

109. Follow-up study for high tibial osteotomy using minimal osteosynthetic material as proposed by A. Renieris

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With the goal of early mobilisation and rehabilitation of the patient and bony union without loss of correction, many methods of internal and external fixation have been used.

Since 1985, we have been using proximal tibial wedge osteotomy with minimal osteosynthetic material for the correction of varus deformity in osteoarthritic knees. This has successfully provided stability of correction in 65 knees (53 patients). The postoperative complications were minimal and in all our cases bone healing at the osteotomy site was achieved in the corrected position.

The method involves first, osteotomy of the fibular head, followed by a wedge osteotomy of the upper tibia above the tibial tuberosity and compression of the osteotomy by an anchored wire passing through two cannulated screws supported by specially made staples. The first screw is situated proximally, parallel to and 1 cm below the tibial articular surface and the other distally, 1–2 cm from the lower saw cut of the osteotomy and parallel to it. The site of the screws is prelocated using guide pins and confirmed by AP radiographs.

The tightened wire is effective in maintaining the correction of the deformity, leading to rapid union of the osteotomy. At the same time it permits early mobilisation and weight bearing, reducing the hospitalisation and rehabilitation period, as has been evident from the follow-up study.

110. Complications of the patella after total knee replacement

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Over a period of 9 years more than 250 primary total knee arthroplasties have been implanted in the Orthopedic department of the Academic Hospital of Maastricht. Recently all patients with a total knee arthroplasty have been contacted. A physical examination was performed and radiographs made.

The complication rate was in accordance with data in the literature. Problems involving the patella were the most frequent (10%). The resurfaced patella presented problems including patella fractures, patella subluxation and patella loosening. Most of these complications can be explained by features of the chosen prosthesis or to the technique of implantation.

111. Load-bearing cartilage of the knee after proximal tibial valgus osteotomy

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In 19 consecutive patients with medial gonarthrosis, an arthroscopic examination with cartilage biopsy of the load-bearing cartilage in the medial femoral condyle was undertaken at the same time as a proximal tibial valgus osteotomy. A follow-up biopsy was performed at an average of 26 months after the valgus tibial osteotomy—again with a transarthroscopic procedure. In 9/19 knees there was an improvement of the cartilage quality, 8/19 knees were unchanged whereas 2/19 knees deteriorated. Radiographs of the knees were taken before and 2 years after the osteotomy. Six knees had improved, 11 were unchanged and 2 had deteriorated. Our results suggest that the proximal valgus osteotomy has a beneficial effect on the load-bearing cartilage in the medial femoral condyle.

Knee injuries

112. Osteochondral lesions and acute ACL injuries

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Introduction: Injuries to the anterior cruciate ligament (ACL) are often accompanied by lesions in joint capsule, ligaments, menisci and cartilage. Recent studies using magnetic resonans imaging technique (MRI) have shown a high frequency of subcortical and osteochondral lesions although radiographs are normal. The purpose of this study was to examine the frequency of bony lesions judged by MRI and correlate the findings with the arthroscopic diagnosis in patients with acute ACL injuries.

Patients and methods: During the period from August 1990 to May 1991, 49 patients were treated surgically due to an acute rupture of the ACL. In 18 patients MRIs were obtained in order to rule out a repairable meniscal injury prior to surgery. The MRIs were read by one radiologist. The arthroscopic diagnosis were carried out by two surgeons.

Results: Apart from one tibial avulsion fracture, all the radiographs were normal. All 16 total ruptures of the ACL seen on the MRI were confirmed through the scope. In addition, the arthroscopic exam showed two partial ruptures

one of which was classified as normal through the MRI. 28 bony lesions were diagnosed in the 18 patients. Only three patients had normal MRIs. 25 of the bony lesions were detected on the lateral femoral or tibial condyle. Five patients showed cartilage injuries in the lateral compartment through the scope.

Conclusion: Bony lesions were found through MRI in 85% of the patients with acute ACL ruptures. The lesions could not be detected radiographically or through the arthroscopic examination. Experimental studies suggest that some of the lesions verified on MRI may lead to degenerative changes. This may lead to changes in the evaluation and rehabilitation protocol in patients with acute ACL ruptures.

113. Biomechanical alterations and histologic changes of the anterior cruciate ligament of the rabbit knee after acute hemarthrosis—an experimental study

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36 male New Zealand rabbits (72 knees) were divided into 7 groups of 4 and one age and sex matched control group of 8 rabbits. In the first 7 groups, a small amount (1cc) of arterial blood taken under general anesthesia from the same animal was injected under aseptic conditions into both knees of each one. All right knees were immobilized for 2 weeks, while the left knees were freely mobile from the beginning. The rabbits were killed at the 1st, 2nd, 3rd, 4th, 6th, 8th, and 9th postinjection weeks, one group at a time.

The control group (16 knees) was used to establish the normal resistance of the anterior cruciate ligament in tensile stress.

Six knees from each group (3 left and 3 right) were used for biomechanical studies. An Instron type of machine was used to apply a continuously increasing tensile force until the anterior cruciate ligament ruptured.

The remaining two knees in each group (1 rabbit) were sent for histology. The histological studies revealed that hemarthrosis caused degeneration of the ligament, and that regeneration began at the third week, gradually increased until the 6th week, and was completed at the 9th week with the creation of a small amount of scar tissue.

The results of the biomechanical study showed a considerable drop in the strength of the ligament within the first week, to about 55% of normal, gradually increasing thereafter to reach normal levels at the 8th or 9th week. The rate of recovery was considerably slower in the initially immobilized left knees than in the right knees. All ruptures of the examined cruciate ligaments took place at the midsubstance of the ligament, even after completion of regeneration, in contrast with the healthy controls where the ligament always ruptured at the tibial insertion. This difference was attribut-

ed to the small amount of scarification that was developed in the ligament.

The results of this study lead us to the conclusion that there is a need for protection of the anterior cruciate ligament from high stresses for a period of at least 2 months following an acute hemarthrosis of the knee.

114. Untreated knee injuries—a 5-year follow-up

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Introduction: Several studies have shown that an untreated ACL rupture leads to decreased function of the knee with pain, instability and early arthrosis. However, diagnosing the ACL-rupture in the acute stage might be difficult. The aim of this study was to examine the long term results in patients with nontreated knee injuries. Does this group include unrecognized ACL-ruptures, and if so, do these people have any complaints?

Patients and methods: Patients with knee injuries registered at our emergency unit during a one year period, were examined five years after their injury. The mechanism of injury, Tegner score before and after injury and Lysholm score were recorded. Of 226 patients (age 5–59, mean 27) 25 were operated prior to the time of examination. 135 patients went through a clinical examination, a Cybex test, and if instability was discovered, a KT-1000 test. 42 patients just answered a questionnaire. There were 24 drop-outs (10.6%).

Results: Of the 25 operated patients during the follow-up period only 9 were hospitalized immediately after their injury. The delay from injury to surgery was 0–49 months (mean 15.3). The diagnoses were: ACL-ruptures (11), meniscal tears (12) and MCL-ruptures (4). Two knees were found to be normal. The tentative diagnoses in the group of 135 patients we examined were: 13 (9.6%) ACL- and 1 (0.7%) PCL-ruptures, 30 (22.5%) meniscal tears and 4 (3%) MCL-ruptures. Of the 13 patients with ACL-rupture (age 18–53, mean 31.4) 12 had reduced their level of activity due to the injury (Tegner). Lysholm score of these 13 patients: Excellent 1, Good 5, Fair 5, Poor 2. Testing of stability (ADS, Lachmann, pivot shift) showed severe instability in all 13 patients. This was verified by KT-1000 tests.

Conclusions: Our study shows that several serious knee injuries are not recognized at the initial examination. Within 5 years 11 out of 24 patients with ACL-ruptures experience severe discomfort and have had their ACL-rupture reconstructed. The rest is doing fine in their activity of daily living, but of the remaining 13 patients, 12 have had to reduce their level of activity due to the injury (4 out of these 13 patients have later had their ACL reconstructed).

115. Muscle tension during instrumented anteroposterior knee laxity tests of patients with chronic anterior cruciate ligament deficiency

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Introduction: Inexplicable results of anteroposterior laxity measurements during both manual and instrumented laxity testing is often explained by presumed involuntary muscle spasm in the active stabilizers of the knee.

This study was conducted to assess the electromyographic (EMG) activity of the vastus medialis, the vastus lateralis and the lateral hamstrings during instrumented knee laxity tests using the Genucom System.

Material and methods: Ten persons, six with arthroscopically verified unilateral anterior cruciate ligament (ACL) deficiency, and four normal subjects acting as controls, were examined. EMG bipolar surface electrodes with 2 cm of center-to-center spacing were placed 15 to 20 cm proximal to the knee joint over the vastus medialis and the vastus lateralis and over the biceps femoris muscle. An EMG at rest with the person seated free in the Genucom "chair" was obtained. Then EMG was recorded at isometric maximum voluntary extension and flexion. The person was now prepared for A/P testing in the Genucom Knee System which includes three thigh restraint blocks placed 10 cm proximal to the knee and tightened with the use of a force of 90 Newtons. Another EMG recording at rest, after securing the thigh in the restraint blocks, was performed. A manually applied force at the proximal end of the tibia anteriorly and posteriorly within the range of a 150 Newtons was performed by the examiner (HNA) at 90, 70, 50 and 30 degrees of knee flexion.

Results: EMG activity in all three muscles during the anteroposterior tests was in nine persons not different from the EMG obtained at rest. In one patient with ACL deficiency the activity in the biceps femoris muscle on the sick side increased slightly to a level less than two times the base-line level of noise at rest. This is well below 5% of the EMG amplitude recorded at maximum muscle contraction.

There were in all persons examined no difference between the response recorded at rest with the person placed unattached in the Genucom chair and the response after securing the restraint blocks.

Conclusions: We found in only one person an insignificant rise in EMG response to an anteroposterior drawer test performed in the Genucom system. It is unlikely that involuntary muscle spasm during anteroposterior drawer tests, both performed with laxity tester instruments and performed by hand, reach a level which could effect the measured laxity in patients with chronic knee ligament deficiency.

116. Device analysis after failure of polyethylene terephthalate anterior cruciate ligament prostheses

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Introduction: Cruciate ligament prostheses are widely used for the repair of cruciate ligament deficiency. Although animal experiments give insight into the mechanisms of biocompatibility and ingrowth, device retrieval analysis after prostheses failure in man is important to recognize biomaterial related problems in clinical device performance.

Material and methods: A total of 97 cruciate ligament prostheses (PET-TreviraRhoChfest) were implanted in 70 patients following cruciate ligament rupture. The average life of these prostheses being 4 years (20–65 months), 5 had to be explanted due to failure after on an average 9 (3–15) months. Another 2 PET implants ruptured after a 4 year implantation period. All explants were fixated, roentgen examined and prepared for light and scanning electron microscopy. The latter two ligament prostheses were also examined by transmission electron microscopy.

Results: Six anterior cruciate ligament prostheses had ruptured intra-articularly at the bone tunnel entries and one had become unstable without complete rupture. No bony ingrowth but fibrous tissue fixation was present in all three parts of the implant interface (intra-articular, bone tunnel, periosteum). Inflammatory cells and foreign-body giant cells were abundant close to the site of ligament rupture at the intra-articular entries of the bone tunnels. These cells were scarce at the periosteal anchor points. Even after an implantation period of 4 years the knee joint synovialis contained neither wear particles nor signs of foreign-body reaction.

Conclusion: Evaluating the reasons for short- and middle-term prosthetic ligament failure in human knees nonideal surgical placement of bone tunnels and inadequate strain during rehabilitation were responsible for all early breakages. The implant's excellent chemical and physical inertness as well as the amount of mechanical strain upon the prostheses both seem to influence its well acceptable middle-term biocompatibility.

117. Anterior cruciate ligament reconstruction with bone-patellar tendon-bone graft—a long-term follow-up

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832 patients were operated in our Department between February 1983 and January 1991 for chronic incapacitating

insufficiency of the anterior cruciate ligament, using fresh free autologous bone-patellar tendon-bone graft through osseous tunnels in the tibia and femur to replace the torn ligament.

724 (87%) were reviewed 1–8 years after the operation. There were 548 men and 176 women. The anterior cruciate ligament was ruptured during participation in athletic activities in 96% of our patients.

The parameters examined were age at the time of injury, period between injury and operation, previous operation, X-ray appearances, associated injuries. In only 164 knees (23%) were both menisci intact.

The objective signs used to evaluate the knees, both pre- and postoperatively, were the anterior drawer test, the Lachman test and the pivot-shift test.

The patients were divided into two groups, according to the approach that was used for the operation and the postoperative regime.

In Group A (503 patients) we used two incisions, one anterior and one lateral, for the fixation of the graft. Postoperatively the range of motion of the knee was restricted to 20° to 90° maximum for a period of six weeks. Free movement of the knee and full weight bearing were allowed after that.

In Group B (329 patients), one anterior skin incision was used and the whole operation was performed through a medial parapatellar mini arthrotomy. This technique is described in detail. Postoperatively the knee was held in full extension from the beginning, followed by continuous passive motion in the range of 0° to 90° and weight bearing as tolerated with crutches and with the knee in a Donjoy type splint.

Postoperatively, 50% of our cases were converted to a negative A.D. test, 58% to a negative Lachman test and 66% to a negative pivot-shift test.

For the functional evaluation of our patients we used a functional knee score scaling system, as described by Tegner and Lysholm (1985). According to this scaling system, our results were classified as excellent or good in 89.5% of the cases. Most of the 10.5% fair or poor results were due to extensive meniscal and degenerative changes.

In a group of 100 professional footballers, an isokinetic evaluation of muscular strength and power was also performed preoperatively and 6 and 12 months postoperatively. These patients were randomly selected, 50 from each group. The results showed higher values postoperatively for all the parameters examined in the majority of cases.

The main postoperative complications were infections due to *Staph. aureus* (5 cases), restriction of motion of the knee (52 cases) and mild to moderate patellofemoral pain (73 cases). Infection was treated aggressively and the symptoms subsided. Failure of the graft was noted in two cases.

Restriction of motion was treated with manipulation under general anesthesia at an average of 6 months postoperatively, with good overall results. Eleven resisting cases were treated surgically. In 7 of them, a hypertrophic fibrous mass was found at the tibial insertion of the graft,

blocking extension of the knee, and was removed with excellent results.

Of the knees with postoperative restriction of motion, 44 of the 52 manipulated and 9 of the 11 operated on knees were from the first group of patients.

118. Fifteen-year follow-up evaluation after ACL reconstruction

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Introduction: The present study reports a long time follow-up done by an independent observer, of reconstructions of the ACL performed by one surgeon. The patients had all been treated surgically with a bone-tendon transplant technique.

Material and methods: 18 patients (16 men and 2 women) underwent surgical reconstruction of the anterior cruciate ligament. The mean age at the time of operation was 29 (18–47) years. The follow-up examination was performed on an average 14.7 (10–19) years after reconstruction and included the following tests:

1) Knee function score. 2) Activity grading. 3) Clinical examination. 4) Performance test consisting of two items (figure eight running test and one-leg hop test). 5) Instrument stability testing of anterior tibial displacement with a KT-1000 Knee Arthrometer. 6) Isokinetic concentric and excentric strength measurements. 7) Radiographic examination of both knees.

Results: The knee function score was excellent/good (>83) in 13/18, fair (65–83) in 4 patients, and poor (<65) in one patient. Three patients had a positive pivot shift test. The anterior tibial displacement measurements showed that 14/18 were stable (<3 mm), 3/18 had 3–4 mm and 1/18 >5 mm difference compared with the noninjured knee. Gonarthrosis was found in 7/18—severe in 4.

Conclusion: In a 15-year follow-up evaluation after ACL reconstruction with a bone-tendon transplant technique the majority of patients had a high function score, activity level and stability.

119. Disability and effect of physical therapy in chronic anterior cruciate ligament insufficiency

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Introduction: We analyzed the knee function in 26 patients with chronic instability after an anterior cruciate ligament rupture. The injured and the noninjured legs were tested before committing the patients to a physiotherapy program.

Methods: Muscle strength, activity level, functional knee score and a performance test were evaluated. Body sway movements in the frontal plane in single-limb stance test were used as a parameter for assessment of postural control. The patients were re-examined after a training period of three months. Follow-up tests were made after 12 and 36 months.

Results: Quadriceps strength was only slightly reduced in the injured limb and no weakness in the hamstrings was found. Significant disturbance of balance of both legs was found before training, compared to normal subjects. Body sway movements of the noninjured leg were normalized after three months of training, but the injured leg still showed an increased body sway. Normal balance parameters on the injured side were found at examination after 12 months. Follow-up examination after 36 months proved persistent normalization of the single-leg standing balance on both sides.

Discussion: There were more disturbances of balance parameters than muscle strength values in these previously untreated patients with symptomatic chronic anterior cruciate ligament injuries. Muscle strength improved earlier than body sway. 22 out of the 26 patients were improved and satisfied with the physical therapy treatment.

120. Decreased femoral neck bone mass 15 years after anterior cruciate ligament reconstruction

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Introduction: Weight-bearing activity is essential for the development and maintenance of bone mass and strength. Prolonged inactivity is known to cause disuse osteopenia. Reconstruction of the anterior cruciate ligament (ACL) is followed by immobilization, nonweight bearing and prolonged decreased activity. In this study, we have investigated thigh muscle strength and proximal femoral bone mass 15 years after ACL-reconstruction.

Patients and methods: Sixteen men underwent ACL

reconstruction, postoperative immobilization in plaster and subsequent rehabilitation according to one treatment protocol. Follow-up examination was performed at an average of 14.7 (10–19) years after operation. Isokinetic concentric and eccentric strength measurements of the quadriceps and the hamstrings were made using the Biodex device. Bone mass of the proximal femoral region was assessed by dual photon X-ray absorptiometry (Lunar DPX).

Results: The Lysholm knee function score was excellent or good in 13 patients (81%) and fair in 3 (19%). Their mean activity level according to Tegner was 4.4.

Bone mineral density (BMD) of the femoral neck was significantly decreased on the injured side ($p < 0.001$). Significant decreases in BMD were also noted for Ward's and trochanter regions of the injured side. There were no significant correlations between peak torque of the quadriceps or the hamstrings muscles and BMD values of the femoral neck of either the injured or uninjured side. Total work (J) performed by the quadriceps or hamstrings showed significant correlations to femoral Ward's BMD values at slow angular velocities.

Conclusions: ACL reconstruction followed by postoperative immobilization and subsequent prolonged decreased physical activity result in a significant decrease in proximal femoral BMD. The decrease is evident despite predominantly good knee and thigh muscle function and relatively high activity scores.

121. Primary suture in posterior cruciate ligament ruptures

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May 1981–December 1987, 23 posterior cruciate ligament ruptures were treated with primary suture. Avulsion fractures were not included. Twenty patients returned for follow-up, four of whom had an isolated rupture. The remaining 16 patients had combined ligament injuries, including 8 total ruptures of the anterior cruciate ligament. All ruptured ligaments were sutured.

At follow-up (median = 5.5, range 3–10 years) median knee score according to Lysholm was 81 (53–100). Five were rated excellent, 6 good, 3 fair and 6 poor. There was a significant reduction of activity level at follow-up, assessed by the Tegner activity score.

KT-1000 arthrometer measurements revealed a posterior instability between 5 and 10 mm in five and below 5 mm in 14 patients. Eleven patients had patello-femoral crepitations in active extension but without correlation to knee pain. Six patients had radiographic findings, five a slight narrowing of the medial articular space (Ahlbäck grade 1), and one patient more severe osteoarthritis (Ahlbäck grade 3).

Conclusion: Some instability remained in most patients after primary direct suture with Palmer technique.

122. Time dependent denovo expression of matrix glycoconjugates and collagens in traumatic anterior cruciate ligament ruptures

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Introduction: Previous data revealed that in complete or partial anterior cruciate ligament (ACL) ruptures only very slow and incomplete regeneration processes can be anticipated even under favourable conditions. It was the aim of this study to investigate these poor healing capacities of the ACL by analyzing the matrix processes after rupture.

Material and methods: Specimens from patients with traumatic ACL-rupture (n=11) were taken during surgical ligament repair. 70 nm ultracuts were evaluated by conventional electron microscopy. Cryosections were taken for immunohistochemistry with monoclonal antibodies against fibrillin, undulin, tenascin and collagen types I, III, IV and VI. Binding reactivity was detected using the streptavidine-peroxidase method or FTC-labelled secondary antibodies. Normal cruciate ligaments (n=35) served as controls.

Results: In normal ligaments the glycoprotein fibrillin was present in microfibrils or free localized in groups. The predominantly parallel, horizontal fibrils were rather thick. Tenascin was localized in the basal laminae as well as in the adjacent connective tissue. It was only sparsely distributed, mainly in association with fibronectin. Undulin formed parallel aligned fibres. Type I and III collagen were the major fibril forming collagens within the matrix. Type IV collagen was exclusively found in the basal lamina, whereas type VI collagen revealed an ubiquitous distribution.

Within the first two days after rupture a massive increase of fibronectin was observed throughout the ligament. A higher amount of type I collagen appeared on the 7th day, suggesting newly synthesized connective tissue. Severe alterations of the collagen architecture were detected including the appearance of dysplastic fibrils and of giant fibrils near the rupture zone. The average fibril diameter was reduced. A de-novo expression of fibrillin, type IV and VI collagen was seen after two or three weeks. In repair tissue, there was a marked increase in the expression of tenascin. It was present throughout the matrix of the granulation tissue. After a period of several weeks tenascin was less detectable. It disappeared more rapidly than fibronectin.

Discussion: The results suggest a higher expression of tenascin in early ligament healing. This glycoprotein may have a transient role in matrix processes after ligament ruptures. A matrix disorganization after ACL-ruptures with pathological arrangements of collagens, undulin, tenascin and fibrillin cause a functional insufficiency of the extra-

cellular matrix. The repair tissue is therefore not structured to resist tension stresses. These findings may explain the observed poor healing capacities of the ACL.

123. Grading of the pivot shift

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Objective: To analyze the influence of partial and total ACL-lesions, lesions of the medial or lateral capsula or the medial or lateral collateral ligament in the knee in relation to a defined pivot shift.

Design: Abduction-adduction rotation, coupled tibial translatory movement and coupled tibial axial rotation were recorded continuously and simultaneously during flexion while applying a well defined valgus directed moment in an experimental setting using 48 normal osteoligamentous knee preparations. Data were collected after sequential transection of the anterior cruciate ligament (ACL) and lateral or medial capsula (LCAP, MCAP) or lateral or medial collateral ligament (LCL, MCL) and compared to those of the intact knee. Pivot shift was defined as a simultaneous change of more than 5 mm anteriorly directed translation and more than 5° internally directed rotation in the measured instability during 20° of knee flexion movement. Pivot shift was further classified into a Grade 1 and 2 rating less than 10 mm anteriorly directed translation and less than 10° internally directed rotation as Grade 1. Also a Grade "Trace" was defined as more than 2.5 mm and less than 5 mm anteriorly directed translation and more than 2.5° and less than 5° internally directed rotation during 20° of knee flexion. Using stepwise logistic regression (BMDP, program LR) ligamental status was analyzed against the different pivot shift grades after pooling of the measurements at different ligamental states of the knees (120 measurements).

Results: Combined lesion of the MCL and ACL was the only ligamental status significantly associated with pivot shift Grade 2 ($p = 0.0005$). Isolated complete ACL-lesion ($p = 0.04$), combined lesion of the ACL and MCL ($p = 0.003$), combined lesion of the ACL and MCAP ($p = 0.01$) and combined lesion of the ACL and LCAP ($p = 0.04$) were significantly associated with pivot shift Grade 1. None of the analyzed ligamental lesions or combinations hereof were significantly associated with pivot shift Grade "Trace". The Grade 1 pivot shift was observed at a mean knee angle of $26^\circ \pm 5^\circ$ (SEM), while Grade 2 pivot shift was observed at mean knee angle of $40^\circ \pm 4^\circ$.

Conclusion: The study demonstrates, that apart from isolated complete ACL-lesions additional clinically important ligamental or capsular lesions could be involved, when high grades of anterolateral instability using the pivot shift test are observed.

124. Possibilities of a healing process in the avascular area of menisci

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The feasibility of a healing process in the avascular area of the meniscus was investigated both experimentally and clinically. Twenty-eight patients with a torn meniscus in the avascular area were treated between 1980 and 1990 with direct suturing.

In 18 patients the open technique was used and in the remaining 10 the outside-in arthroscopic repair. In both cases the stitching material was dextron O2. Care was taken that the stitches passed through the cut edges of the meniscus and the synovium, on the basis of our previous experimental work. Regardless of the technique used, the intervals between stitches were of 3 to 5 mm each. Usually, a plaster cylinder was used for the first 6 postoperative weeks and the patient was advised to put on weight bearing. In cases of plateau fracture the usual principles of treating fractures were employed. After the third postoperative month the patients were allowed to resume athletic activities. The follow-up was between six months and two years. Five patients were lost to follow-up and another two were excluded because they had refused to follow the protocol. In the remaining 21 patients there were 3 recurrences, 2 fair results (pain with increased activity) and 16 patients with good results based on clinical grounds.

Repair of the avascular area of the meniscus seems feasible, provided that the stitches pass through both the avascular substance and the synovium. There is as yet insufficient information concerning the intervals between the stitches or the strength of the healing substance (scar tissue).

The above mentioned experimental and clinical work goes some way to solving the problem of whether or not a longitudinal rupture of the meniscus within the avascular area can be repaired. Thus, in cases where there is doubt about the vascularity of the injured area of semilunar cartilage, the meniscus can be repaired, provided that the stitches pass through the cut edges and the synovium.

Fractures

125. Colles' fracture—Older type IV—comparison of the results of fixation with 2 K-wires vs a Rush pin

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Introduction: The optimal treatment of severe Colles' fractures is difficult and controversial. In order to evaluate two methods of operative treatment of Colles' fractures we compared fixation with 2 K-wires vs a Rush pin.

Patients and methods: In the period 1.1 1985 – 30.6 1990 a total of 114 patients with a Colles' fracture—Older type IV were treated in the County Hospital of Aarhus, Denmark. 86 (79%) patients (42 patients with K-wires and 44 patients with a Rush pin) participated in the follow-up, 5 patients were dead and 23 did not want to participate. All patients were examined clinically and radiologically.

Results: The radio-ulnar wrist mobility was significantly better in the group operated on with K-wires, but there was no significant difference in flexion-extension or pronation-supination between the two groups.

The range of motion in the nonoperated wrist was better compared to the operated wrist. The two treatment groups were comparable with regard to sex, age, distribution of fracture dominant/nondominant side, radius shortening, dorsal angulation, grip score and subjective symptoms. Two patients treated with K-wires developed sympathetic dystrophy. One patient developed caput ulna syndrome and one patient could not resume work because of reduced pronation-supination movement, both treated with a Rush pin.

Conclusion: No difference in results was found between percutaneous fixation with 2 K-wires and intramedullary fixation with a Rush pin in Colles' fracture—Older type IV.

126. The changes in the blood flow to the tubular bones in rabbits during the healing of shaft fractures by the method of radio-active microspheres

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The precise knowledge of the vascular anatomy of the bone, and more so of the osseous circulation, is of paramount importance for the complete understanding of the various functions taking place in bone, in both health and disease.

This study consists of a series of experiments which were performed in order to look into the blood flow changes occurring in the radius of rabbits during the healing process