaking to graft implantation. No correlations were observed between the concentration of Vancomycin and the duration from implantation to fluid aspiration ($r=-0.73$ $p=0.841$) as well as the concentration of Vancomycin and the graft diameter (median 8.5 mm Range 6.0-9.0 mm $r=0.031$ $p =0.931$). There was no significant difference regarding the concentration of Vancomycin in the synovial fluid with and without a preserved remnant ($p=.108$).

Conclusion: Chondrotoxic concentrations of equal to or greater 1000 µg/ml were not reached in any aspiration of synovial fluid following ACL-Reconstruction using semitendinosus autografts that were intraoperatively soaked in a 5 mg/ml vancomycin solution. Against the backdrop of multiple studies, showing significantly reduced infection-rates after ACLR when using vancomycin-soaking of the graft, this study distinctly attenuates the counter-argument of chondrotoxic side effects of this method.

Stichwörter: ACL Recontruction; Vancomycin; Vancomycin Soaking; Septic Knee Arthritis; Chondrotoxicity

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Thema: Frakturen rund ums Knie

Inhalt Englisch

Titel: Arthroscopic aiming device for tibial plateau fractures - an imageless fracture treatment?

Aims and Objectives: Posterolateral tibial plateau fractures are difficult to address and might lead to rotational instability. Arthroscopically assisted fracture treatment offers improved visualization of reduction and simultaneous treatment of intra-articular pathologies. However, a lateral arthroscopic view and simultaneous intraoperative radiographs are nearly impossible. The concept of an aiming device is intended for arthroscopic assisted imageless reduction and screw fixation of tibial plateau impression fractures.

Materials and Methods: A cadaver study was conducted to treat a possible tibia fracture with an aiming device arthroscopically. The intraarticular probe of the aiming device was placed on the lateral and medial side of the intact tibial plateau. With a guided hollow cutter a fracture reduction was simulated against the intraarticular probe. The fixation was performed in the "jail" technique by guided pins and cannulated screws to support the joint line 5 and 10 mm below the plateau without radiographic imaging.

Results: Arthroscopically assisted fracture treatment with simulation of reduction and screw implantation was possible. The polyaxially adapted sleeve allowed screw fixation in "jail" technique without imaging with perfect positioning already in the second application. No adverse event occurred during the first applications.

Conclusion: The presented device is particularly useful for the treatment of posterolateral impressions associated with ligament ruptures of the knee joint and simple impression fractures. The advantages of this instrument to improve fracture treatment and reduce radiation must be investigated in further studies.

Stichwörter: Aiming device, apple bite fracture, posterolateral tibial fracture, arthroscopic fracture treatment

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Thema: Indikationen in der Revisionschirurgie

Inhalt Englisch

Titel: Synthetic Mesh Augmentation for Reconstruction of Chronic Ruptures of the Knee Extensor Mechanism

Aims and Objectives: Chronic disruption of the extensor mechanism of the knee is a devastating complication, especially after total knee arthroplasty.
Multiple repair series have demonstrated inconsistent results. Various repair techniques are reported in the literature.
The purpose of this study is to investigate the results of patients with chronic extensor mechanism disruption who underwent reconstruction with the use of Marlex mesh.

Materials and Methods: The author prospectively analyses 4 knees in 4 consecutive patients operated using the Marlex Mesh technique during the period of 2019 to 2021. All had a chronic extensor mechanism disrupture. 3 patients had a quadriceps tendon rupture, 1 patient a patella tendon rupture. 2 cases had a prior total knee arthroplasty (TKA).
The surgical technique was performed in a fashion modified to the originally description by Browne and Hanssen 2011.
Mean time from the extensor mechanism disrupture to the mesh reconstruction was 3 months (range 1-7 months). 3 of the patients (75%) had previously undergone one or more attempted reconstruction of the extensor mechanism at an outside institution.
The mean patient age at the time of the mesh reconstruction was 76 years (range 69 to 85 years). 2 patients were female, 2 male.
All patients had a prospectively follow-up after 6 weeks, 12 weeks, 6 months and 12 months with clinical and ultrasound evaluation. In the 2 non-TKA cases a follow up MRI was performed. The clinical outcomes were assessed with the use of the Knee Society Score (KSS).

Results: No patient experienced mesh failure or required mesh revision or reoperation.
The 1-year survivorship was 100%. 3 patients demonstrated very good clinical functions, no use of walking aids, good muscle strength and no or minimal (<5°) extension lag.
1 patient with an intact mesh reconstruction in ultrasound investigation and MRI had a severe neurological co-morbidity (AL-amyloidosis), showing an extensor lag of 20°, a muscle strength of BMC 3/5 and had to use a wheel chair for mobility.
Active flexion in the whole group was a mean of 120° (range 90° to 135°).
All patients without neurological co-morbidity had a significant improvement in the KSS after mesh reconstruction at the time of the latest follow up. Extensor lag improved by a mean of 20°.
The mean KSS prior to reconstruction was 33 and improved to
81. The mean KSS functional score improved from 10 to 52.
No complications occurred.

Conclusion: Chronic extensor mechanism disruption of the knee is a catastrophic complication, especially after TKA. Surgical repair techniques are challenging with inconsistent results.
This study has limitations (small group, short-term follow up).
Our small series demonstrated that reconstruction with the use of Marlex mesh is a viable option with encouraging results and excellent short-term survivorship.
100% of the mesh reconstructions were in place with good functional outcomes after 1 year.
Further studies will show wether the survivorship will decrease with continued follow-up.

Stichwörter: Marlex mesh, extensor mechanism reconstruction, chronic ruptures, knee.

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Thema: Frakturen rund ums Knie

Inhalt Englisch

Titel: 3D print-assisted diagnosis of tibial plateau fractures

Aims and Objectives: The treatment success of complex tibial plateau fractures depends largely on correct and valid preoperative diagnostics. The reliable use of one of the three classification schemes (AO classification [AO], 10 segment classification [10S], Revisited Schatzker classification [RS]) is a challenge in clinical practice. A possible solution is the use of 3D models. This approach has already shown first indications of usefulness in the diagnosis of fractures of large joints (acetabular fracture, tibial plateau fracture). The aim of the present study was to investigate the impact of 3D printing on diagnostics in comparison to conventional computed tomography (CT) and 3D CT, and to identify any strengths and weaknesses of the current classifications.

Materials and Methods: As part of the data collection, 25 raters with varying levels of experience were asked to classify 22 tibial plateau fractures (AO B & C fractures) using a CT, a 3D CT, and using a 3D printed model (AO, 10S, RS). Subjective perceived safety of these decisions was assessed using a five-point Likert scale. Data collection was performed using an online questionnaire. The data set was first examined using descriptive methods and then using reliability analyses (Fleiss' Kappa).

Results: In 25% of the cases, the raters stated that they had obtained new information through 3D printing. The available data also suggest that classifications using 3D printing are strikingly clearer than those using traditional imaging. For AO classification, higher interobserver reliability could be observed when using 3D printing compared to CT and 3D CT (0.3 vs. 0.32 vs. 0.36). This abnormality was particularly evident in complex C-fractures (0.35 vs. 0.37 vs. 0.43). The 10S classification, on the other hand, showed that an increase was achieved by 3D printing (0.45 vs. 0.45 vs. 0.55) especially in less complex B fractures. An increase was also seen in RS classification (0.25 vs. 0.27 vs. 0.31). Moreover, after assessment of 3D pressure, previously made classifications of AO classifications were corrected in 23% of cases (10S 55%; RS 30%). The subjectively perceived certainty of 3D printing claims increased to 69% (AO; 10S 67%; RS 64%).

Conclusion: The use of 3D printed models in the diagnosis of complex tibial plateau fractures improves the interobserver reliability of the classifications in both experience groups and shows significant advantages regarding several aspects: The 3D-printed models allow a haptic access to the complex tibial plateau fractures that was not available before. They allow a more differentiated understanding of the fracture and, based on this, more precise treatment and therapy, which enhances an even more valid treatment possibility.

Stichwörter: tibial plateau fracture, 3D printing, Diagnostics, AO classification, 10-Segment classification, Revisited Schatzker classification

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Thema: Sonstiges

Inhalt Englisch

Titel: Isolated gout of the patella: case presentation and review of the literature

Aims and Objectives: Isolated gout of the patella is rare and only a few case reports exist in the literature. Additionally, only a few reports exist describing a symptomatic tophaceous deposit as a first sign of gout, in contrast to the classic presentation with prior gout flares in the medical history.

Materials and Methods: A 52 year-old technician presented with anterior knee pain for 1 month. There was no history of gout. The already performed MRI showed on T1-weighted images two homogeneous hypointense and in T2-weighted images heterogeneous hyperintense, peripheral enhancing (Dotarem) lesions in the patella and the anteromedial aspect of the head of the tibia with a mainly osteolytic intraosseous and a smaller extraosseous extension of unknown origin. The dual-energy CT scan showed urate acid deposits in these lesions. For further evaluation, a biopsy was performed, which confirmed the urate crystals deposit without any aspect of malignancy. His serum uric acid level at presentation was 520µmol/l (ref. 214-488µmol/l).
With the extension of 40% of the patella and therefore assumed instability risk, a curettage and defect filling with autologous spongiosa from the head of the tibia was performed. A urate-lowering therapy with a xanthine oxidase inhibitor was established and a dietary/lifestyle change recommended with a good clinical and radiological result after 1 year.

Results: The few published case reports describe patients with already diagnosed hyperuricemia with gouty flares in their history. We describe a case with a rare intraosseous tophaceous deposit as a first manifestation of a gout. As a diagnostic cascade, the imaging with MRI and DECT is well established. Demonstration of urate crystals in aspirates of synovial fluid or of tophaceous deposits provides a convenient and specific means to corroborate the diagnosis. In absence of prior gouty flares and the intra- and extraosseous periarticular extension of the lesions of the knee, possible differential diagnosis were metastasis or a metabolic disorder with granuloma. Therefore, a sonography directed core needle biopsy was performed. Based on the extension of the tophus in the patella and a risk of pathologic fracture, as described in the literature, a debridement and defect filling, was obtained.

Conclusion: Isolated gout of the patella is rare. Even in absence of prior gouty flares or any mono- or polyarthritis, gout is a possible differential diagnosis and a biopsy of the lesion will determine the diagnosis.

Stichwörter: gout, intraosseus tophus, patella

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Thema:	Frakturen rund ums Knie

Inhalt Englisch

Titel:	Characterization of a collective of distal femur fractures - indications for future care concepts.
Aims and Objectives:	Distal femur fractures occur with an incidence of 4.5/100,000 and show a prevalence of 0.4%. Causes include low-impact trauma in older patients and high-impact trauma in younger patients without pre-existing medical conditions. An analysis of potential intrinsic, fracture- or care-related risk factors does not exist. Therefore, the aim of this study was to perform a comprehensive evaluation of trauma mechanisms, trauma-promoting factors, comorbidities, medication history, type of surgical care, and postoperative patient satisfaction to provide an overview of the causes of injury and the most appropriate therapeutic approach.
Materials and Methods:	A retrospective analysis of 157 patients who sustained a distal femur fracture between January 2011 and December 2020 was performed. Individual fracture patterns, fracture predisposing factors, concomitant disease profiles, medication history, treatment strategy and associated complications were analyzed.
Results:	157 patients were included in the retroperspective analysis. 58% of patients with high-impact trauma were men, with a mean age of 55 +/-12 years. Low-impact trauma was sustained by 84% women, with a mean age of 76 +/- 21 years. Lateral plate osteosynthesis was performed in 123 (78.3%). These resulted in a complication in 20 (16.2%) patients. 84% of complications occurred in fractures associated with a comminuted zone (AO 33 A3, C2, or C3). Significant risk factors for complication were increased BMI greater than 29 ($p<0.05$), if preoperative imaging showed dislocation of the fracture greater than half a shaft width ($p<0.05$), and open fractures ($p<0.05$). Fourteen patients underwent double plate osteosynthesis. Of these, 7 (50%) resulted from revision surgery. All of the fractures treated were classified as AO 33 A3, C2, or C3 according to AO classification, and the average BMI was 29.5. 35.7% showed a dislocation of more than half a shaft width on preoperative imaging, and 42.9% were open fractures. No complications occurred in this group of patients.
Conclusion:	Fractures of the distal femur occurred most commonly as a result of increased trauma energy or in older patients with multiple medication and comorbidity profiles. Plate osteosynthesis was the most commonly used treatment strategy. Unilateral plate osteosynthesis offers the advantage of reduced surgical time as well as reduced surgical access and associated complications. In the case of increased BMI, open fractures, fractures with a comminuted zone and in fractures that preoperatively show a dislocation of more than half a shaft width, we recommend double plate osteosynthesis.
Stichwörter:	Distal femur fractures, double plate osteosynthesis, high and low impact trauma

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Thema: Sonstiges

Inhalt Englisch

Titel: Use of the Internal Brace technique for the primary repair of the anterior cruciate ligament in a patient with simultaneous anterior cruciate ligament, medial collateral ligament, and patellar tendon ruptures

Aims and Objectives: A combined rupture of the anterior cruciate ligament (ACL), medial collateral ligament (MCL), and patellar tendon (PT) is an unusual event with about two dozen reported cases. The treatment of these cases is heterogeneous and varies between single- and two-staged procedures. Regarding surgical treatment, acute PT (+/-) MCL ruptures are usually directly repaired, whereas the gold standard for ACL injuries is reconstruction with an autograft. However, for acute proximal lesions, new ACL repair techniques are emerging with promising results. Herein, we present the case of a patient with a simultaneous rupture of the ACL, MCL, and PT who underwent direct repair of all three structures, using the Internal Brace technique for the ACL tear.

Materials and Methods: A 68-year-old woman presented to our emergency department following a valgus-internal rotation trauma, in combination with a forced anterior tibial translation in a flexed position, as a result of a skiing accident. A focused exam established the presence of a knee effusion and a palpable soft tissue defect at the inferior pole of the patella. Radiological assessment revealed simultaneous ipsilateral proximal ruptures of the ACL and MCL near to their femoral insertion, as well as of the PT. A decision was made to perform single-stage surgery encompassing the primary repair of all three ruptured structures.

Results: A curved skin incision was made from the medial epicondyle to the tibial tuberosity. Deep surgical dissection revealed the patellar tendon had ruptured in mid-substance and the anterior capsule was completely lacerated, horizontally.
First, a FiberWire suture was passed through the proximally ruptured ACL. The femoral and tibial tunnels were drilled with an Endobutton drill (4.5 mm) via a guiding wire (2.4 mm). The Endobutton, together with the Fibertape and FiberWire-suture of the ACL, were diverted through the femoral tunnel of the lateral femoral cortex. The button was flipped and fixed to the femur. The tibial ends of the Fibertape were bound to the tibia with a Dogbone. The ACL then presented as properly repaired. Finally, the MCL and the patellar tendon were repaired using Corkscrew anchors and FiberLoop sutures. Postoperatively, pain-dependent weight bearing was allowed in full extension using a knee brace. Unloaded knee mobilization was limited to 30° flexion from week 1-2, 60° flexion from week 3-4, and 90° flexion from week 5-6. Six weeks postoperatively, the patient presented as pain-free, with a clinically stable knee and the expected reduced range of motion.

Conclusion: In patients with simultaneous ACL, MCL, and PT ruptures, the ACL tear is either conservatively treated or a reconstruction is performed in single- or two-staged procedures. With this case report we demonstrate that when operative intervention is mandatory and a proximal ACL tear is present, a primary ACL repair using the Internal Brace technique offers a feasible treatment option as it increases knee stability and preserves its proprioceptive fibers.

Stichwörter: Internal Brace, patellar tendon rupture, primary repair, anterior cruciate ligament rupture

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Thema: Frakturen rund ums Knie

Inhalt Englisch

Titel: Ergebnisse nach arthroskopisch-assistierter Refixation von kombinierten knöchernen VKB- Ausrissen mit Impressionsfrakturen des posterolateralen Tibiaplateaus

Aims and Objectives: Über die seltenen Kombinationsverletzungen aus knöchernem vorderen Kreuzband (VKB)- Ausriss mit gleichzeitig vorliegender posterolateraler Tibiakopfimpressionsfraktur (TKIF) finden sich nur wenige Daten. Insbesondere die arthroskopisch gestützte Versorgung bietet einige Vorteile. Ziel der Studie war es daher, erste Ergebnisse der arthroskopisch gestützten Versorgung dieser Kombinationsverletzungen zu ermitteln.

Materials and Methods: Es erfolgte die retrospektive Untersuchung von Patienten mit arthroskopisch gestützter Versorgung von Kombinationsverletzungen aus knöchernem VKB- Ausriss mit zusätzlicher (TKIF). Die arthroskopische Refixation der VKB- Ausrisse erfolgte entweder mittels kanülierter Schrauben oder Fadenauszugsnähten. Die Reposition und Fixation der Tibiaplateaufraktur wurde bei Impressionen über 2mm mittels transmedullärer Aufstösselung unter arthrokopischer Sicht sowie Bildwandlerkontrolle und Abstützung durch perkutan eingebrachte Schrauben (GF/KF/Jail-Technik) durchgeführt. Primäre Outcomeparameter waren der Lysholm- Score, Knee Injury and Osteoarthritis Outcome Score (KOOS), Kujala Score, NRS Pain Score sowie IKDC Score. Sekundäre Outcomeparameter waren die knöcherne Konsolidierung in radiologischer Bildgebung, Komplikationen und Revisionen.

Results: N=15 Patienten (37±16 Jahre) konnten mit einem durchschnittlichen Follow-up von 24 Monate(12-45 Monate) in die Studie eingeschlossen werden. Ein Patient hatte eine Typ 4 Verletzung nach Meyers/McKeever, n=7 eine Typ 3 Verletzung, n=4 eine Typ2 und n=3 Patienten eine Typ 1 Verletzung. Bei allen Patienten lag eine begleitende posterolateraler TKIF vor. Bei n=10 Patienten erfolgte die Refixation der VKB- Ausrisse über gekreuzte, kanülierte Schrauben, bei n=3 Patienten über Fadenauszugsnähte (n=2 konservativ). In n=8 Fällen wurde die begleitende TKIF arthroskopisch-assistiert reponiert und perkutan fixiert, in n=7 Fällen wurde die Impressionskomponente bei lediglich vorliegender Gelenkstufe kleiner 2mm nicht adressiert. Der Lysholm- Score der Patienten betrug 84± 13, der KOOS bei 81± 15%, der Kujala Score 80±15 und der IKDC Score bei 78± 12. Das Schmerzniveau lag auf der NRS Skala im Median bei 1,5, der Tegner Aktivitätsscore betrug im Median 5. Bei allen Patienten konnte eine vollständige knöcherne Heilung erzielt werden. Komplikationen traten nicht auf. Bei n=6 Patienten zeigte sich während des FU eine verbliebene 1° Laxität des VKB im Seitenvergleich. Bei n=2 Patienten bestand ein Streckdefizit von 5° auf der betroffenen Seite.

Conclusion: Die arthroskopisch gestützte Refixation kombinierter knöcherner VKB- Ausrisse und posterolateraler TKIF führt als minimalinvasives Verfahren zu sehr guten klinischen und radiologischen Ergebnissen. Die Arthroskopie bietet ferner den Vorteil der guten Visualisierung der Gelenkfläche zur Vermeidung residueller Gelenkstufen und ein gutes kosmetisches Ergebnis. Die Refixation der knöchernen VKB Ausrisse ist sowohl mittels Schraubenosteosynthese als auch über Fadenauszugsnähte möglich.

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Thema:	Frakturen rund ums Knie

Inhalt Englisch

Titel:	Long-term evaluation of osteosynthetically treated patella fractures - which method is convincing?
Aims and Objectives:	Approximately 13,250 patella fractures are treated with osteosynthesis in Germany every year. According to a recent survey, the surgical procedure of tension band osteosynthesis predominates. Although the angle-stable plate osteosynthesis shows a significantly higher fracture stability in biomechanical studies, this procedure is not yet leading in everyday clinical practice. The procedure with the lowest complication rate was to be determined in a retrospective cohort study with a clinical-radiological comparison between different osteosynthesis procedures used in the treatment of patellar fractures.
Materials and Methods:	In the data collection period from 2010 to 2020, a total of 403 isolated patella fractures were treated osteosynthetically in a level I trauma center. The inclusion criteria for a critical long-term analysis were a minimum observation period of 12 months. This should allow the detection of postoperative signs of osteoarthritis and non-union. In addition to the epidemiology, AO fracture classification, trauma mechanism, osteosynthesis procedures (tension band osteosynthesis (TBO), small fragment screw osteosynthesis (SFO), hybrid procedures (HO), angle-stable plate osteosynthesis (APO)), postoperative complication analysis (refracture, secondary dislocation, infection), and metal removal were evaluated.
Results:	112 patients met the inclusion criteria. The mean follow-up was 29.3 months (+/- 27 months, 12-168 months). AO type 34.C1 - C3 fractures were most frequently treated surgically (n=94). Older patients were more likely to be treated with APO (n=15, mean 54 years), while younger patients were predominantly treated with TBO (n=30, mean 45 years) or HO (n=20, mean 47 years) or SFO (n=47, mean 47 years) were treated. Complicated C3 fractures were most commonly treated with APO (66%), followed by HO (55%) and TBO (28%). In this study, SFO found no treatment approach for C3 fractures. A direct comparison of procedures between TBO and SFO showed significantly fewer postoperative complications (p=0.028) after SFO. Secondary fracture dislocations were observed most frequently after TBO (10%), postoperative infections occurred most frequently after HO (15%). Postoperative signs of osteoarthritis were seen most frequently after fracture treatment with TBO (14%) and least frequently after surgical procedures with SFO (3.4%).
Conclusion:	Despite the small number of retrospectively analyzed patients, fracture treatment using SFO shows a significantly lower postoperative complication rate in direct comparison to TBO in the long-term analysis. The APO is superior in the treatment of complex C3 fractures without evidence of significant postoperative complications in the long-term evaluation.
Stichwörter:	Patella, Fracture, Osteosynthesis, Outcome, Longterm Evaluation

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Thema: Frakturen rund ums Knie

Inhalt Englisch

Titel: Postoperative knee instability in tibial plateau fractures

Aims and Objectives: Malreduction and instability are most relevant in the development of posttraumatic osteoarthritis following tibial plateau fractures. Isolated ligament injuries of the knee joint and their effects on stability are demonstrated in numerous studies on quantitative measurement. These data have been lacking in tibial plateau fractures. The purpose of this study is to quantify postoperative instability of the knee joint after tibial plateau fracture.

Materials and Methods: Patients (n=57; mean age 50.8 ± 11.9 years) with a tibial plateau fracture who underwent surgery between 2014 and 2019 at a Level I trauma center were included in this study. The minimum follow-up time after surgery was 12 months. Knee stability was measured using the Laxitester® (ORTEMA Sport Protection, Markgröningen, Germany) and the Lachmeter (Equipamentos Ortopedicos LTDA, Preto, Brazil) device, measuring internal (IRO), external rotation (ERO) and tibial translation (AP). Measurements were performed in the supine position with 30° flexion. Dynamic valgus instability was measured using the Orthelligent system (OPED GmbH, Valley, Germany). All tests were performed on both the injured and the uninjured knee.

Results: The mean follow up time of this study was 3,.9 years. Simple fractures (Schatzker I-III) were present in 51 % (n=29) and complex fractures (Schatzker IV-VI, Moore I-V) in 49% (n=28). All participants underwent surgical treatment by different approaches (61.4% lateral approach, 24.6% combined, 8.8% posterior, 5.3% medial).
There is a significant increase in rotation/translation at the injured knee compared with the uninjured knee (AP 78%, IRO 78.9%, ERO 54%). Simple fractures (Schatzker I-III) showed significantly higher instability in ERO and IRO compared with complex fractures (Schatzker IV-VI), whereas no significant difference was observed in ap translation. Patients treated with medial approaches demonstrate higher dynamic valgus instability.

Conclusion: The majority of patients demonstrate measurable uni- or multidimensional instability after surgical treatment of a tibial plateau fracture. Of interest is the increased rotational instability in simple fractures. It remains unclear to what extent fracture type, surgical approach or posttraumatic inflammatory reaction are responsible for this.

Stichwörter: Tibial plateau fractures· Instability · Posttraumatic Osteoarthritis

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Thema:	Sonstiges

Inhalt Englisch

Titel:	Biomechanical properties of a new arthroscopic pull-in all-suture anchor meniscus root tear repair in comparison to standard suture anchor and trans-osseous pull-out repair
Aims and Objectives:	Previous studies already evaluated arthroscopic suture anchor (SA) refixation compared to transosseus pullout (TPO) refixation of meniscal root tears. Current SA techniques require a posterior portal with risk of damage to neurovascular structures and TPO refixation requires an extracortical fixation. Therefore, a new all-suture anchor refixation was developed. In this technique, an all-suture anchor is arthroscopically pulled in not requiring an additional posterior portal or an extracortical fixation nor interfere in a tunnel conflict. Aim of this study was the evaluation of the biomechanical capabilities of this new refixation using a new trans-tibial pull-in (TPI) technique in comparison to standard TPO and SA repair. We hypothesized that biomechanical specifications of meniscal root tear repair using all-suture anchors in the TPI technique are comparable to standard techniques.
Materials and Methods:	Porcine proximal tibias were used and posterior medial meniscus root was sectioned 5mm from its insertion. In TPI we modified a double loaded all-suture anchor and pulled it into the subcortical bone through the tunnel at the meniscal root insertion instead of tapping in. Drilling was performed transtibial similar to the TPO technique and th meniscus root was fixed to the anchor as in the SA technique. Standard SA reconstruction was done from posterior. 4 groups were defined (n=10): 1. native meniscal root (NM), 2. TPO repair with 2 sutures (#2Hi-Fy, Conmed, USA) and extracortical fliptack fixation (Storz, Germany), 3. double loaded SA repair (SuperRevo, Conmed, USA), 4. double loaded new TPI repair (Y-KnotFlex 1.8 mm, Conmed, USA). A servohydraulic testing device (Zwick, Germany) was used. The meniscus was clamped to the testing device and the proximal Tibia was potted into a cylinder and fixed with PMMA. The meniscus was mounted 90° to the testing device (posterior part up) and force was applied in posterior direction to the NM. Cyclic loading with subsequent load to failure (LTF) (preload 2N, 1000 cycles with 5-20N; 0.5Hz) was applied and LTF, displacement, elongation (mm) and stiffness (N/mm) were calculated. Significancy was defined as $p \leq 0,05$.
Results:	TPI showed similar displacement after 1000 cycles (TPI 2,4±0,9mm vs. SA 2,6±0,3mm vs. TPO 2,0±1,1mm; n.s.) and significantly lower stiffness (TPI 13,3± 3,8N/mm, SA 24,0±3,3N/mm, TPO 22,7±6,2N/mm; p=0,042) compared with SA/TPO. TPI showed similar elongation during cyclic loading (TPI 2,4 ±0,9mm, SA 2,6±0,3mm, TPO 2,0± 1,1mm; n.s.) compared to SA/TPO refixation. No significant difference was observed for displacement at failure (TPI 15,1±7,8mm, SA 11,9±3,4mm, TPO 10,1± 1,2mm; n.s.). LTF did not differ significantly between groups (TPI 224,9±54,6N, SA 278,9±49,6N, TPO 224,8±35,0N; n.s.). Final failure was always a suture cut out in all groups.
Conclusion:	The novel TPI technique showed similar biomechanical properties compared to the TPO/SA technique. All techniques did not reach the biomechanical properties of the intact meniscus root.
Stichwörter:	meniscus root tear, biomechanics, meniscus repair, anchor refixation, knee arthroscopy, new technique

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Thema: Sonstiges

Inhalt Englisch

Titel: Does the position of the fluoroscopy in femoral MPFL identification matter? Implementation of a cadaver study in a daily practice setting

Aims and Objectives: Background: Medial patellofemoral ligament (MPFL) reconstruction is an established procedure in the treatment of patellar instability. However, femoral tunnel misplacement is responsible for 38.2% of cases in revision surgery.
Different methods are published for the identification of the femoral MPFL insertion site. In daily practice, the method, according to Schöttle et al., using fluoroscopy has been established as the gold standard.
Purpose: To determine the differences in femoral MPFL tunnel placement depending on the location of the fluoroscopy. This study hypothesized that (1) fluoroscopy positioning affects the localization of femoral MPFL tunnel positioning and (2) one position is preferable to the other.
Study Design: Descriptive laboratory study.

Materials and Methods: Methods: Ten cadaveric knees were dissected, the MPFL identified in its entire length, and the femoral insertion site was identified and marked using a 10 mm eyelet. True lateral radiographs in two different fluoroscopic positions can be found in daily practice (ML5: 5cm from the receptor with X-ray beam from medial to lateral; LM25: 25cm from the receptor with X-ray beam from lateral to medial) were taken. The anatomical femoral MPFL point was then calculated according to Schöttle et al..
Data are shown as mean, standard deviation (+/- SD) and range. Differences were calculated using the Wilcoxon signed-rank test (2-related sample), and a P value of less than 0.05 was considered significant. All analyses were performed with the IBM SPSS Statistics version 26 program (IBM Corp., Armonk, N.Y., USA).

Results: The anatomic femoral insertion compared to the Schöttle point in the ML5-position was located a mean of 2.3 +/- 2.4 mm (range, 0.2-5.8) proximally and 4.1 +/- 6.0 mm (range, -6.2-13.6) anteriorly. This resulted in an absolute distance of 7.2 +/- 3.0 mm (range, 3.6-13.6). In the LM25-position it was located a mean of 0.6 +/- 1.8 mm (range, -3.2-5.6) distally, and 2.7 +/- 5.7 mm (range, -8.4-9.8) anteriorly, which resulted in an absolute distance of 5.5 +/- 3.1 mm (range, 1.1-9.8). In the ML5-position the mean distance to the Schöttle point was 3.0 +/- 2.3 mm (range, 0-7.3) proximally and 1.4 +/- 2.3 mm (range, -2.7-4.8) anteriorly. The absolute distance 4.1 +/- 2.1 mm (range, 2.4-8.8). Wilcoxon signed-rank test (2-related sample) showed a significant difference between the two fluoroscopy setups in the x-axis. No significant differences could be determined when comparing the distance in the y-axis or the absolute distance between Schöttle point and the anatomic attachment of the MPFL.

Conclusion: When using radiographic identification to assess the femoral MPFL tunnel in MPFL reconstruction surgery in daily practice, the surgeon should take the respective position of fluoroscopy and the resulting deviation from the Schoettle point into account.

Stichwörter: MPFL, Schöttle, radiographic Identification, femoral tunnel

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Thema: Osteotomie

Inhalt Englisch

Titel: Joint geometry significantly affects the location of osteochondritis dissecans lesions of the knee

Aims and Objectives: The pathophysiology of osteochondritis dissecans (OCD) of the knee is not well understood but several theories exist. A recent study showed that increased knee joint line obliquity (KJLO) and the resulting coronal tibiofemoral subluxation lead to contact pressure peaks between the abutting femoral condyle and tibial eminence. The purpose of this study was to determine whether there is a difference in KJLO and the relative tibiofemoral position between patients with medial (MOCD) or lateral OCD (LOCD) of the femoral condyle. It was hypothesized that there is a significant difference of KJLO and tibiofemoral position between MOCD and LOCD patients.

Materials and Methods: Patients who were treated for either MOCD or LOCD of the femoral condyle between 2010 and 2020 were retrospectively included in this study. Exclusion criteria comprised history of trauma, missing long leg standing radiographs, knee osteoarthritis, meniscal or ligamentous injuries. Patient's characteristics were retrieved from clinical and surgical documentation. Preoperative long leg standing radiographs were study to obtain several radiographic measurements including lower limb alignment (LLA), KJLO, central (C-SUB) and lateral subluxation (L-SUB) of the tibia in relation to femur in the coronal plane, and the distance between the center of the distal femur and proximal tibia (TFJC). Student's t-test was used to find differences in means between the MOCD and LOCD group. Statistical significance was set at $p<0.05$.

Results: 46 knees with MOCD and 9 with lateral OCD with a mean age of 21 ± 4 were included. LLA was significantly different between MOCD (1.7 ± 3.1° varus) and LOCD (2.7 ± 3.1° valgus, $p<0.0001$). 36/46 (78%) of MOCD patients had varus alignment, whereas 7/9 (78%) of LOCD exhibited valgus knees ($R2=0.45$, $p<0.01$). Patients with MOCD revealed a more medial tibial position in relation to the femur showing a significantly smaller C-SUB (MOCD: 7.2 ± 6.6 vs. LOCD: 14.9 ± 8.8mm, $p<0.01$), smaller L-SUB (MOCD: 2.3 ± 2.6 vs. LOCD: 4.4 ± 2.7mm, $p<0.05$) and a reduced TFJC (MOCD: 3.5 ± 1.7 vs. LOCD: 6.6 ± 1.8mm, $p<0.001$) compared to the LOCD group. The KJLO was not significantly different between the studied groups (MOCD: 1.4 ± 2.2° vs. LOCD: 2.8 ± 2.2°, $p=0.071$).

Conclusion: In this cohort, LLA was significantly associated with the location of OCD with the majority of MOCD patients having varus aligned knees and LOCD patients showing valgus deformity. Moreover, the position of the tibia under the femur was significantly different between MOCD and LOCD patients. In MOCD patients, the tibia subluxated medially (or the femur laterally) resulting in a change of joint geometry by an approximation of the medial tibial eminence towards the medial femoral condyle and possibly causing an articular overload. In conclusion, LLA and the coronal tibiofemoral subluxation may play a role in OCD pathogenesis by supposedly causing contact pressure rise between the articulating femoral condyles and adjacent tibial eminences.

Stichwörter: osteochondritis dissecans, lower limb alignment, knee joint line obliquity, risk factors

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Thema:	Prothetik 360° von Teil- über Total- bis zur Revisionsendoprothetik

Inhalt Englisch

Titel:	Metallosis of oxidized zirconium metal prothesis leading to a TKA Revision
Aims and Objectives:	Metallosis, which can lead to osteolysis and implant loosening due to chronic inflammatory reaction, is an uncommon complication following a TKA. Recent studies however show a rise in revision rates due aseptic reasons in relation to oxidized zirconium compared to cobalt chromium. It is unclear however, why favorable characteristics of oxidized zirconium in reducing polyethylene wear do not lead to a decline in revision rates.
Materials and Methods:	Case Report One major factor attributed to failure of a total knee arthroplasty (TKA) is an aseptic loosening of the prosthesis. It can be the result of an inadequate initial fixation, loss of mechanical properties (of the fixation) over time or a biological influence (on the fixation) caused by particle-induced osteolysis around the implant. All the materials currently used in TKA are well known for their good biocompatibility. The cobalt chromium alloy bearing surface has shown excellent resistance to abrasion. Oxidized zirconium has been introduced in an attempt to reduce polyethylene wear. Non-comparative studies have been promising, but to date there are no long-term studies verifying the positive attributes of oxidized zirconium on a polyethylene bearing surface.
Results:	In our case, we had to perform revision TKA surgery due to significant functional impairment and oxidized zirconium prosthesis failure. We describe a 73-year old female patient who presented herself with persistent pain, instability and increasing varus deformity of the right lower limb. The physical examination showed a significantly decreased range of motion and walking ability. There were no signs of infection. She had a total knee replacement 9 years ago at another hospital and due to her nickel allergy she received an oxidized zirconium femoral component with a steel based tibial mobile bearing. The patient underwent a one-stage revision surgery of the right knee. Massive black metallosis, synovialitis and bone loss were detected. After removal of the components, the tibial base and the polyethylene insert showed minimal wear, but the femoral component was severely damaged on the medial aspect 40 x 20 x 3mm. After complete synovectomy, we implanted a semi-constrained prosthesis, again with an oxidized zirconium femoral component. The patient was mobilized with full weight bearing showing very little pain and a good range of motion.
Conclusion:	Our case emphasizes the need for more long-term studies to better understand the risks associated with oxidized zirconium components in TKA
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Thema: Digitale Education Tools und Update Alignment

Inhalt Englisch

Titel: Standard knee radiographs compliment weight bearing full-length radiographs to facilitate intraoperative alignment

Aims and Objectives: This study investigates whether lower limb alignment measured on standard a.p. knee radiographs and weight bearing full-length leg radiographs correlates. Further, radiological parameters for correlation and intraoperative verification were identified.
It was hypothesized that the established parameters for alignment determination on full-length weight bearing and classic knee a.p. radiographs correlate.

Materials and Methods: 130 adult patients who received a weight bearing full-length leg and classical knee a.p. radiograph in supine position between 2018 and 2020 in a time interval of 6 months were included in the study.
On the full-leg radiograph, femorotibial angles (mFTA/ aFTA), lateral distal femoral angle (mLDFA/ aLDFA), medial proximal tibial angle (mMPTA/ aMPTA), and joint line convergence angle (JLCA), as well as the magnitude of aFTA-JLCA, were determined using the mechanical (m) and anatomical (a) axes of the leg. Equivalently, on the a.p. radiograph, these angles were measured based on the anatomical axis (aFTA_ap, aLDFA_ap, aMPTA_ap, JLCA_ap).
The univariate Pearson (in the case of aLDFA Spearman) coefficient was calculated firstly. For final model building, linear regressions were used to univariately analyze the correlation between the target variables mFTA, aFTA, and aFTA_ap and all potential influence variables. Variables with $p<0.1$ were included in a multivariable analysis with backward selection.

Results: For the target variables mFTA (Ø1.3° varus ±5.1°), aFTA (Ø5° valgus ±5.5°), aFTA_ap (Ø2.8° valgus ±4.1°) variables with significant correlations could be identified in the multivariable analysis.
An increase in JLCA_ap, aFTA_ap, and aMPTA_ap by 1° each led to an average increase in mFTA by 0.5° and 0.8° and a decrease by -0.3°, respectively ($p<0.01$).
If the aFTA_ap and aMPTA_ap increase by 1°, the aFTA responds on average with an increase of 0.9° and decrease of -0.3° ($p<0.01$).
The aFTA_ap responded to an increase of JLCA and JLCA-aFTA by 1° with an increase of 0.7° and 0.5° ($p<0.001$).

Conclusion: The established radiological parameters for alignment determination of the lower limb on weight bearing full-length leg and classic knee a.p. radiographs in supine position correlate with each other. Complementary classic knee a.p. radiographs for preoperative alignment determination facilitate intraoperative verification on the supine patient and improve the accuracy of realignment osteotomies. In particular, the JLCA should be included in non-weight bearing images.

Stichwörter: alignment, osteotomy, radiographic imaging

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Thema: Sonstiges

Inhalt Englisch

Titel: Relationship between Quantitative Measurement Methods of the Lateral Femoral Condyle Morphology on Lateral Radiographs in Anterior Cruciate Ligament-Injured Patients

Aims and Objectives: The osseus morphology of the lateral femoral condyle (LFC) has recently gained attention as a risk factor for anterior cruciate ligament (ACL) injuries. To date, various methods have been described for quantifying LFC bony morphology on lateral radiographs. We aimed to analyze the relationship between different measurement methods of the LFC on lateral radiographs in ACL-injured patients.

Materials and Methods: A retrospective analysis of 101 patients was performed. Inclusion criteria were primary ACL reconstruction at our institution between March 1, 2018 and 30 May, 2019 and the availability of lateral radiographs of the injured knee. Conventional lateral radiographs were utilized to measure the following morphometric parameters: Lateral Femoral Condyle Ratio (LFCR), Height of Lateral Femoral Condyle to Anteroposterior Diameter Ratio (HAPR), Femur Tibia Size Ratio (FTSR), Tibia to Posterior Femoral Condyle Ratio (TPFCR) and Porto Ratios (XY/AB; B/AB; B/XY). Patients with malrotated radiographs (condylar overlap > 6mm) were excluded. All measurements were performed by three raters and intraclass correlation coefficients (ICC) were calculated for inter- and intrarater reliability. Pearson's correlation coefficients were used to identify relations between the morphometric parameters with significance set at $p < 0.05$.

Results: 58 patients (20 women, 28.4 ± 11.6 years; 38 men, 29.1 ± 12.4 years) were included in the final analysis. The mean values and standard deviations were the following: LFCR 63.7% ± 2.8%, HAPR 0.35 ± 0.02, FTSR 1.23 ± 0.07, TPFCR 2.99 ± 0.28, XY/AB 0.41 ± 0.08, B/AB 1.20 ± 0.06 and B/XY 3.05 ± 0.58. Significant correlation was observed between FTSR and XY/AB ($r = .425$), B/AB ($r = .582$) and TPFCR ($r = -.326$), between XY/AB and HAPR ($r = -.309$) and B/XY ($r = -.933$) and between TPFCR and B/AB ($r = .302$). LFCR did not show any correlation with other parameters. Intra-rater reliability analysis showed excellent agreement for LFCR, HAPR, FTSR, TPFCR and B/AB (ICC > .90; $p < .001$) and good agreement for XY/AB and B/XY (ICC = .75 - .90; $p < .001$). ICC between the raters varied from poor for XY/AB and B/XY (ICC < .50; $p > .05$), moderate for HAPR and B/AB (ICC = .50 - .75; $p < .001$), good for FTSR and TPFCR (ICC = .75 - .90; $p < .001$) to strong for LFCR (ICC > .90; $p < .001$).

Conclusion: Values for LFCR, HAPR, FTSR, TPFCR and B/AB showed comparable results to the original publications. Correlation could not be found between all methods, although all have been shown to be associated with an increased risk of ACL injuries or rotatory knee instability. As expected, methods using the same measured distances showed greater correlation. Moderate to strong agreement among raters was seen on most parameters. Thus, we conclude that the complex morphology of the LFC can be quantified in two-dimensional radiographs by different methods. In this context, the LFCR in particular is associated with excellent intra- and interrater reliability and can therefore be well used in daily clinical practice.

Stichwörter: bone morphology;measurement technique;knee;ACL;tear;injury

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Thema: Prothetik 360° von Teil- über Total- bis zur Revisionsendoprothetik

Inhalt Englisch

Titel: Mittelfristige Ergebnisse der lateralen unikondylären "fixed-bearing" Schlittenprothese

Aims and Objectives: Bisher existiert wenig Literatur und nur kleine Serien von lateralen unicondylären "fixed-bearing" Kniegelenksprothesen. Daher wurden im Rahmen dieser Studie die mittelfristigen Überlebensraten und klinischen Ergebnisse der lateralen Schlittenprothese (Oxford Fixed Lateral) untersucht.

Materials and Methods: In dieser monozentrischen retrospektiven Kohortenstudie wurden alle Patienten, die in den Jahren 2014 und 2015 mit einer lateralen "fixed-bearing" Knieprothese in der Orthopädischen Klinik Paulinenhilfe versorgt wurden, nachuntersucht. Es handelte sich hierbei um 92 Patienten mit 96 Knieprothesen. Das Durchschnittsalter lag zum Zeitpunkt der Operation bei 71,4 Jahren und es ergab sich ein durchschnittlicher Nachuntersuchungszeitraum von 44 Monaten. Mittels einer Kaplan-Maier Analyse wurden die Überlebensraten mit den Endpunkten _Revision_, definiert als jede Wechseloperation, bei der mindestens eine Prothesenkomponente ausgebaut wurde, und _Reoperation_, definiert als jede sekundäre Operation, ausgewertet. Zur klinischen Beurteilung wurden der Oxford Knee Score, die VAS, die Patientenzufriedenheit sowie der Schmerzmittelbedarf erfragt_

Results: Von 85 Patienten konnten bei 100% die Überlebensraten und bei 90,5% die klinischen Scores erhoben werden. Sieben Patienten waren zum Zeitpunkt der Nachuntersuchung bereits verstorben. Drei Patienten mussten sich aufgrund einer medialen Anschlussarthrose einer Revision zur bikondylären Oberflächenersatzprothese unterziehen. Bei einem weiteren Patienten wurde wegen einer spontanen Osteonekrose des medialen Femurkondylus eine additive mediale Kniegelenksprothese implantiert. Es wurden keine weiteren Komplikationen dokumentiert. Die Kaplan-Maier Analyse ergab eine Überlebensrate von 96,6% für den Endpunkt "Revision", definiert als jede Wechseloperation, bei der mindestens eine Prothesenkomponente entfernt wurde, und 95,5% für den Endpunkt "Reoperation", definiert als jede sekundäre Operation. Klinisch zeigten sich hervorragende Ergebnisse mit einem durchschnittlichen OKS von 43 Punkten, sowie einer sehr hohen Patientenzufriedenheit von 96%. Das postoperative Aktivitätsniveau war mit einem UCLA von 5,9 und Tegner Score von 2,7 zufriedenstellend.

Conclusion: Die Ergebnisse der hier vorliegenden Studie zeigen, dass der laterale "fixed-bearing" Kniegelenkersatz eine hervorragende Therapieoption für eine fortgeschrittene isolierte laterale Gonarthrose ist. Bei der "fixed-bearing" Variante kann keine Inlayluxation auftreten, wodurch im Vergleich zu der lateralen "mobile-bearing" Variante das Komplikationsrisiko deutlich geringer ist. Wir empfehlen im lateralen Kompartiment eine "fixed-bearing" Knieprothese zu verwenden. Es gilt zu beachten, dass es sich hier um eine Studie in einem high-volume Zentrum mit viel Erfahrung im Bereich des Knieteilgelenkersatzes handelt, sowie das Langzeitergebnisse noch ausstehen.

Stichwörter: -

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Thema: Sonstiges

Inhalt Englisch

Titel: Anterior cruciate ligament reconstruction using semitendinosus tendon with and without an additional internal brace stabilization. Is there any difference? A minimum 2 year follow up.

Aims and Objectives: ACL rupture is one of the most common sports injuries. Arthroscopic reconstruction using an autograft is the treatment of choice. Despite constant further development, a rupture risk of up to 25% is described. The most used graft in Germany is the semitendinosus tendon. In this study, a tape is inserted in parallel with the semitendinosus graft. Movement in the tendon-bone interface during the healing process is described as one potential risk factor for a rupture. Is this procedure a way to reduce rerupture and is there a difference in the recorded scores compared to the same reconstruction procedure without internal brace?

Materials and Methods: In this study 48 patients were matched. 24 Patients with the use of a semitendinosus graft (grp1) and 24 patients with a parallel internal brace (grp2). Patients aged 18-52 were included under following inclusion criteria: unilateral ACL tear, meniscus tear. Exclusion criteria: complete collateral ligament injury, advanced cartilage damages.
In the surgical technique, the tendon is quadrupled and fixed in a tibial and femoral socket using adjustable loops with cortically applied buttons. In the second group a Fibre-Tape is inserted next to the graft in parallel and fixed on the tibia individually. The patients were followed up preoperatively, 3 months, 6 months, 9 months, 1 year, 2 years and 5 years postoperatively. At these timepoints the following scores were recorded: Visual Analogue Scale (VAS) of pain, sport and leisure activity (Tegner), the Single Assessment Numerical Evaluation (SANE) and Knee Injury and Osteoarthritis Outcome Score (KOOS), a Pivot-Shift Test and the anterior tibial translation (using KTS) was determined after 2 years.

Results: At this time, there was one retear in each group (4,17 %) caused by adequate trauma in both groups. One patient in grp1needed a secondary arthroscopy due to cyclops formations in the knee joint. The VAS score in both groups was 2.0 preoperatively. After two years the VAS decreased significantly ($p = 0.02$) between the groups to 0.4 () in grp1 and to 1.4) in grp2. The Tegner was 5.1 in grp1 and 4.9 in grp2 preoperatively and 5.5 against 5.1 after two years. The mean KOOS was 64.7 and 67.7 before the operation and 86.7 against 80.9 after two years. The preoperative difference between grp1 and grp2 in the SANE was 38.4 against 47.0 and increased after two years to 86.9 and 78.1. There was no significant difference between both groups in the Pivot-Shift Test and anterior tibial translation recorded after 2 years.

Conclusion: The treatment of anterior cruciate ligament injuries using a quadruple semitendinosus tendon and internal bracing is an option for cruciate ligament treatment. This study shows that there seem to be no negative effects of bracing even after 2 years, but the Tape has not yet led to a reduction in the rerupture rate. Biomechanical studies show an additional stabilizing property of the internal bracing, so it can be considered in revision cases or with smaller graft diameters.

Stichwörter: ACL, Internal Brace, Retear, Knee

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Thema: Prothetik 360° von Teil- über Total- bis zur Revisionsendoprothetik

Inhalt Englisch

Titel: DESPITE DIVERSE BEARING GEOMETRIES A CLEAR ANTERIOR FEMORAL SHIFT REMAINS IN CRUCIATE RETAINING SYSTEMS

Aims and Objectives: Although total knee arthroplasty (TKA) is an established procedure with 95% survivorship, around 14-39% of patients report dissatisfaction with the outcome ***Maratt et al. 2015***. One of the reported causes is anterior knee pain due to a paradoxical anterior shift ***Donadio et al. 2015***. Despite a wide number of available TKA designs, there is no clear consensus about the effectivity of specific design geometrical features in combination with cruciate ligaments strategy to achieve a physiological knee joint kinematic pattern during flexion. The aim of this study was to analyze two different TKA designs in both cruciate ligaments strategy during in-vivo conditions to achieve an understanding of the outcome.

Materials and Methods: In a retrospective in-vivo study, five groups of patients operated with specific TKA designs consisting of; 10 gradually changing radius posterior stabilized (G-Curve PS), 10 gradually changing radius cruciate retaining (G-Curve CR), 10 lateral pivot CR (LP-CR), 10 asymmetric bicruciate stabilized (A-BCS) and 10 asymmetric CR (A-CR) were analyzed in-vivo during open chained unloaded flexion-extension and during a closed chain loaded lunge activity. Single plane fluoroscopy was used to collect the movement from extension until maximal flexion ***Pfitzner et al. 2017***. Specific CAD models of the femoral and tibia components of the four systems were registered to the fluoroscopic images. Medial and lateral distal points relative to the tibia component plateau were determined to calculate the relative tibio-femoral knee kinematic.

Results: A clear tendency towards a paradoxical anterior shift was observed on the medial compartment in all CR cohorts during unloaded flexion-extension (ranging from 4,0 to 10,2 mm, Standard Deviation (SD): 3,0 mm). Although still present during loaded lunge, the magnitude of the anterior shift was however reduced (around 5,7 mm, SD: 2,4 mm). Also, certain degree of lateral femoral rollback can be observed, reaching a posterior translation of maximal 4,6 mm, SD: 2,5 mm. In contrast, the kinematic of both BCS and PS systems was characterized by reduced movement on the medial compartment, remaining almost stationary or tranlasting maximaly 2,4 mm, SD: 1,2 mm. Femoral rollback on the lateral compartment of up to 11,0 mm, SD: 2,4 mm was observed during unloaded flexion-extension and loaded lunge.

Conclusion: Although there is undoubtedly an effect of specific design features, the results of this in-vivo study showed that despite geometrical variations, the kinematic outcome is rather defined by the presence or lack of cruciate ligament. Although cruciate retaining systems are very well established, the kinematic of the analyzed CR cohorts indicates that the retained posterior cruciate ligament alone seems to be insufficient to avoid paradoxical anterior shift during flexion. Future TKA designing needs to consider the multifactorial aspect of TKA and as consequence the interaction between ligament tension, loading and geometrical features.

Stichwörter: Total knee arthroplasty, knee joint kinematics, TKA designs, single plane fluoroscopy

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Thema:	Sonstiges

Inhalt Englisch

Titel: Body mass index and total knee arthroplasty in adult osteoarthritis patients

Aims and Objectives:

Obesity is a global phenomenon that increased dramatically in recent decades. It is associated with a high risk of numerous chronic diseases. Effects on the musculoskeletal system include degenerative and inflammatory diseases, of which osteoarthritis (OA) is the most common. Thereby, obesity is the most important modifiable risk factor for OA. Recent analysis indicated that individuals with a body mass index (BMI) >30 had a 6.8-fold higher risk of developing knee OA than normal-weight control subjects.

This study aimed to investigate the relationship between height, weight, and the age at which primary total knee arthroplasty (TKA) was performed in adult OA patients. Our hypothesis stated that the commonly used BMI may not be the best indicator to examine the associations between the previously mentioned variables.

Materials and Methods:

This is a retrospective cohort study with patients who underwent a primary total knee arthroplasty (TKA), between 2016 and 2022, in a tertiary level university hospital. Associations between height, weight and age at the time of surgery and were analyzed using linear correlation analyses (one-tailed Spearman-Rho). For this purpose, height and weight were transformed into the known BMI (kg/m^2) and a novel 'height-weight' index (HWI, $(m*kg)^2/1000$).

Results:

Data of 144 patients in the age range of 55-85 years were evaluated. On average the male patients (n=70) were 66 years old (mdn, IQR: 61-75.25), 1.78m tall (mdn, IQR: 1.75-1.82) and weighed 92 kg (mdn, IQR: 84.75-105.00) at the time of surgery. The female patients (n=74) were 69 years old (mdn, IQR: 63-78), 1.68m tall (mdn, IQR: 1.62-1.72), and weighed 85 kg (mdn, IQR: 73.5-98). The first analysis compared the correlations between age at time of surgery and BMI or HWI for the entire cohort. Although both indices correlated with age at time of surgery (BMI: r=-0.214, p=0.05; HWI: r=-0.341, p<0.001), the HMI showed slightly better results although significance criteria were missed (Pearson-Filon's z=0.409, p=0.683). When the subgroups were analyzed, no correlation between age at time of surgery and BMI was found for the male patients (r=-0.144, p=0.117), but for the HWI (r=-0.211, p=0.039) (Pearson-Filon's z=1.130, p=0.258). In female patients' data both analyses showed significant results (BMI: r=-0.279, p=0.008; HWI: r=-0.364, p<0.001) with slightly better correlation for the HWI (Pearson-Filon's z=1.567, p=0.117).

Conclusion:

As in other work previously, this study was able to establish a relationship between body weight and height and age at the time of primary TKA. Furthermore, it could be shown that the presented HWI might be better suited for correlation analyses than the widely used BMI. Although the differences between these indices were small in the current study, the HWI should be tested in predictive models that consider additional variables.

Stichwörter: Total knee arthroplasty, Body mass index, Osteoarthritis

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Thema: Robotik, Sensorik, KI

Inhalt Englisch

Titel: Robotic-assisted TKA reduces the complication rate of complex TKA to the level of non-complex TKA

Aims and Objectives: Complex primary total knee arthroplasties (TKA) are reported to be associated with excessive episode of care (EOC) costs compared to non-complex procedures. The impact of robotic assistance (rTKA) on economic outcome parameters in greater case complexity has not been described yet. The purpose of this study was to investigate economic outcome parameters in the 90-day postoperative EOC in robotic-assisted complex versus non-complex procedures.

Materials and Methods: This study is a retrospective, single-center review of 341 primary rTKAs performed between 2017 and 2020. Patient collective was stratified into complex (n=218) and non-complex TKA (n=123) based on presence of the following criteria: Obese BMI, coronal malalignment, flexion contracture >10°, posttraumatic status, previous correction osteotomy, presence of hardware requiring removal during surgery, severe rheumatoid arthritis. Group comparison included surgery duration, length of stay (LOS), surgical site complications, readmissions and revision procedures in the 90-day EOC following rTKA.

Results: Mean surgery duration was marginally longer in complex rTKA but showed no significant difference (75.26 vs. 72.24min, p=0.258), neither did the mean LOS, which was 8 days in both groups (p=0.605). No differences between complex and non-complex procedures were observed regarding 90-day complication rates (7.34 vs. 4.07%, p=0.227), readmission rates (3.67 vs. 3.25%, p=0.841) and revision rates (2.29 vs. 0.81%, p=0.318).
Normal distribution was tested using the Kolmogorov-Smirnov test. Group differences were calculated using Student's t test for normally distributed data and Mann-Whitney U-test for nonparametric data. Chi-square test was used to compare categorical data. A p-value <0.05 was considered significant.

Conclusion: Robotic-assisted primary TKA reduces the surgical time, inpatient length of stay as well as 90-day complication and readmission rates of complex TKA to the level of non-complex TKA. Greater case complexity does not seem to have a negative impact on economic outcome parameters when surgery is performed with robotic assistance.

Stichwörter: total knee arthroplasty, robotic-assisted surgery, complex knee, case complexity, readmission rate, economic outcome parameters, episode of care costs

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Thema: Physiotherapie und Rehabilitation

Inhalt Englisch

Titel: Ultrasonography For Quantitative Assessment of Knee Joint Effusions - Useful Tool For Objective Evaluation Of Rehabilitation Progress

Aims and Objectives: Clinical assessment of knee joint effusion during routine physical knee examination is the gold standard, but lacks criteria and accuracy that would allow quantitative, objective, and reproducible assessment across centers in a scientific context or for individualised adjustments in knee rehabilitation after surgery.
An external validation of ultrasonography (US) for quantitative measurement of suprapatellar effusion size (ES) to improve diagnosis and individualised rehabilitation strategies in knee rehabilitation after anterior cruciate ligament reconstruction (ACLR) surgery compared with the reference method (palpation) was performed.

Materials and Methods: US was performed in 35 patients (66% male, age 33 [23 - 41] from June 2020 to September 2021 as part of the ongoing CAMOPED study. Data were collected in patients with planned ACLR and during rehabilitation after surgery at the following time points: preoperative (preop), discharge (postop), 3 + 6 weeks (predefined time to primary endpoint), 3 + 6 months postop and 1 year postop. Palpatory assessment was performed before the US examination by an independent examiner and was graded using the International Knee Documentation Committee (IKDC) 4-level objective scale.

Results: A total of 164 sonographies were performed. ES (in mm) was: preop 4.0 ± 4.8, postop 7.4 ± 2.6mm and consequently decreased significantly ($p=0.01$, ANOVA) time dependently after surgery 6.3 ± 3.7, 6 weeks 4.5 ± 4.6mm ($p<0.01$ vs. postop), 3 months 1.9 ± 3.0mm. This was not shown with palpatory qualitative assessment (p=n.s.). Patients with additional meniscal reconstruction had larger ES 6 weeks postop (8.1 ± 3.4 vs. 3.4 ± 4.4 mm, $p=0.05$) and on palpatory examination ($p<0.05$). ES corresponded to palpatory quantification when investigators assigned the effusion to be "none" (0.9 ± 1.5mm), "mild" (5.9 ± 2.7mm), "moderate" (8.5 ± 4mm) or "severe" (10.3 ± 2.4mm). There was a strong correlation between palpatory and US effusion ($r=0.83$, $p<0.01$) with lower deviations in US quantification compared to palpatory quantification $Y=1.15 + 0.15*x$. Threshold values could be determined for the detection of ES by palpation and for the differentiation between mild and moderate/severe effusions (effusion depth: 2.6 mm and resp. 5.8 mm, respectively). Time-dependent reduction of the ES could be shown to the same extent by means of US and palpatory assessment.

Conclusion: As demonstrated in this multicenter study size of suprapatellar effusions can be quantified with high accuracy using standardised bedside ultrasound. Especially in moderate to severe effusions US provides a practical and reliable tool for outcome measurement that is superior to palpatory assessment with the goal of optimising individual recommendations during the rehabilitation course. Furthermore, for the first time, it has been possible to define sonographic threshold values for the detection of effusion and differentation of mild vs. moderate/severe effusion by means of palpation.

Stichwörter: Anterior cruciate ligament reconstruction; Rehabilitation; Effusion; Ultrasonography

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Thema: Sonstiges

Inhalt Englisch

Titel: Combining ACL Reconstruction and Refixation: The SAMBBAR-Technique

Aims and Objectives: Anterior cruciate ligament (ACL) preservation surgical techniques have been rising lately. In the acute setting, proximal ACL tears and femoral avulsions of the ACL are good indications for primary repair of the ACL. However, literature shows a wide range of failure rates. An intact synovial membrane seems to be a predicational factor for the outcome of primary ACL repair. Disruption of the synovial membrane is associated with higher failure rates. We describe a surgical technique repairing the ACL in combination with a semitendinosus augmentation for proximal ACL tears with or without disruption of the synovial membrane.

Materials and Methods: The procedure preserves as much of the original anatomy as possible by repairing the synovial membrane and ACL remnant to the femoral origin. To accomplish this, we have built on the so-called "Single Anteromedial Bundle Biological Augmentation (SAMBBA) technique" and developed it further to the "Single Anteromedial Bundle Biological Augmentation and Refixation (SAMBBAR) technique" (Fig. 1).

Results: All three patients treated with the SAMBBAR technique showed very good short-term clinical outcomes comparable with successful standard ACL reconstruction. There were no complications. Twelve months postoperatively, patients had no pain. They had normal range of motion in the affected knee without any signs of instability.
The SAMBBAR technique seems to be an adequate procedure to preserve as much proprioceptive native tissue as possible, while at the same time ensuring high tissue strength in order to reduce failure rates. Prospective randomized controlled trials are needed to compare the new SAMBBAR technique with standard ACL reconstruction, with the original SAMBBA technique, and with techniques of ACL refixation.

Conclusion: With the presented surgical procedure, it is possible to perform a standard ACL reconstruction using an autologous semitendinosus graft and at the same time preserving the tissue remnant of the ACL in all proximal tear patterns. This might contribute to improved proprioception and rehabilitation without sacrificing stability.

Stichwörter: Anterior Cruciate Ligament, Lachman test, Ligamys, Knee instability, Semitendinosus tendon

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Thema:	Knorpelchirurgie

Inhalt Englisch

Titel:	No significant difference between biological cartilage repair and patient specific metal implants in middle-aged patients

Aims and Objectives:	Focal chondral lesions of the femur are a challenge in middle-aged patients. Oftentimes, neither biological chondral repair, nor partial knee arthroplasty represent an adequate treatment. Patient specific mini-metal implants are an option to close this treatment gap. Nevertheless, despite the lower treatment response with increasing age, biological repair is still considered the golden standard for these patients. This study compares the clinical results of Autologous Matrix Induced Chondrogenesis (AMIC) to the implantation of singular patient specific mini-metal implants 12 months after treatment.
Materials and Methods:	32 patients were included in this retrospective study. 18 patients were treated with a singular patient specific mini-metal implant ("Episealer", Fa. Episurf, Stockholm, Sweden). Exclusion criteria were deviation in the axis of the leg, massive obesity or advanced damage of the opposing tibial cartilage. 14 patients underwent an AMIC of the medial or lateral femoral condyle. In addition to demographic data, the visual analogue scale (VAS) for pain and the Knee Injury and Osteoarthritis Outcome Score (KOOS) were collected.
Results:	18 patients, 10 male and 8 female, were included in the implant-group. The mean age was 54 years (SD 9), 16 patients underwent surgery due to a lesion of the medial femoral condyle, 2 patients received an implant of the lateral femoral condyle. 16 of these patients underwent prior treatment with biological chondral repair without success. The AMIC-group consisted of 14 patients, 7 male and 7 female with a mean age of 39.5 (SD 12). 12 patients received an AMIC of the medial femoral condyle, 2 patients were treated with an AMIC of the lateral condyle. All patients received the AMIC as the first operative treatment of the respective cartilage lesion. Corresponding tibial cartilage lesions were ruled out before the intervention via arthroscopy (AMIC-group) or a damage-report that was compiled from special MRI-data (Episealer-group). No signs of loosening or infection were found in the Episealer-group. No revisions were reported. While the AMIC-group reported no infections as well, 4 patients underwent implantation of Episealer-Implant due to disease progression after receiving the AMIC. The VAS for pain of the AMIC-group improved from 56 preoperatively to 27 12 months postoperatively, the aggregated KOOS increased from 57 to 83. For the Episealer-group, the VAS for pain decreased from 59 to 21 and the KOOS improved from 48 to 83 after 12 months.
Conclusion:	Both groups showed improvement in the measured scores and thus appear to be valid options in treatment of cartilage lesions in the "best-agers". However, future studies will have to evaluate the long-term results.

Stichwörter:	AMIC, patient specific implant, Episealer, cartilage lesion, knee

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Thema: Osteotomie

Inhalt Englisch

Titel: High prevalence of increased posterior tibial slope in ACL revision surgery demands for a patient specific approach

Aims and Objectives: An increased posterior tibial slope (PTS) is a described important risk factor for recurrent anterior cruciate ligament (ACL) graft insufficiency. A PTS higher than or equal to 12°, as measured using the proximal anatomical axis, has been defined as a cut-off value for a pathological slope. The primary aim of this study was therefore to determine the prevalence of a pathological PTS in a population with one, two or three ACL graft insufficiencies. The secondary aim was to investigate if the prevalence of a pathological PTS and the absolute PTS increases with the increasing number of ACL graft insufficiencies. The hypothesis was that there is a high prevalence of a pathological PTS in ACL graft insufficient patients and that the prevalence as well as the absolute PTS increases with the increasing number of ACL graft insufficiencies.

Materials and Methods: Between January 2021 and March 2022, all patients with an ACL graft insufficiency after anterior cruciate ligament reconstruction (ACLR) were included. Exclusion criteria were previous multi-ligament surgery or new multi-ligament injury requiring multi-ligament surgery; previous ipsilateral septic knee arthritis; previous osteotomy around the injured knee; incomplete medical records; previous ACLR not using a standard type of ACL graft (quadriceps, hamstring or patellar tendon autograft, or allograft tendon); previous ACL repair and no true lateral long leg radiograph. The PTS was measured as the angle between the tangent to the medial tibial plateau and the proximal anatomical tibial axis. Patients were subsequently divided into groups depending on number of ACL graft insufficiencies: group A, 1 graft insufficiency; group B, 2 graft insufficiencies; group C 3 or more graft insufficiencies. Chi-square test and independent student T tests were used to compare the prevalence of pathological PTS and absolute PTS between the groups. Significance was set at $p<0.05$.

Results: In total 206 patients (147 men / 59 women) were included. 73 patients showed a pathological PTS with an overall prevalence of 35% (95% confidence interval (CI) [29%; 42%]). 155 patients were included in group A, 42 patients were included in group B and 9 patients were included in group C. The prevalence of the pathological PTS for group A, B and C was respectively, 32% (95% CI [25%; 40%]), 38% (95% CI [23%; 53%]) and 78% (95% CI [51%; 100%]). The prevalence of the pathological PTS did not increase significantly between group A and B ($p>0,05$). However, it increased significantly between group A and C, and group B and C ($p< 0,05$). The mean PTS did not increase significantly between group A and B ($p >0,05$). However, the mean PTS increased significantly between group A and C, and group B and C ($p<0,05$).

Conclusion: There is a 35% overall prevalence of pathological PTS in the studied ACL graft insufficient patient population. Surgeons should be aware of the high prevalence when consulting patients for revision ACLR.

Stichwörter: Tibial slope, ACL, osteotomy

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Thema: Osteotomie

Inhalt Englisch

Titel: Simultaneous coronal and sagittal correction with uniplanar osteotomy of the proximal tibia using variable hinge positions

Aims and Objectives: Surgical correction of varus malalignment and increased posterior-tibial-slope (PTS) bears a high potential for mutual interference. This study aims to test the feasibility and predictability of uniplanar high tibial osteotomy (HTO) for simultaneous correction of PTS and varus malalignment, using variable-hinge-positioning.

Materials and Methods: Monoplanar medial open-wedge HTO (mowHTO) was performed in two sets with gap sizes (GS) of 5mm (set 1) and 10mm (set 2), using standardized left tibial SawBone® models. Hinge-angulations (HA) in steps of +10° (HA) were used between 0-90° (n=2x10) in the axial plane, so a total amount of 20 osteotomies were conducted. After fixation with 2.5mm K-wires, a ConeBeam CT-scan was performed to measure the lateral (latPTS) and medial PTS (medPTS), as well as medial proximal tibial angles (MPTA). A multiple linear regression analysis (MLRA) was calculated.

Results: The native model presented an MPTA of 84.9°, latPTS 11.5° and medPTS 9.1°. After mowHTO, the mean gap sizes (GS) were 5.55±0.36mm (4.92-5.99mm) (set 1) and 10.09±0.57mm (8.95-11.06mm) (set 2). MPTA was significantly influenced by HA between 0-20° in both sets ($p < 0.001$). In HA of > 20°, however, the influence of GS prevailed, increasing the MPTA by 0.62° per mm of gap opening ($F(2,18)=13,94$, $p<0.001$). The medPTS ($p<0.001$) and latPTS ($p<0.001$) were also influenced by both factors (GS and HA). With increasing HA (0-90°), medPTS decreased by 0.64° ($p<0.001$) and latPTS by 0.65° ($p<0.001$), while this effect was stronger in set 2. The influence of GS was most apparent in hinge angles between 0-50°, where medPTS was increased by 0.84° ($p<0.001$) and latPTS by 0.70° ($p< 0.001$) per mm of gap opening. In HA of > 50°, the influence of GS on medPTS and latPTS ceased continuously.

Conclusion: The simultaneous effect of monoplanar mowHTO on sagittal and coronal alignment (particularly MPTA) is limited to particular sections of HA. MPTA was significantly influenced by HA between 0-20° of hinge position, but was further alterable by GS in higher angles (> 20°). PTS can be changed predictably by variable HA, while GS is less influential in sections of higher HA (>50°). In conclusion, monoplanar mowHTO may allow simultaneous sagittal and coronal correction. However, in selected cases biplanar osteotomy may be required.

Stichwörter: osteotomie, monoplanar, hinge position, slope, VKB, HKB, HTO

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Thema:	Osteotomie

Inhalt Englisch

Titel: Iatrogenic ischiofemoral impingement due to high tibial osteotomy with overvalgisation

Aims and Objectives: Open wedge high tibial osteotomy (owHTO) is a standard procedure for frontal realignment. It is indicated in varus knees with a reduced mechanical medial proximal tibia angle (mMPTA). Overcorrection producing a mMPTA out of the normal range (85-90°) is not recommended because this would lead to a unphysiological joint-line orientation. Osteotomies around the knee also influence the adjacent ankle and hip joints. For the hip, it is known that frontal alignment of the leg influences the ischiofemoral space. A decreased ischiofemoral space can lead to painful impingement between the ischial bone and the lesser trochanter.

Materials and Methods: A 53-year-old woman presented with severe ischiofemoral impingement symptoms and a valgus malalignment of the left leg after she had received owHTO, that was indicated and performed by an orthopaedic surgeon with the intention to treat medial knee pain due to degenerative arthritis of the medial compartment years after medial meniscectomy.

Results: The mMPTA was 100.5°. We performed a closed wedge HTO producing a mMPTA of 90.0° and a normal joint-line orientation. The hip pain was gone immediately after the surgery and the patient had no signs of ischiofemoral impingement or hip pain at the last follow-up 12 months after closed wedge high tibial osteotomy (cwHTO).

Conclusion: Frontal realignment osteotomy around the knee can create problems at adjacent joints. Overvalgisation of the proximal tibia made the patient compensate by hyperadduction of the hip to enable full foot sole contact with the floor. Hyperadduction of the hip decreased the ischiofemoral space leading to severe impingement. Therefore, meticulous planning of osteotomies is important not to produce unphysiological situations or unwanted negative effects on the level of an adjacent joint.

Stichwörter: Hip, Knee, Malalignment, Realignment, Varus, Valgus

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Thema:	Sonstiges

Inhalt Englisch

Titel:	Limb salvage in Complex knee trauma - surgical options and strategies for functional outcome
Aims and Objectives:	In complex knee trauma neurovascular & soft tissue damage complicate surgical treatment for limb preservation. A stepwise multidisciplinary approach has to be coordinated for functional knee joint restoration.
Materials and Methods:	08/2017 a 34 y female motor cycle rider sustained severe two level lower extremity injury compromising ipsilateral femoral schaft fracture & 3° open knee dislocation with neurovascular injury. Day 0 DCO with exploration & debridement of the O3C knee dislocation confirmed a Schenk IV injury with pop artery dissection & peroneal & tibial nerve rupture (KD IV C N). Pop artery was reperfused with ipsilateral sapheneal vein. Ruptured nerve ends were suture marked for secondary coaptation & dermatofasciotomy with vac sealing was performed to prevent compartment syndrome. Reduction & EF of the ipsilateral femoral fracture & femorotibial k-wire & EF for knee joint retention was performed. Day 4 Second look debridement & vac sealing exchange & tibiometatasal EF due to foot palsy. Day 11 third look to achieve peroneal & tibial nerve coaptation by ipsilateral sural nerve interposition. Soft tissue coverage of the poplitea was achieved by medial and lateral gastrocnemius transfer. Day 23 femorotibial EF was removed & RTKA with long femoral stem was implanted to address both, knee instability & ipsilateral femoral fracture. Subtotal PT rupture was protected by McLaughlin cerclage. Day 30 Residual soft tissue defect at the knee was addressed by a pediculated fasciocutaneous perforator flap. Further clinical course showed regular wound healing & successful limb salvage with ROM 0/0/20. The patient presented in the outpatient clinics with painless full WB.
Results:	1 year after LS the patient presented satisfied, but asked for options to improve ROM. Based on the fact that 20° flexion would not be sufficiently improved by TO solely, the option of soft tissue expansion was explored to lengthen the quadriceps muscle by positioning STE in the anterior thigh. 03/2019 KA was performed with ROM 0/0/45 & two 700cc STE partially filled with methylene blue were implanted in row underlying the RFM. Over a period of 3 months the STE were expanded 2 weekly until max volume of 1400cc was achieved. Soft tissue expansion was performed for additional 3 months. In 09/2019, 6 months after soft tissue expansion STE were removed and for soft tissue release Judet tenotomy of the RM & KA with removal of the McLaughlin cerclage and long tuberosity osteotomy was performed in 90°. During 3 to 5 y FU ROM 0/0/90 & almost normal walking & climbing mountains was registered.
Conclusion:	Shared treatment decision based on patient's informed consent is mandatory for successful surgical treatment aiming limb salvage. Early reperfusion & solid soft tissue coverage is crucial to prevent infection & for successful knee reconstruction. To achieve good functional results out of the box thinking has to consider different orthoplastic surgical treatment options.
Stichwörter:	complex knee dislocation, limb salvage, knee arthrolysis, skin expander, tuberosity osteotomy

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Thema: Frakturen rund ums Knie

Inhalt Englisch

Titel: Posterolateral Tibial Plateau Impaction Fractures in Patients undergoing Primary Anterior Cruciate Ligament Reconstruction - an MRI analysis of 556 cases

Aims and Objectives: Posterolateral impaction fractures of the tibial plateau have been identified as being associated with anterior cruciate ligament (ACL) tears. These fractures are often related to high energy pivoting injuries, which is why the frequency of such injuries in patients undergoing primary ACL reconstruction is of key concern. The objective of this study was to evaluate the occurrence of posterolateral tibial fractures as well as concomitant injuries in patients undergoing primary ACL-reconstruction.

Materials and Methods: A retrospective case series was conducted to study the occurrence and type of posterolateral tibial impaction fractures in patients undergoing ACL-reconstruction between October 2015 and October 2020. The records of all patients were reviewed to collect patient demographics, exact injury patterns and details about concomitant injuries. Descriptive statistics were performed to determine the incidence of each type of posterolateral tibial plateau impaction fracture as well as concomitant injuries like tibial or femoral edema, meniscal tears, meniscal posterior root tears or medial meniscal ramp lesions.

Results: Of the 556 knees with primary ACL reconstruction, 171 (30.8%) posterolateral tibial plateau impaction fractures were identified. 385 (69.2%) patients showed no fracture. Intraoperative arthroscopic examination showed lateral meniscus (LM) tears in 144 cases and medial meniscus (MM) tears in 163 cases. LM posterior root tears were found in 21 patients, MM posterior root tears in 8 patients. Medial meniscal ramp lesions were found in a total of 39 knees.

Conclusion: 30.8% of patients undergoing primary ACL-reconstruction show posterolateral tibial plateau impression fractures. LM tears were more frequent in patients with posterolateral tibial plateau impression fractures, with the highest incidence in IIIB fractures according to Bernholt et al. MM tears are more frequent in patients without posterolateral impaction fractures and LM posterior root tears are more frequent than MM posterior root tears among the whole study population. The clinical relevance of this study lies in the exact analysis of posterolateral tibial plateau fractures in patients with ACL lesions and the resulting therapeutic consequences depending on the fracture type and concomitant injuries.

Stichwörter: Posterolateral tibial plateau impaction fracture, ACL-lesion, concomitant injuries in ACL-deficient knees, meniscal tear

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Thema: Knorpelchirurgie

Inhalt Englisch

Titel: In the case of traumatic and degenerative cartilage defects in the area of the medial femoral condyle, autologous chondrocyte transplantation (ACT) shows excellent results in the medium term after 36 months (analysis from the DGOU cartilage registry)

Aims and Objectives: The aim of the study was to investigate the outcome after ACT in the area of the medial femoral condyle in the medium term in degenerative and traumatic cartilage defects. The hypotheses assumed were that significantly better outcome parameters (VAS, KOOS total) are achieved after 36 months in the case of traumatic cartilage defects than in the case of degenerative cartilage defects and that significant improvements in the preoperative score values can be achieved in both groups after 36 months.

Materials and Methods: Data was recruited using data from the DGOU cartilage registry. Isolated cartilage defects on the medial femoral condyle, which were treated with ACT and were of traumatic or degenerative origin, were defined as inclusion criteria. 72 degenerative and 70 traumatic patients could be included. The VAS score and the KOOS score were defined as outcome parameters after 36 months.

Results: The age at the time of the operation was found to be higher in the group with degenerative cartilage damage (32.69 years) than in the group with traumatic cartilage damage (27.61 years). The defect size in the degenerative group was 381.46 mm², larger than that in the traumatic group (332.72 mm²).
As far as the VAS value in both groups is concerned, an improvement in both groups after 36 months compared to the preoperative VAS value (mean value VAS preoperatively traumatic: 2.82, mean value VAS preoperatively degenerative: 3.82) was achieved. After 36 months, there was a better VAS value in the traumatic group (VAS traumatic 36 months FU: 1.62 compared to the degenerative group (VAS degenerative 36 months FU: 2.17), a significant difference between the two groups 36 months, however, did not exist ($p>0.05$) There was a significant increase ($p< 0.05$) from baseline in both groups.
When comparing the KOOS value achieved after 36 months, with approximately the same preoperative starting values(KOOS value preoperatively in the traumatic group 59.37, KOOS value preoperatively in the degenerative group 58.08) in the degenerative group (KOOS value degenerative 36 months FU = 81.95) a better KOOS value than in the traumatic group (KOOS value traumatic 36 months FU = 80.52) was achieved after 36 months, but a significant difference between the two groups could not be determined ($p >0.05$). There was a significant increase ($p<0.05$) from baseline in both groups.

Conclusion: The results could not confirm our hypothesis that after 36 months significantly better outcome parameters are achieved in cartilage defects suffered from trauma than in cartilage defects suffered from degeneration. However, after 36 months, both groups showed a significant improvement in both the KOOS values and the VAS values. In conclusion, it can be stated that autologous chondrocyte transplantation in the area of the medial femoral condyle achieves excellent results in the medium term after 36 months and is recommended as a surgical method for both degenerative and traumatic cartilage damage.

Stichwörter: cartilage, ACT

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Thema: Sonstiges

Inhalt Englisch

Titel: Coronal extrusion of the lateral meniscus does not increase after pullout repair of the posterior root of the lateral meniscus at short-term follow-up

Aims and Objectives: Posterior lateral meniscus root (PLMR) tears are injuries that commonly occur together with anterior cruciate ligament (ACL) tears. The aim of this study was to evaluate the clinical and radiological outcome of PLMR repair accompanying ACL reconstruction. Specifically, PLMR healing rates, meniscal extrusion behavior and their influence on patient-reported outcome measures (PROMs) were analyzed. It was hypothesized that PLMR repair shows satisfactory healing rates, no significant meniscal extrusion and that an increased coronal meniscal extrusion would lead to less favorable PROMs.

Materials and Methods: Patients that underwent PLMR repair between 2014 and 2019 were evaluated at least 12 months postoperatively. At follow-up, magnetic resonance imaging (MRI) was performed in order to evaluate the PLMR healing behavior (complete vs. partial vs. no healing) as well as the coronal and sagittal meniscal extrusion in comparison to the preoperative MRI. Additionally, PROMs (Lysholm score, International Knee Documentation Committee subjective knee form) were compiled.

Results: Out of 25 patients, 18 patients (72.0%; 11 male and 7 female) were available for final assessment at a mean follow-up of 40.8 ± SD 17.5 months. One revision PLMR repair was performed 5 months after the initial repair. In 14 cases (77.8%), healing of the lateral meniscus was observed (6x complete, 8x partial). Coronal extrusion of the lateral meniscus did not increase significantly following PLMR repair (2.00 ± 1.45 mm vs. 2.14 ± 1.3 mm; $p > 0.05$). Sagittal extrusion increased significantly (25.69 ± 2.36 mm vs. 27.03 ± 1.37 mm; $p < 0.001$). The healing status of the PLMR showed no influence on meniscal extrusion. An increased coronal meniscal extrusion negatively affected PROMs.

Conclusion: High healing rates of the PLMR and no significant increase in coronal extrusion may be expected following combined PLMR repair and ACL reconstruction. A greater increase in postoperative coronal meniscal extrusion correlates with less favorable clinical results.

Stichwörter: ACL; Meniscus tear; Meniscus repair; Meniscus root repair

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Thema:	Sonstiges

Inhalt Englisch

Titel:	Dynamic MRI measurement allows reliable control of success after surgical correction of patellofemoral instability and maltracking

Aims and Objectives:	The purpose of this study was to test the applicability of dynamic MRI in the postoperative control of success following surgical correction of patella maltracking in patients with patellofemoral instabilities.
Materials and Methods:	Patients who presented with symptoms of patellofemoral instability (PFI) and patellar maltracking (PM) between December 2019 and August 2021 were included. Inclusion criteria were reported patellar dislocation and / or persistent feeling of instability after dislocation, a positive (reverse) J-sign as well as clinically increased mediolateral translation. Exclusion criteria were PFI without PM and a limited range of motion (<0° Extension, <90° Flexion). All patients were examined using a 3 T MRI unit (Ingenia, Philips, Best, Netherlands) with repeated active flexion (40 °) and full extension of the affected knee joint preoperatively and at least 3 months after the surgical treatment. Common anatomical risk factors for PM (tibial-tuberosity-to-trochlear-groove-(TT-TG)-distances, trochlea-sulcus-angle (TSA), trochlea-sulcus-depth (TSD), lateral-inclination-angle (LTI), Caton-Deschamps-ratio (CDR), Insall-Salvati-ratio (ISR)) were analyzed using static MRI sequences. Dynamic measurement of dynamic mediolateral translation (dMPT) and patella tilt (dPT) were measured according to a previously described method.
Results:	21 Patients (6 males, 15 females, average 22.19 years) were included in the study. Surgical realignment procedures included bony tibial tubercle transfers (n=8), soft tissue transfers of the patella tendon insertion (n=5), trochleoplasty (n=4), torsional distal femoral osteotomy (DFO) (n=1), lateral retinaculum lengthening (n=3) and medially closing, varisating DFO (n=1). All patients received an additional MPFL reconstruction for patellar stabilization. After 3 months the dMPT was significantly reduced (10.92 ± 6.16 mm to 4,47 ± 0.35 mm p<0,001, d=1.441) and the patellotrochlear distance in extension was significantly reduced (16.67 ± 6.75 mm to 9.98 ± 4.87 mm, p<0.001, d=1.128). Furthermore, a significant reduction of the dynamic patellar tilt (dPT), from 15.04 ± 10.25 mm to 7.64 ± 6.41 mm was observed (p<0.005, d=0.855). Postoperative TT-TG and TT-PCL were significantly improved after surgery.
Conclusion:	Surgical realignment procedures in patients with patellofemoral maltracking leads to a measurable correction of patellofemoral kinematics. The extent of alteration can be quantified using dynamic MRI.

Stichwörter:	patellofemoral instability, patellofemoral maltracking, dynamic MRI,

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Thema: Frakturen rund ums Knie

Inhalt Englisch

Titel: Functional and radiological outcome of tibial plateau fracture

Aims and Objectives: The correlation between malreduction and clinical outcome is not yet fully understood in tibial plateau fractures. This work intends to clarify the correlation between fracture classification, functional Rasmussen knee score and modified radiological Rasmussen score.

Materials and Methods: Patients with a tibial plateau fracture treated surgically from 2014-2019 were included in this monocenter, retrospective study of a level I trauma center. Fractures were classified according to Schatzker/AO and Moore. One year postoperatively, conventional radiographs were evaluated in 2 planes according to the modified radiological Rasmussen score. Furthermore, patients received a clinical examination evaluating the functional Rasmussen score at the time before injury, one year after injury, and at the time of final follow-up.

Results: A total of 50 patients (58% females, 42% males, 47.4 ± 11.4 years mean age) were included in the study with a mean follow up of 3.9 years (± 569.59 days). There were 25 simple fractures (Schatzker I-III) and 25 more complex fractures (Schatzker IV-VI, Moore fractures).
Absolute functional outcome score was significantly worse one year postoperatively than before trauma for both simple and complex fractures. However, at further follow-up, simple fractures did not show significantly worse score than before trauma, but complex fractures did. In the radiological Rasmussen score after one year, there is neither a significant difference between the simple and the complex fractures nor a correlation to the clinical results. Both groups achieve an average score corresponding to a "good" result.

Conclusion: After surgical treatment of tibial plateau fractures, the overall functional outcome is "excellent". The results for simple fractures are superior to complex fractures in both the short and medium term. Because of improved surgical techniques and outcomes, the radiological Rasmussen score does not appear to have sufficient discriminatory power to distinguish between simple and complex fractures. Furthermore, there is no correlation with functional score, which explains the need for a more detailed radiological evaluation.

Stichwörter: tibial plateau fracture; treatment strategy; clinical and radiological outcome

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Thema: Osteotomie

Inhalt Englisch

Titel: Derotational femoral osteotomy adequately addresses torsional and coronal limb malalignment and leads to a good functional outcome in patients with recurrent patellofemoral instability at short- to midterm follow-up

Aims and Objectives: The aim of the study was to evaluate the functional and radiological outcome following derotational distal femoral osteotomy (D-DFO) in patients with high-grade patellofemoral instability (PFI) and an associated increased femoral antetorsion angle (FAA). It was hypothesized that D-DFO would lead to an excellent clinical and radiological outcome and that both torsional and coronal malalignment could be normalized.

Materials and Methods: Patients that underwent D-DFO between 06/2011 and 12/2018 for high-grade PFI and an increased FAA (> 20°) were included. Patient-reported outcome measures (Visual Analog Scale [VAS] for pain, Lysholm score, Kujala score, International Knee Documentation Committee subjective knee form [IKDC], Tegner Activity Scale [TAS]) were evaluated pre- and minimum 2 years postoperatively. Magnetic resonance imaging of the lower extremity and standing whole-leg anteroposterior radiography were conducted postoperatively and compared to the preoperative imaging in order to evaluate the change in the FAA and coronal limb alignment.

Results: In total, 27 patients (30 knees), were included. In 14 cases each, the D-DFO aimed to only correct the FAA (Group 1) or to additionally perform a varization (Group 2). In the remaining two cases, double-level osteotomies were performed to correct additional tibial deformities. In 25 cases (83.3%), concomitant procedures were performed. At follow-up (38.0 months [25-75% interquartile range: 31.8-52.5 months]), a significant reduction in pain (VAS for pain: 2.0 [1.0-5.0] vs. 0 [0-1.0], $p < 0.05$) and improvement in subjective knee function (Lysholm score: 58.6 ± SD 17.4 vs. 79.5 ± 16.6, $p < 0.05$; Kujala score: 55.6 ± 13.6 vs. 80.3 ± 16.7, $p < 0.05$; IKDC: 54.6 ± 18.7 vs. 74.1 ± 15.0, $p < 0.05$) as well as an increase in sporting activity (TAS: 3.0 [3.0-4.0] vs. 4.0 [3.0-5.0], $p = 0.236$) were reported. Femoral antetorsion was significantly reduced (28.2 ± 6.4° vs. 13.6 ± 5.2°, $p < 0.05$). A significant varization was observed in Group 2. One patellar re-dislocation occurred 70 months postoperatively.

Conclusion: In patients with high-grade PFI and an associated increased FAA, a significant reduction in pain and improvement of subjective knee function, a low rate of patellar re-dislocation and an adequate correction of torsional and coronal alignment could be observed following D-DFO.

Stichwörter: patellofemoral instability; patellar dislocation; mpfl; trochleoplasty; tibial tubercle transfer

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Thema:	Physiotherapie und Rehabilitation

Inhalt Englisch

Titel:	Physiotherapy and supportive measures use in the early rehabilitation phase after anterior cruciate ligament reconstruction - data from the CAMOPED study
Aims and Objectives:	The basis for guideline-based recommendation and further development of cost-efficient and effective innovations in early postoperative rehabilitation after knee injury is the standardized recording of the actual reality of care.
Materials and Methods:	As part of the ongoing prospective, stratified randomized, controlled, single-blinded, multicenter CAMOPED study (DRKS00021739) an exploratory analysis was performed: After surgical care for anterior cruciate ligament (ACL) rupture, the respective a) prescriptions, b) physiotherapy measures performed, and c) use of supportive measures were recorded. Patients and their physiotherapists received a standardized physiotherapy recommendation protocol (6 rehabilitation phases up to 12 months), but were free to actually perform or use according to clinical indication alone. Reporting was standardized and time-dependent by patients (n=71) and by their self-selected physical therapists (n=65).
Results:	Within 2-10 weeks postoperatively, 90% of patients received a total of 643 units of physical therapy (median: 10 [9 - 12]). Manual mobilizations (48%), thigh muscle stretching (14%) and partial weight bearing (15%) were most common, followed by cooling (11%), static motor control of the contralateral side (8%), and trunk and shoulder control (6%). Manual measures took place predominantly in weeks 2-8, stretching of the muscles after 5 and 9 weeks, cooling as expected until week 3, static motor control starting from week 3 to 7 and trunk and shoulder control starting after week 6. Already 6 weeks postoperatively 50% of the patients used the ergometer. Orthoses were used by initially 80% until 6 weeks postoperatively. Patients with ACL rupture and meniscus injury used walkers and orthoses for a longer period postoperatively than those with isolated ACL rupture (Kaplan Meier 14.4 95% CI 3.1.-4.3; p<001). After 7 and 9 weeks, 50% had returned to work or sports respectively. Approximately 60% of practices treated between 0 and 20 and approximately 26% treated more than 40 ACL rupture patients/year, 75% of practices had more than 5 years experience. 33% of practices reported a standard approach. The remaining practices followed - if available - physician guidelines and own experience values (each approx. 50%).
Conclusion:	The data from this prospective and standardized survey show the care reality of postoperative rehabilitation in Germany. Due to the lack of guideline-compliant physiotherapy practice for this exemplary indication, scientific data cannot be collected in a standardized manner within the framework of larger high-quality studies. This should be a reason to focus the development of physiotherapeutic guidelines, as in many other countries, and thus increase the effectiveness and cost-efficiency of care.

Stichwörter:	anterior cruciate ligament; rehabilitation; physiotherapy

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Thema:	Knorpelchirurgie

Inhalt Englisch

Titel: Does bone marrow stimulation procedure make sense as a first line treatment? A matched pair analysis

Aims and Objectives:

Due to the costs, regulatory limitations and the effort for the surgeon, larger cartilage defects are often treated with a bone marrow-stimulation procedure (e.g. microfracture). Autologous chondrocyte implantation (ACI) is therefore often used in case of failure of this first line therapie, although better results have been published for ACI in the medium and longer follow-up compared to microfracture, especially for larger defects. Based on a matched pair analysis this study investigates whether previous bone marrow stimulation adversely affects the outcome of third generation ACI as second line therapy. For this the clinical results in a follow-up of three years after matrix-based autologous chondrocyte implantation of the knee as second line therapy were compared to a group with first line therapy.

Materials and Methods:

In this study forty patients were included (20 patients with first line therapie with ACI (Novocart® 3D), 20 patients with second line therapie with ACI after microfracture as first line therapy). The mean defect size was 5.4 cm² (SD 2.6). The subjective IKDC score and the VAS were determined after 6, 12, 24 and 36 months postoperatively.
The matched pair analysis was performed by number of treated
defects, defect localization, defect size, sex, age and BMI.

Results:

Both first-line (Group I) and second-line (Group II) therapy showed significantly better clinical results in the IKDC score and VAS score compared to the preoperative findings im
Follow-up over three years. In addition, group I showed significantly better results in IKDC and VAS throughout the follow-up at 6, 12, 24, and 36 months compared to Group II
with second line therapy (IKDC 6 months p=0.015, 1 year p=0.001, 2 years p=0.001, 3 years p=0.011). Group I showed also a lower failure rate (no revision in group I, 30% revision rate in group II)

Conclusion:

ACI of the third generation is a succesfull therapy for the treatment of full-thickness cartilage defects with improvement of clinicl results in a medium and long follow-up. The data in the literature shows that ACI is superior to bone marrow stimulation in larger defects. In these defects microfracture has a higher failure rate and also ACI as a second line therapy after failed bone marrow stimulation has a higher failure rate and not as good results compared to first line ACI.
Therefore, in cases of larger cartilage defects (see recommendations e.g. of the AG Tissue Regeneration) ACI is to prefer as first line treatment option.

Stichwörter: ACI, microfracture, IKDC, VAS, first line therapy, second line therapy, matched pair analysis

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Thema: Sonstiges

Inhalt Englisch

Titel: Association of medial collateral ligament complex injuries with ACL ruptures based on posterolateral tibial plateau injuries

Aims and Objectives: The combined injury of the medial collateral ligament complex (superficial (sMCL), deep medial collateral ligament (dMCL), and posterior oblique ligament (POL)) and the anterior cruciate ligament (ACL) is the most common two ligament injury of the knee. Additional injuries to the medial capsuloligamentous structures are associated with rotational instability and a high failure rate of ACL reconstruction. Pathognomonic edema or fractures of the posterolateral tibial plateau are an expression of the large pivotal force during the accident. The purpose of this study was to analyze the exact pattern of the medial injuries and their risk factors in order to be able to diagnose them at an early stage and, if applicable, to initiate the necessary therapeutic steps.

Materials and Methods: Between January 2017 and December 2018, 151 patients with acute ACL ruptures were included. Using magnetic resonance imaging in the acute phase, a retrospective analysis of capsuloligamentous and osteochondral structures was performed by two radiologists and two trauma surgeons focusing on knee surgery. Special attention was paid to the medial capsuloligamentous structures.

Results: 151 patients with a mean age of 32 +/- 12 years were included in this study. Injury to the medial collateral ligament complex occurred in 34.4% of the patients. The dMCL was the most frequently injured structure (92.2%). A dMCL injury was significantly associated with an increase in trauma severity at the posterolateral tibial plateau ($p<0.02$) and additional injuries to the sMCL (OR 4.702, 95% CL:1.3-133.3, $p=0.03$) and POL (OR 20.818, 95% CL:5.9-84.4, $p<0.0001$). Isolated injuries to the sMCL were not observed. Significant risk factors for acquiring an sMCL injury were age ($p<0.01$) and injury to the lateral meniscus ($p<0.01$). sMCL injuries were not accompanied by medial meniscus injuries. Combined dMCL/POL injuries showed 26% associated injuries of the medial meniscus. In 16% of the cases the lateral meniscus was additionally injured.

Conclusion: In about one-third of acute ACL ruptures the medial collateral ligament complex is also injured. This might be associated with an increased knee laxity as well as anteromedial rotational instability. Also, this might be associated with an increased risk for failure of revision ACL reconstruction. In addition, we show risk factors and predictors that point to an injury of medial structures and facilitate their diagnosis. This should help physicians and surgeons to precisely diagnose and to assess its scope in order to initiate proper therapies. With this in mind, we would like to draw attention to a frequently occurring combination injury, the so-called "unlucky triad" (ACL, MCL, and lateral meniscus).

Stichwörter: Anteromediale Rotationsinstabilität, Medialer Kollateralbandkomplex, Deep MCL

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Thema: Prothetik 360° von Teil- über Total- bis zur Revisionsendoprothetik

Inhalt Englisch

Titel: EARLY RESULTS OF AN ANATOMICALLY BI-CRUCIATE LIGAMENT-RETAINING TOTAL KNEE ARTHROPLASTY: A MATCH-PAIR ANALYSIS OF 90 PATIENTS

Aims and Objectives: Maintaining the biological structure is of enormous importance in knee reconstruction in order to get as close as possible to natural knee kinematics and high patient satisfaction. The aim of this study is to evaluate the clinical and radiographic results of a fully anatomical total knee arthroplasty(TKA-BCR) that preserves both the anterior and posterior cruciate ligaments and compare the results to match-paired patients treated with a posterior stabilized TKA-PS and unicondylar arthroplasty(UKA).

Materials and Methods: In our analysis, we continuously compared 30 patients who received a both cruciate ligaments preserving anatomical total knee arthroplasty(TKA-BCR) with 30 patients who received both cruciate ligaments sacrificing TKA (TKA-PS) and 30 patients who received a partial knee replacement(UKA). We recorded our clinical results using a web-based registry. VAS (Visual Analogue Scale), KOOS Jr. (Knee Injury and Osteoarthritis Outcome Score Joint Replacement) and Tegner activity level were recorded pre-surgery, 3, 6 and 12 months post-surgery. X-rays were obtained before the procedure and in the first 3 months and at 12 month to assess the fitting of the implants. The groups were matched according to the following criteria: sex, age, BMI, pre-vas outcome as well as follow ups.

Results: After one year, 30 patients in each group completed the 1-year questionnaire: The average pain after 12 months was 1.5 / 1.6 / 1,2 (TKA-BCR/ TKA-PS /UKA). There were no significant differences between the groups ($p = 0.0847$). The knee function showed an improvement in all subclasses. The functional development (KOOS Jr.) after 12 months in the individual groups is 75.8 / 73.0 / 80.3 (TKA-BCR/ TKA-PS /UKA). There is a significant difference between all groups here ($p = 0.0161$). For the Tegner Score, the group values after 12 months are 2.7 / 2.6 / 2.8 (TKA-BCR / TKA-PS /UKA). There were no significant differences between all groups for Tegner ($p = 0.697$). No pathological changes were seen in radiographic follow up. In two patients of the BCR group a screw fixation of a fissure fracture of the cruciate bone block hat to be performed.

Conclusion: TKA-BCR provides similar patient related outcomes compared to conventional TKA-PS and UKA in a matched paired cohort of patients. There is a tendency that the functional outcome is close to the outcome of UKA and superior to TKA-PS. The radiological follow up showed not difference within the groups. Future randomized controlled trials should be performed to support new implant designs such as BCR.

Stichwörter: Bi-cruciate retaining total knee arthroplasty, posterior stabilized total knee, unicondylar knee arthroplasty, matched paired cohort

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Thema: Knorpelchirurgie

Inhalt Englisch

Titel: Effect of graft positioning on dissipated energy in knee osteochondral autologous transplantation-A biomechanical study

Aims and Objectives: Because of the demographic development and altered lifestyle the quantitiy of focal cartilage defects is increasing. A common surgical treatment is the osteochondral autologous transplantation (OAT). A correct implantation with a high congruence is essential for a good clinical outcome. Sometimes it is not achieved to implant the transplant in a congruent and even position. We therefore examined how implant positioning affects the dissipated energy, a friction parameter we established at the orthopedic department of the University Tübingen.

Materials and Methods: Six knees of the sheep were cyclically motioned in a robot system (KUKA KR60-3 robot, Augsburg) under an axial force of 400 Newton and within a flexion range from 0° to 60°. We tested 4 different conditions after measurement of a native condition. After harvesting a osteochondral cylinder from the medial femur condyle we implanted a donor cylinder from an unloaded section of the medial femur condyle in an even position, a high position (+ 1mm), a deep position (- 1mm) and a defect situation without cartilage in an even position.

Results: We observed no significant difference of the dissipated energy between the nativ status and a deep or even position of the graft. Between the status native and high there was a small significant increase of dissipated energy, and a large increase in the defect situation.

Conclusion: Regarding to biomechanical criteria a higher position of the graft should be clearly avoided. Instead of this it should be inserted even or at least in a deeper position.
The use of dissipated energy as a friction parameter has shown a reliable method to examine joint partner.

Stichwörter: -

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Thema: Sonstiges

Inhalt Englisch

Titel: Comparison of the Press-Fit-Hybrid®- and Interference-screw-technique for ACL-Reconstruction. Can the advantages of the biological Press-Fit-Hybrid®-technique be confirmed? A retrospective analysis of 200 patients with at least 3 years follow-up

Aims and Objectives: There is currently no consensus regarding the preferred surgical procedure for the reconstruction of anterior cruciate ligament (ACL). The interference-screw-technique (IF) is widely used, but has been associated with a risk of graft damage. The Press-Fit-Hybrid®-technique (PFH) is one of the alternatives for biological ACL-reconstruction with minimal implant requirements. The hypothesis of this retrospective analysis is, that the Press-Fit-Hybrid®-technique leads to better results with respect to re-rupture rate and secondary meniscal lesion than the interference-screw-technique.

Materials and Methods: To compare the re-rupture rate of the IF used until 2015 with the currently used PFH, the last 100 patients of the IF-group and the first 100 patients of the PFH-group were retrospectively analyzed. Surgical procedures were carried out by an anatomical single bundle reconstruction with the AM-portal-technique. Hamstring tendon was used, because the donor site morbidities are lower and a sling can be created for graft fixation. In the Press-Fit-Hybrid®-technique the bone tunnels are NOT drilled with a headspace drill, but rather with a diamond AlphaLock®-Turbo-Cutter (BIOMEDIX®, Dietzenbach, Germany), that generates both the bone tunnel and the bone cylinder (Fig) in a single procedure (Fig 1). Primary outcomes were re-rupture rate, complications and secondary meniscal injury. Additionally, laxity, Lachman and Pivot-shift and range of motion were evaluated.

Results: A mean follow-up of 4.2 and 5.3 years revealed 4% rerupture rate and 1% complication in the PFH-group and 9% re-rupture and 2% complication in the IF-group. In the PFH-group there were no re-ruptures in patients older than 23 years. Secondary meniscal injury post-surgery was 6 % for the PFH group and 9 % for the IF-group. Knee stability was similar in both groups. Range of motion was significantly better in the PFH-group, with 136° of flexion, 6 months after surgery.

Conclusion: For ACL-reconstruction the Press-Fit-Hybrid®-technique is an alternative new method. Low level of secondary meniscal lesions after surgery and high stability is known to prevent later osteoarthritis of the knee. The encouraging observed trend of the reduction of the re-rupture rate and post-surgical meniscus injury after ACL reconstruction using the Press-Fit-Hybrid®-technique in comparison to the interference-screw-technique must be confirmed by further studies.

Stichwörter: ACL; Press Fit Hybrid; Interference screw; meniscal injury; knee stability; hamstrings autograft

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Thema: Indikationen in der Revisionschirurgie

Inhalt Englisch

Titel: The significance of the posterior tibial slope- a study of 811 patients with primary and revision ACL instability

Aims and Objectives: As the posterior tibial slope (PTS) is known to be a significant risk factor for primary and revision ACL reconstruction (ACLR) failure, little is known about the association between an elevated PTS and clinical or radiological parameters.
The purpose of this study was to evaluate possible differences of patients with an elevated PTS (>12°) in comparison to patients with a PTS <12° in patients with primary and revision ACL reconstruction (ACLR).

Materials and Methods: Between 2017 and 2020, we conducted a retrospective study of 811 patients (307 women, 504 men; mean age 33.3 ± 12.4 years, range 18-63 years) undergoing primary (n=571) or revision (n=240) ACLR. Clinical and radiological data were collected and evaluated to determine possible differences between patients with a PTS >12° (n=218) in comparison to patients with a PTS <12° (n=593).

Results: Patients with primary ACLR had a significant elevated PTS >12° in 23.3% of the cases (n=133), while patients with revision ACLR had an elevated PTS in 35.4% (n=85, p< 0.001).
Preoperative high-grade anterior knee instability (Lachman test grade 3) occurred significantly more often in patients with a PTS >12° (14.4% vs. 8.2%, p=0.007). Also, a preoperative high-grade rotational instability (pivot-shift grade 2/3) was seen more often in patients with a PTS >12° (20.3% vs. 13.3%, p=0.013). Osteoarthritis was detected more often in patients with an elevated PTS (19.3% vs. 13.6%, p=0.047). No differences were found between the two groups (PTS >12 vs. PTS <12°) concerning medial meniscus lesions (39.3% vs. 36.7%, p=0.510), lateral meniscus lesions (22.5% vs. 22.1%, p=0.902), medial collateral ligament lesion (17.3% vs 18.5%, p= 0.704) and lateral collateral ligament lesion (13.1% vs. 13%, p=0.973).

Conclusion: An elevated PTS occurs in every fourth patient with primary and in every third patient with revision ACLR. A PTS >12° can be associated with high-grade anterior and rotational instability, revision ACLR and elevated risk of osteoarthritis.

Stichwörter: posterior tibial slope (PTS) , ACL reconstruction failure, PTS and instability

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Thema: Sonstiges

Inhalt Englisch

Titel: Treatment of a deficient extensor mechanism with in-vivo vascularised allograft - a new interdisciplinary treatment concept.

Aims and Objectives: The post-traumatic loss of the distal extensor mechanism always leads to a gross functional deficit. Surgical salvage procedures are limited and an arthrodesis might be indicated which in turn leads to disturbance of the function of the lumbar spine and hip joint. Here we present a new method to regain the knee joint function by means of transplantation of a vascularised extensor mechanism allograft.

Materials and Methods: Case presentation: 36 year old patient who was treated surgically with osteosynthesis for a transverse patella fracture elsewhere. At admission the metal work was infected und the fracture had not healed. Multiple re-revisions at our unit lead to complete removal of all hardware and subsequently to a complete loss of the patella and the patellar tendon. Microbiological cultures revealed a mix of different Staphylococci pathogens. After a targeted long-term antibiotic treatment and a consented decision process we elected to proceed with further surgical treatment aiming to reestablish the knee extension in a staged treatment concept using a vascularised extensor mechanism allograft.
The first operative step was the implantation of an allogenic extensor mechanism consisting of quad tendon, patella, patellar tendon and tub.tibiae into the ipsilateral tensor fasciae latae muscle (TFL). The aim was to establish neovascularisation of the allograft within three months. Thereafter the second interdisciplinary surgical step was to move the vascularised graft together with the TFL onto the knee joint. The tub.tibiae was fixed to the tibia with screws and the quad tendon was firmly sutured to the native quad tendon/muscle with maximum tension. An end-to-side anostomosis was performed to connect the TFL to the femoral vessels. The postoperative course was uneventful. After initial immobilization of the knee joint a hinged knee brace was applied and limited to 30/60/90° of flexion for 3 weeks each.

Results: At the one-year follow-up the patient was very satisfied with the result and fully rehabilitated. He could demonstrate a near normal gait pattern without aids. There was a minimal extension lag and full knee joint flexion.

Conclusion: Discussion: The transplantation of a vascularised extensor mechanism allograft may represent an individual treatment option to regain knee joint function in young patients with complete loss of the extensor mechanism. This treatment concept should be based on an interdisciplinary team approach including orthopaedic surgeons, reconstructive trauma surgeons and plastic surgeons.

Stichwörter: extensor mechanism, allograft

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Thema: Prothetik 360° von Teil- über Total- bis zur Revisionsendoprothetik

Inhalt Englisch

Titel: UNICONDYLAR MEDIAL KNEE ARTHROPLASTY- WHICH AGE GROUP BENEFITS THE MOST? PROSPECTIVE 2 YEAR FOLLOW-UP OF 395 PATIENTS

Aims and Objectives: The proportion of patients who are eligible for UKA has thus increased over the past decade.There is now more evidence that the implantation of a unicompartmental knee arthroplasty(UKA) in patients with monocompartment arthrosis of the knee joint compared to treatment with a total knee arthroplasty (TKA) offers better physiological function, faster recovery and fewer perioperative complications Despite these advantages, the use of partial knee replacement is still limited. The aim of our study was to analyze to what extent which age group benefits from being treated with a medial unicompartmental knee arthroplasty.

Materials and Methods: As part of our data analysis, we prospectively re-examined 395 patients after medial unicompartmental (Oxford Phase IV - mobile bearing, ZimmerBiomet). The patients were assigned to 4 age groups: 45-54 years of age (n = 102), 55-64 years of age (n = 150), 65-74 years of age (n = 106) and> 75 years of age(n=37).
In addition to the visual analog scale for pain (VAS), the KOOS Jr. Score and Oxford Knee Score (OKS) were measured using the Surgical Outcome Measurement System (SOS, Arthrex, Neaples, Florida, USA) before surgery and after 3, 6, 12 and 24 months. The overall compliance of the five treatment groups was 92.0%.

Results: In all age groups a significant decrease in pain could be achieved after performing a medial unicondylar arthroplasty.The lowest pain reduction with VAS 5.7 pre-op to 2, two years after surgery, was recorded in the age group of 45 to 54 years. In the KOOS Jr. score, the youngest patient group achieved the smallest increase of all groups with an increase from 43.5 preop to 71.4 two years postop.Oxford Knee Score results, the youngest patient group achieved the smallest increase of all groups with an increase of 24.5 preop to 36.9 two years after surgery.During the follow-up period of 2 years, 9 revisions were performed in 395 implantations. This corresponds to a cumulative revision rate of 2.27%.
Of these, 4 revisions were due to isolated inlay changes of the mobile bearing (2 of traumatic origin with internal ligament refixation, 1 due to infection and 1 due to luxation).
Thus, there is a survival rate of the medial sled implants of 98.73% after 2 years. Thus, in summary, an excellent survival rate was documented in all age groups, with 7 of 9 revisions performed in the two younger age groups as well.

Conclusion: Our data demonstrate that all age groups benefit significantly from a medial unicondylar arthroplasty fitting in terms of reduction in pain (VAS) and increase in functional scores (KOOS, OKS, KSS). Outcomes in younger patients (<55 years) are slightly less good than in older patients in terms of outcome parameters achieved. Also, higher revision rates are recorded in the younger patient groups.

Stichwörter: age, unicondylar arthroplasty