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Fractures

Ender-nailed trochanteric fractures

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530 patients with 538 trochanteric fractures were treated with the Ender method in a 10-year period 1981–1990, quotient women/men 2.42:1. In the same period 244 patients were operated with other methods, totally 782 fractures, 769 >50 years old, an incidence of 1,9/1000 pr year in the population >50 years. In the same period 1629 transcervical fractures were registrered, incidence 4.1, totally 2398 fractures of the proximal femur, incidence 6, the double of the incidence in the early seventies. The mortality at 6 months was 20%, in the whole period 69%. Prospected male and female lifespan was shortened by 3.6 and 3 years, respectively, compared with expected lifespan in the corresponding population.

Of 166 living patients 155 were evaluated by an illustrated questionaire, 43 of them also tested clinically. Radiographic classification was made according to Evans/Jensen in stable (group I–II) and unstable (III–V) groups. The results were satisfactory (excellent/good) in about 90% in the stable while only 40% in the unstable ones. With a failure rate of 60% the Ender method is absolutely not advisable in the treatment of unstable trochanteric fractures. As a conclusion we have changed the standard method in our hospital and are now using the sliding screw-plate in group I, II and IV while in group III and V a special plate design with a broad elongation of the plate in the proximal direction as a support of the posterolateral fragment is used.

Mobility, survival and nursing-home requirements after hip fracture

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Place of residence and walking ability before fracture was determined for all 117 patients treated for hip fracture during one year and then checked prospectively 1, 3, 6, 12, and 36 months postoperatively.

The mortality was highest during the first year. Among those admitted from institutions (own home) it was 22 (4)% after 1, 27 (9)% after 6, 38 (18)% after 12 and 59 (27)% after 36 months.

The proportion living in nursing homes was increased by 25% at three years, but the actual number reduced because of mortality. Reduced pre-injury mobility (one cane or worse) among those injured at home increased the risk of being institutionalized at three years by 5.5.

The proportion of the survivors who walked without aids was reduced by more than half at one and three years. The proportion that was bedridden increased by 6. Only half of those with severe reduction in mobility (two canes or worse) at one and three years attributed this wholly or partly to the hip fracture. Among patients who walked without (with) aids before fracture 7 (43)% were bedridden after one year.

Hip fractures are a catastrophe also for the survivors.

Results from Ex-fi-re external fixation treatment of open tibial shaft fractures

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Introduction: By aid of the Reduction unit of the Ex-fi-re system, displaced fractures can be reduced instrumentally, by the functions of the device, in contrast to commonly used manual reductions. This makes a more exact reduction possible in many cases, and the purpose of this retrospective study was to find out whether the implementation of the system led to improved reductions and better results.

Patients and method: According to Gustilo and Anderson there were 12 grade I, 14 grade II, 9 grade IIIA, 6 grade IIIB and one grade IIIC injuries. Four fractures were segmental.

Results: The primary reductions were performed by the Reduction unit in all cases by 29 surgeons and assistants. The reductions were classified as "exact" in 26 cases and as not "exact" in 10 cases. Six cases could not be classified. "Exact" reduction was defined as maximum 2 mm sidewards, or parallel displacement. The 63-year-old man with the IIIC injury had an above knee amputation. Three patients developed nonunions. Time to union was median 20 (8–46) weeks, and time to full unprotected weight bearing was median 21 (8–46) weeks.

Conclusion: Improved reduction was obtained by use of the Reduction unit of the Ex-fi-re system, also in inexperienced hands.

The effect of cerclage wires on the strength of diaphyseal bone

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Introduction: Cerclage wires had been used in fracture treatment for many decades when they fell into disrepute because of concern regarding their effect on the circulation of the bone. There is, in fact, no evidence or indication that the wires "strangle the bone" and numerous histological studies demonstrating normal circulation in cerclaged bone. We wished to study the strength of diaphyseal bone after application of cerclage wires.

Materials and methods: In ten mature rabbits two cerclage wires were placed 9 mm apart on one femur. On alternate animals the wires were placed over or under the periosteum. The contralateral femurs were sham operated and served as controls. The animals were killed after 99 days and the femurs subjected to four-point bending tests.

Results: All wires were embedded in callus. Strength was slightly increased (+4%, $p<0.05$) and stiffness unchanged compared to the contralateral femurs.

Conclusion: Provided they give sufficient stability, cerclage wires may be used without fear of reducing bone strength.

Effect of sciatic nerve resection on fracture healing in the rat

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Introduction: A recent study showed missing innervation in human nonunited fractures, raising the possibility that the lack of neural ingrowth contributes to delayed healing (1). This investigation was designed to study the effect of sciatic nerve resection on tibial fracture healing in the rat.

Materials and methods: 45 male rats were allocated to two groups: Resection of the right sciatic nerve (SNR-group) or sham-operation (sham-group). The right tibia was fractured, stabilized with an intramedullary nail (2), and further in a plaster cast to prevent unequal loading in the two groups. All animals were injected with 85Sr i.p. on day 22. After 25 days all animals were killed and 19 were included in this study (8 SNR and 11 sham). Radiograms of the fractures were taken, bone mineral content (BMC) of the callus was measured by single photon absorbptiometry (SPA), and 85Sr activity was counted. Tibiae were fractured in a three-point cantilever bending test, measuring ultimate bending moment, energy absorption, bending stiffness and deflection, comparing the fractured tibia to the non-fractured.

Results: ^{85}Sr incorporation in the fractured tibiae was 9% higher in the SNR-group ($p=0.15$). Seven out of eight fractures in the SNR-group showed extensive callus formation in contrast to only three out of eleven in the sham-group ($p<0.05$). Callus had a 53% higher BMC in the SNR-group compared to the sham-group ($p<0.05$). However, the mechanical strength of the callus was not significantly higher in the SNR-group, implying a defect in the structural organization of the callus in the nerve resected animals.

Conclusion: Normal neural innervation is of significant importance for fracture healing in the rat.

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Intensive training does not increase the in vivo fracture strength in the lower leg of oophorectomized rats

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Introduction: Physical activity is associated with a lower incidence of hip fractures in some studies, and this has often been connected to a possible effect on bone density. The aim of this study was to investigate the effect of training after oophorectomy before osteoporosis has been established.

Material and methods: 24 female Wistar rats (214g) were radomized into three groups: two were oophorectomized (ovx) and given a low calcium diet (Ca 0.01%) while the third was sham operated and given ordinary rat chow (Ca 1.1%). The Ovx-s (sedentary) and sham groups remained in their cages, while ovx-t (training) three days postoperatively started a high intensity training program running on a treadmill five days a week for eight weeks. At testing the right lower legs were fractured during muscle contraction in a three point bending-test, and the left legs fractured at the same level after removal of all soft tissues. Histomorphometry of the meta- and diaphysis of the distal tibiae was performed.

Results: Weight-gain was equal in ovx-t and sham (61g) and significantly higher in ovx-s (108g). Ultimate bending moment, energy absorption, and stiffness were lowest in ovx-t both in vivo and in vitro, but there were no significant differences between the groups. Correcting for the weight-gain differences did not effect this result. Histomorphometry showed a trabecular volume in sham much greater than in the two ovx-groups ($p<0.0001$), and in the cortical bone there were significant differences between inner radius, medullary, and cortical area.

Conclusion: Biomechanical testing showed no significant differences, but histomorphometry showed development of osteoporosis in the ovx-groups. The weight gain seen after oophorectomy was absent in the ovx-t group indicating training effect (2). However training in the early phase after oophorectomy has no effect on in vivo or in vitro fracture strength in the rat lower leg. In contrast to what we have seen in established osteoporosis (1) and in male rats (2), the high intensity training has not contributed positivély to the protective effect of muscle contraction in the leg.

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Hip

40 years of hip-surgery. Charnley L.F.A., 20 years anniversary

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Chief surgeon Gunnar Ulland was in 1943 employed by Sandnes Hospital. The county of Rogaland at this time had eight hospitals. Dr. Ulland had very broad experience and worked in the small Sandnes Hospital always thinking ahead. The small hospital expanded to become a modern "mixed" hospital. He worked hard to find a niche that could justify the existence of the hospital on a long term basis. Besides running the hospital he therefore educated himself to become an orthopaedic surgeon. Orthopaedics were sneaked in the back-door and after a while the hospital was regarded as an orthopaedic institution. After WW II the organization of Norway's hospitals was revised and basically centralized, first financially and later professionally. Dr. Ulland by then was a renowned orthopaedic surgeon and Sandnes Hospital was tagged to become the Department of orthopaedics.

Chief surgeon Ulland withdrew in 1972. He was very active within the "cold" orthopaedic surgery, especially hip-surgery. Even before the end of WW II he did 8 resections of the acetabulum a.m. Smith Petterson. From 1946 and yearly on he performed several arthrodeses and vitalium-cup plastics. From 1952–1954 he put in 50 Judet acrylprosthesis with the same resulting catastrophe as evolved globally. He performed 68 intertrochanteric osteotomies, the first ones in 1946. Muscle release was another well reputed operation, he did 23 of these between 1965–1969. Endoprostheses after fractures of the femoral neck were not uncommon and 75 were performed in the period 1952–1970. Arthrodeses (291) and cup-plastics (373) were the most frequently performed hip operations up to 1968 when the total hip replacement was introduced, first with the McKee Farrar prosthesis. From 1973 the Charnley prosthesis has been used almost without exceptions in the department of orthopaedics. Up to now approximately 4500 Charnley prostheses have been implanted in our department. Today the department has its own five wards and 20 employed orthopaedic surgeons.

Survival analysis of primary uncemented hip prostheses in Norway 1987–1992. The Norwegian Arthroplasty Register

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Introduction: In the national arthroplasty register (Norway: 4.3 million inhabitants), the results of the different types of uncemented components were assesed. Only components that had been used in more than 100 patients each, were evaluated.

Patients and methods: Survival time until revision because of loosening, was estimated by the Kaplan-Meier method and assessed on 2900 femoral and 3740 acetabular components with an observation period of 0–5.4 years. Only neglible differences were found between the different systems regarding sex, diagnoses and age.

Results: 18.6% of the femoral component Bio-Fit (n=210), and 13.6% of the Femora components (n=173) had been revised after 4.5 years. Of the Parhofer and Harris/Galante femoral components 5.6 and 3.6% had been revised. Less than 2% of the other femoral components (LMT Biomet, Landos, Profile, Zweimüller) had been revised.

Of the acetabular components, 8.1% of the Ti-Fit (n=302) and 6.3% of the Endler (all polyethylene)(n=346) components had been revised. The other acetabular components (Parhofer, Gemini, Coxa, Endler (metal-backed), Harris/Galante, Link Cementless Screw Cup, LMT Biomet, European cup, Landos) had revision rates below 2% during the first 4.5 years.

Conclusion: Large variations were found concerning the results of the different systems of uncemented components. The femoral components Bio-Fit (press-fit) and Femora (screw-in stem) had the poorest results. Of the acetabular components the Ti-fit (Titanium backed screw up) and the Endler screw cup (all polyethylene) had the poorest short time results.

Survival analysis of hydroxyapatite-coated hip prostheses

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In the Norwegian Arthroplasty Register, data on 24,408 primary total hip replacements (followed for 0–5.5 years) were collected. 13% of the femoral components were uncemented, of these 1,202 were with hydroxyapatite coating (HA) and 1,692 without. For survival analyses of the femoral components (time until revision because of loosening), the Kaplan-Meier method was used and differences in failures were tested with the log rank test. The influence of the different variables was estimated by the Cox proportional hazard regression model.

No preoperative differences were found between the two groups regarding sex, age, or diagnosis. The survival for the HA-prostheses were better than for those without HA ($P<0.001$). After 4 years the cumulative failure (revision) was 0.6% for the implants HA compared to 6.6% for those without HA. The Cox analysis revealed that the risk for revision of an uncemented femoral prosthesis without HA was 12 times higher than for a prosthesis with HA.

Conclusion: Short-term results for hydroxyapatite-coated femoral prostheses are good with a survival rate of 99.4% after 4 years.

Total hip prosthesis in patients under 30 years

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Introduction: Severe arthrosis of the hip in young patients traditionally has been treated by arthrodesis. However, today most persons refuse hip fusion. Total hip replacement, then, may become the only alternative to disability.

Material and methods: During the years 1990 and 1991 we have operated 9 female and 5 male patients with total hip replacement; all of them were totally disabled because of severe unilateral arthrosis. The age of the patients ranged from 15 to 30 years. The CLP cause of arthrosis was: CDH in 7 cases, osteonecrosis of the femoral head in 4, disease in 1, epiphysiolysis in 1 and coxitis in 1. All patients were given a cementless prosthesis covered with hydroxylapatitis, and they have been followed for 2 to 3 years.

Results: Prior to operation all patients were disabled from work/school, 12 used daily analgetic drugs and 6 were in need of crutches. At follow-up all of them had returned to work/school, one for only 50%, and no one used analgetics or crutches. There were no signs of loosening of the prosthesis in any of the patients.

Conclusion: Although the long term results are uncertain, these patients have all returned to a normal way of living in an extremely important phase of their life.

Uncemented hip arthroplasty

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We present the evaluation of uncemented hip prostheses in different combinations inserted through a period of 5 years: Endler-Zweymüller, Landos HA (hydroxyapatite) and "hybrid" (i.e. cemented femoral component with uncemented acetabular implant).

The follow-up evaluation aims to assess loosening problems. In this context, the Endler acetabular implant and the Zweymüller femoral implant have relatively high incidence of loosening. Non of the Landos HA implants are loose so far. The "hybrid" combination for patients aged 60 to 70

years is excellent.

In revision operations, we always attempt to implant uncemented prostheses supported by bone grafting. The HA-covered prostheses are very promising also in this context.

Frequency of loosening
Period: January 1986 – January 1991, 2–7 years follow-up

Type of implant	Primary	Revision
Endler acetabular cup	10% (8/78)	47% (7/15)
Landos HA cup	0% (0/84)	0% (0/23)
Zweymüller femoral stem	11% (8/73)	28% (9/32)
Cemented femoral stem (hybrid)	0% (0/97)	0% (0/2)

Noncemented revision arthroplasty with a Landos reconstructive prosthesis

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A 70-year-old woman with rheumatoid arthritis had her 5th revision arthroplasty of the right hip. The radiographs demonstrated loosening of the acetabular cup with pelvic discontinuity and rim defects and loosening of the femoral component with an extremely poor quality of bone and femoral fractures about the prosthesis.

At revision the prosthesis and all cement were removed. An Atoll acetabular hemispheric cup, in titanium alloy coated with calcium hydroxyapatite was fixed with 3 titanium screws and autologous bone grafts. After reaming of the femur using flexible reamers, a specially designed reconstructive prosthesis in titanium alloy coated with calcium hydroxyapatite, was used. The diaphyseal component was inserted in the femur and locked with one titanium screw in the distal end through the distal femoral condyle. The proximal base was mounted and the proximal bone shells and autologous bone grafts were fixed with titanium wires. A separate 32 mm femoral head was used.

After 3 months the patient was allowed to bear full weight. Six months later she was without pain in her hip and the radiographs showed healing of bone in the femur and acetabulum.

Conclusion: The case reports an alternative prosthesis for revision arthroplasty in patients with extremely poor quality of bone and femoral fractures in the proximal femur.

Digital subtraction arthrography of painful hip arthroplasties

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Introduction: The diagnosis of loosening of hip arthroplasties can be difficult. Beside clinical investigation, plain radiography and scintigraphy, digital subtraction arthrography can be a helpful method to demonstrate loosening.

Materials and methods: From 1991–1993, 14 patients with suspected loosening of hip arthroplasties were investigated with digital subtraction arthrography at Vest-Agder Central Hospital. With sterile technique a 22 gauge (G) spinal needle is fluoroscopically positioned pointing at the junction of the neck of the femoral component. The needle is directed vertically downward until a metal to metal contact is obtained. Manually a non-ionic x-ray contrast medium, 330 mg I/ml is injected into the pseudocapsule until the patient experiences hip discomfort or an increase in resistance to further injection is noted. Before the injection, a precontrast mask is exposed and we expose one picture per second in 20 seconds during the injection. Postexercise pictures in frontal and frog-leg oblique position are obtained. Penetration of contrast medium in the prosthesis-cement/bone-cement interface indicate loosening.

Results: In the study group of 14 patients, 9 demonstrated loosening of the acetabular component, 1 loosening of the femoral component. 7 suspected acetabular loosenings were surgically confirmed. 3 patients are not operated yet. 3 investigations did not indicate loosening and 1 was not conclusive.

Conclusion: It is important to evaluate the size of the pseudocapsule and use a correct amount of contrast medium. When properly performed and interpreted digital subtraction arthrography can be the most accurate tool in evaluating loose hip prosthesis. It is a simple procedure with little discomfort to the patients.

Total hip replacement for arthrodesed hips

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The main aim of this study was to evaluate the functional outcome of total hip replacement (THR) for arthrodesed hips.

Patients and methods: During the years 1979–1988 we converted 55 arthrodesed hips to THR. 37 women and 9 men have been followed for 5–13 years. At the time of conversion the age ranged from 33–75 years, and they had had a fused hip for 7–28 years. At follow-up the subjective benefits were graded from very much satisfied via much satisfied, satisfied, not satisfied to unsatisfied. The functional

outcome was classified according to the Harris hip score. Furthermore, the use of support for walking was noted, and the strength of the abductors was graded on a standard scale for manual muscle testing where 0 denotes no muscle contractions and 5 indicates normal muscle strength. In the cases with low back pain as the major preoperative complaint, the degree of pain was rated on a ten point scale from 0 (no pain) to 10 (intense pain).

Results: 13 of the patients were very much satisfied with the operation, 19 were much satisfied, 7 were satisfied, 3 were less satisfied while 4 were unsatisfied. The Harris hip score was improved from 51–83 at the time of operation to 53–93 at the follow-up. Before conversion none of the patients used crutches. At follow-up 10 patients used 2 crutches, 24 used 1 and 12 did not need support. Muscle strength of the abductors ranged from 1 to 4. In 26 patients with major low back pain before conversion, the pain score was improved from 3–10 to 0–8 at follow-up.

Conclusion: The present study shows that with conversion of an arthrodesed hip to arthroplasty, most of the patients need support for walking. However, they are generally greatful for their new mobility, manoeuverability and improved ability to sit comfortably.

Activation of granulocytes and monocytes in total hip replacement surgery

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Introduction: Cell adhesion phenomena and activation of granulocytes and monocytes are important components of the acute phase reaction after total hip replacement surgery and are involved in wound healing and complications as thromboembolic events and infections.

Material and methods: Three series of patients were operated with uncemented total hip prosthesis under spinal anesthesia. Blood samples were drawn before, during and after the operation. In series 1, CD14 and the adhesion molecules CD11a (LFA-1), CD11b (MAC-1), CD11c (p150,95) and L-selectin (LAM-1) on the cell surface of granulocytes and monocytes were measured in whole blood by means of fluorochrome-conjugated monoclonal antibodies and flow cytometry. Plasma elastase and calprotectin (essentially products from granulocytes) (ELISA techniques) and plasma IL-1ß, IL-6 (ELISA techniques) and TNF (bioassay) (essentially products from monocytes) were measured in series 2 and series 3, respectively.

Results: Expression of CD11b on the surface of granulocytes and monocytes increased during the operation, but decreased to the initial levels at the end of the operation. A second phase of increased expression was seen within maximum 20 hours after surgery, thereafter the mean fluorescense intensity decreased towards normal (granulocytes) or supranormal values (monocytes) 44 hours after the operation. A similar tendency was observed when measuring the expression of CD11c and monocyte CD14, but the high expression of CD14 was maintained for a longer period postoperatively. The expression of CD11a decreased during the last part of the operation and thereafter increased to initial values 6 days after surgery. Monocyte expression of L-selectin increased until 44 hours postoperatively and then decreased towards initial levels. Similarly, granulocyte expression of L-selectin increased until the end of the operation and then decreased to initial values 20 hours after surgery. Plasma elastase increased postoperatively, reaching a peak level after 24 hours and then decreasing to supranormal values at the end of the first postoperative week. Plasma calprotectin levels were increased, with peak values 4 hours and 5 days after surgery. Plasma IL-1ß was not detectable before, during or after surgery. Plasma IL-6 increased to maximal levels 4 hours postoperatively. There were no significant TNF changes, but a tendency for increased levels 4 hours postoperatively. Samples from Solcutrans blood bags showed low levels of TNF, slightly increased levels of IL-1ß (41–59 pg/ml) and extremely high levels of IL-6 (3000–5000 pg/ml).

Conclusion: Expression of adhesion molecules is increased during operation and the first 2 days after total hip replacement surgery. The initial cellular changes preceded the increase in plasma levels of IL-6, calprotectin and elastase.

The influence of methyl methacrylate monomer (MMA) on human white blood cells and endothelial cells in vitro

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Introduction: Total hip replacement (THR) using bone cement for prosthesis fixation is associated with intraoperative cardiorespiratory dysfunction (CRD) and a high incidence of deep vein thrombosis (DVT). We have earlier found a substantial intraoperative hypercoagulation, i.e., thrombin generation, impaired fibrinolysis and absorption of MMA into central venous blood during THR, which can be linked to these pathophysiological phenomena. We have now performed an in vitro study to find out if MMA in concentrations equivalent to the levels in central venous blood in vivo, can cause vascular and blood cell disturbances which may contribute to peroperative CRD and postoperative DVT.

Materials and methods: Human umbilical vein endothelial cells, monocytes and granulocytes were isolated and seeded in plastic wells. Some cultures were preincubated with ^{51}Cr which then was incorporated into the cellular cytoplasma. MMA (0.01–40 µg/ml was added to native and ^{51}Cr prelabelled cell cultures and cellular injury was meas-

ured by the release of lactat dehydrogenase (LD) and ^{51}Cr. In addition, morphological changes were investigated by scanning electron microscopy.

Results: LD and ^{51}Cr were released in a dose dependant relationship at concentrations of MMA >5 µg/ml. Scanning electron micrographs showed marked membrane alterations one minute after exposure to MMA (10 µg/ml) and total cellular disintegration within 30 minutes.

Conclusion: Clinically relevant blood concentrations of MMA (i.e. 5–10 µg/ml) were clearly cytotoxic to all cell types studied as evidenced by the release of LD and ^{51}Cr. Scanning electron microscopic examination of cells treated with 10 µg/ml MMA showed marked signs of cytotoxicity after 1 minute of incubation and after 30 minutes the majority of the cells were totally disintegrated. Release of potent biological active intracellular constituents from leukocytes and endothelial cells du to the effect of MMA may contribute to intraoperative CRD during THR. Damage to the endothelial coverage may have important bearings for the development of DVT in veins draining cemented areas.

Knee

Seven years survival analysis of uncemented and cemented RMC/Tricon total knees

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From 1985 to 1991 221 uncemented and 1219 cemented RMC/Tricon total knees were implanted at 21 Norwegian Hospitals. In both groups the mean age at operation was 68 years. 80% of the patients were women and 20% men. In the uncemented group there were more patients with osteoarthrosis (64%) than reumatoid arthritis (29%). In the cemented group there were 45% osteoarthrosis and 49% reumatoid arthritis patients.

Revisions were performed in 4.1% (9) of the patients with uncemented arthroplasties, and in 3.2% (40) of the patients with cemented arthroplasties. For patients 60 years or less in the uncemented group 16.7% revisions were done compared to 1.1% for patients above 60. Corresponding figures for cemented knees were 5.8% and 2.7%. Infection was more often the cause of revisions in the cemented (34%) than the uncemented (14%) group. Uncemented tibial components failed more often than cemented, whereas the femoral component failed equally in the groups. Seven years survival ratio was 92% both for uncemented (CI 88–97%) and cemented (CI 88–96%) total knees. In the uncemented group patients 60 years or less had a lower survival ratio than patients above 60. This was not so in the cemented group.

Conclusion: This study show no great differences in the results between uncemented and cemented total knees. However, there is no indication for choosing uncemented total knees in younger patients—in fact on basis of this study they ought to be cemented.

Arthroscopic meniscal repair

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Introduction: The purpose of this study is to evaluate the long term results of our meniscal repairs.

Materials and methods: We report 74 arthroscopic meniscal refixations with a median follow-up of 45 (17–20) months.

Technique: Inside – out (Acufex). There were 45 medial and 29 lateral meniscal repairs. The average patient age was 25 years. 8 of the patients had ACL-ruptures. In this material none of our patients had a simultaneus ACL reconstruction done. We used a questionnare, and received information from all the patients. Clinical examination was done in all cases with complaints from their knees.

Results:

1. Medial meniscus: 55% failures (reruptures).
2. Lateral meniscus: 34% failures.

The median time of rerupture was 11 (2–60) months. All patients with ACL deficit had a bad result. In stable knees we had the following results:

1. Medial meniscus: 54% reruptures (43% during the first 12 months).
2. Lateral meniscus: 29% reruptures (7% during the first 12 months).

The difference between lateral and medial meniscus is significant (p=0.04).

Conclusions: Our technique for suture of peripherial meniscal tears of lateral meniscus in stable knees gives acceptable results. Our technique can be improved, but we will be more restrictive in refixing the medial meniscus. We will reserve it for the most peripheral tears and do simultanous ACL-reconstruction when necessary.

Arthroscopic resection of menisceal flap tears with minor degenerative changes in adjoining cartilage

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Introduction: The functional results of menisceal resections in knees with simultanous arthrosis are unsatisfactory (1). The aim of this study was to assess the outcome of menisceal flap tear resections, when adjoining minor cartilage degeneration was present.

Patients and methods: 93 consecutive patients with a simple or complex flap tear in the posterior medial meniscus at arthroscopy were included in a prospective study. There were 65 men and 28 women, aged 45 (21–75). All radiograms were normal. Arhtroscopic resection of the flap tear was performed with basket forceps untill reaching normal meniscus tissue. Articular cartilage pathology adjoining the flap tear was classified according to the criterias of Outerbridge (2). 40 patients sustained chondromalacia of second or third degree in the immediate vicinity of the flap tear (group A). 53 had normal articular cartilage (group B). Neither patient had additional pathological findings in the knee joint. The patients in group A were 52 (23–75) years old, versus 45 (21–70) in group B. Evaluation after 42 (26–50) months follow-up was based on Lysholm's score (3), and score >85 was considered satisfactory.

Results: Complex disruptions dominated in group A (31/40), in contrast to group B where 44 of 53 patients had a simple flap tear. 55% of the patients in group A showed a satisfactory result of the menisceal resection, compared to 80% in group B ($p<0.03$). Comparing the patients from 40–60 years old, who were evenly distributed between the two groups, 55% still showed a satisfactory result in group A, compared to 90% in group B ($p<0.02$).

Discussion: Increasing age and complex flap tears in the posterior medial meniscus have previously been associated with arthrosis (4). This study further shows that even minor cartilage degeneration in the vicinity of a posterior medial disruption worsens the results after menisceal resection, independent of the age of the patients.

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Results of meniscal suture evaluated by survival analysis

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63 patients, 50 men and 13 women with a median age of 23 (8–56) years, underwent meniscal refixation by suture from 1986 through 1991.

Six were operated with open suture, the remaining by arthroscopic outside-in technique with PDS-sutures through injection cannulas. 42 knees were stable, 21 had anterior cruciate insufficiency, five of which were operated concomitantly with patellar tendon reconstruction, and 2 further at a later occasion. Follow-up time ranged from 2 months to 5 years, with a median of 1.5 years. 6 patients were lost to follow-up, and the remaining 57 were analyzed using the BMDP statistical package and the Kaplan-Meyer survival analysis.

No complications were encountered. 25 patients had been reoperated because of meniscus rerupture. At 5 years the cumulative survival rate is 44%. Smaller (posterior) lesions healed better than more extensive ones. No statistical influence of factors like medial or lateral localization, age of patients or lesions, present displacement of meniscus, instability of the knee or experience of the surgeon was revealed in this material.

Follow-up examination of acute ACL-injuries operated with Palmer suture and augmentation with autologous patellar tendon graft a.m. Marshall

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From 1986 to 1989, 16 patients were treated for acute total rupture of the anterior cruciate ligament with Palmer suture augmented with patellar tendon-graft a.m. Marshall. Median age was 22 (14–54) years. 12 of the ruptures were in the proximal part of the ligament while 4 were midsubstance ruptures. 7 patients had isolated ACL-ruptures, the remaining had additional injuries in collateral ligaments (8) and menisci (7).

All patients were treated in a plaster cast for 6 weeks postoperatively, and received physioterapy after the immobilisation. In spite of no further injury, 8 patients required additional operations in the same knee.

At follow-up, after median 5 (4–7) years, 10 knees were stable (KT 1000 max. man. <3 mm). The mean anterior laxity measured with the KT 1000 (max. man.) was 2.9 (0–8) mm. One knee had a 1+ Pivot shift. Two knees had a 1+ valgus instability. 11 had patellofemoral crepitation, but none had patellofemoral pain. No knees had an extension deficit exceeding 5 degrees. Using Lysholm's score the result was graded as excellent/good in 13 (81%) of the cases and fair/poor in 3 (19%), median score was 91 (75–100). The activity score (Tegner) was median 8 (2–10) before the injury and 7 (1–9) at follow-up. Median time out of work postoperatively was 6 (0–16) months, and the median time until stable knee function was also 6 (3–12) months. 7 patients were very satisfied with the operation, 8 found the result acceptable while one patient was not satisfied.

The stability at follow-up was acceptable and compares well with other methods. The period of immobilisation and the large arthrotomy are possible explanations for the long rehabilitation period. The number of operations needed after the primary operation seems unacceptably high.

Patellofemoral pain and chondromalacia. Is patellar shaving worthwhile?

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Introduction: The diversity in hypothesis for patellofemoral pain relates to the fact that no single successful solution for problems related to this joint has been discovered. From 0 to 90% good results have been reported after patellar shaving for patients who do not respond to conservative treatment. The usefulness of this procedure as a sole treatment for patellar pain is questionable.

Patients and methods: 14 patients (15 knees) with anterior knee pain and degeneration of the patellar cartilage were treated with shaving from 1989 to 1991, and analyzed retrospectively. Median age was 30 (14–55) years. They all had a history of symptoms for more than 1 year, 4 patients more than 3 years. One minor resection of the medial meniscus and one partial synovectomy was performed at the same time in two different patients.

Results: At follow-up after median 32 (12–45) months, three patients had no or minimal symptoms. Nine patients were much better off compared to their preoperative status, but two of these were meanwhile reoperated. One patient deteriorated after two painfree months and a distal realignment was performed 10 months later. The other patient had no effect of the shaving procedure. An incipient osteochondritis dissecans was not recognized and because of this, the patient was reoperated 20 months later. The symptoms were unchanged in one patient and worse in two.

Conclusion: Patients with longstanding patellar pain and chondromalacia in otherwise normal knees, seem to have benefitted from the treatment.

Magnetic resonance imaging of anterior cruciate ligament reconstructions

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The aim of this study was to evaluate anterior cruciate ligament (ACL) reconstructions by magnetic resonance imaging (MRI).

Patients and methods: 19 patients underwent 20 ACL reconstructions with patellar bone-central third patellar tendon-tibial bone autografts. They were imaged (Philips 0.5 Tesla) at various postoperative intervals up to 2 years. MRI of 50 normal knees was used for comparisons.

Results: In 14 of the 20 MRI examinations the ACL reconstructions were well defined, and clinically they were stable, as evidenced by a negative Lachmann test and Pivot shift. In the remaining 6 MRI examinations the grafts were of intermediate definition by the MR imaging criterias, and the ACL reconstructions were clinically insufficient.

Conclusion: With better experiences MR imaging may become an excellent noninvasive method for evaluating ACL reconstructions.

Muscle contraction protects the anterior cruciate ligament against failure. An in vivo study in the rat

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Introduction: The co-contraction of gastrocnemius and hamstrings force as in walking and running may unload the ACL entirely except by terminal extension of the knee although a significant quadriceps force is present1. The aim of the present investigation was to examine if synergistic muscle contraction is mechanically significant at ultimate loads as well.

Methods: 10 male Wistar rats of 420 (410–431) g b.w. were used. The joint capsule and ligaments of both knees except the ACL were divided and the menisci were removed using a stereomicroscope. The ACL of the right knee was tested in tension by 2.5 mm/sec. until failure during contraction of the hamstrings and calf muscles induced by electrical stimulation of the sciatic nerve. The ACL of the left knee was loaded to failure with unstimulated muscles as control.

Results: The mean ultimate tensile load during muscle contraction was 70% more than tested with relaxed muscles. 175% more energy was absorbed until failure of the ACL during muscle contraction.

Conclusion: This investigation suggests that studies evaluating the properties of the ACL in a femur-ACL-tibia complex stripped of all soft tissues are incomplete compared to the in vivo situation as muscle contraction absorbes a significant amount of energy and increases the force needed to rupture the ACL.

Reference: 1. O'Connor JJ: Can muscle co-contraction protect knee ligaments after injury or repair? J Bone Joint Surg 1993; 75-B: 41-8.

Hypertrophy of the patellar tendon after intensive rehabilitation following Clancy plasty

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Introduction: Experimental studies on rabbits have disclosed hypertrophy of the patellar tendon when the animals were trained on a treadmill after extirpation of the mid-third of the tendon (1). A corresponding hypertrophy of the patellar tendon has been observed in a top athlete following an intensive rehabilitation program after reconstruction of the anterior cruciate ligament (ACL) with the mid-third of the patellar tendon (Clancy plasty).

Patient and methods: The patient was a 25 year old male with a mid-substance rupture of ACL after a downhill skiing injury. The ACL was reconstructed with Clancy plasty the day after the injury. An intense rehabilitation program started two weeks later with closed chain exercises.

Results: The patient was able to follow the training program for the Norwegian Alpine World Cup team after five months. One month later he started to suffer pain at the apex of the patella. 14 months postoperatively MRI scans showed the patellar tendon to be more than twice as thick as the contralateral one. The proximal and dorsal part of the tendon was removed and histologicial examination disclosed fibrous granulation tissue with partial calcification.

Conclusion: Intensive rehabilitation after Clancy plasty may result in hypertrophy of the patellar tendon.

Reference: 1. Haut R, Kamps B, Linder B: Biomechanical and histological assessments of the patellar tendon after removal of the central one-third. Transactions of the Orthopaedic Research Society 1993, 18:27.

Anterior cruciate ligament strength. Can it be estimated by nondestructive tests?

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Rupture of the anterior cruciate ligament (ACL) constitutes 15% of all injuries in alpine skiing. For structural and material bone strength non-destructive tests exist, while no such tests have been developed for ligaments. In alpine skiing it is possible that release bindings protecting the ACL can be developed, in which case it is important to be able to estimate the strength of the ACL, and thereby the release setting. In this study two different methods have been evaluated for estimation of rupture strength of the ACL.

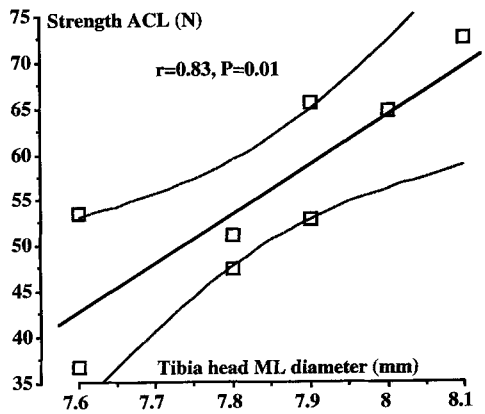
Materials and methods: ACL was tested in tension to rupture with the knee held in 60° flexion in 8 male Wistar rats (423g ±7). Loading rate was 2.5 mm/s. Tibial head diameter in frontal (ML) and sagital planes (AP) was measured with callipers, and bone mineral content (BMC-g) of the entire tibia was measured by "dual energy x-ray absorptiometry" (DXA). Comparisons were made by simple linear regression analysis.

Results: We observed ligamentous mode of failure in all tested knees. The correlation between ACL strength and tibial head diameters was r=0.83 (ML) (Fig) and r=0.76 (AP) (P<0.003). Calculating the tibial head area as an ellipse gave r=0.93 (P<0.01). The correlation between ACL strength and BMC was r=0.65 (P=0.08). ACL strength was not correlated to body weight (r=0.24).

Discussion: Frontal tibia head diameter (ML) is used for setting of alpine release bindings as it is known that it correlates with fracture strength of the tibia (1). This can also become a method for estimating the ACL strength, but needs verification in human specimen.

Conclusion: ACL strength is highly correlated to the tibial head diameter.

Reference: 1. Asang E: Experimental biomechanics of the human leg. Orth Clin North Am 1976,7: 63-73.



The effect of bone block removal on patella strain

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The middle third of the patellar tendon is commonly used as a bone-tendon-bone (B-T-B) graft in ACL reconstructions.

The current study sought to characterize the biomechanical effects of the bone block graft removal on the remaining knee extensor mechanism measured on the patella itself.

Material and methods: The patellas of seven cadaveric knees were instrumented with three rosette strain gauges located around the proximal rim of the planned defect and mounted on a specially designed servohydraulic testing machine. The quadriceps tendon was loaded via a soft tissue clamp to 500N from 0 to 90° flexion at 15° increments while the strain in the patellar surface was recorded. Then a B-T-B graft was removed as would be done for ACL reconstruction. The bone block geometry was varied to compare the normal patella to three different defect conditions: dome shaped and shallow (5 mm), squared shaped and shallow, and square shaped and deep (10 mm).

Results: The greatest strains in the patella were recorded along the medial side and at about 45 degrees of flexion. The strains on each side increased when the defect was made, while the strains in the central rosette decreased. These changes were statistically significant ($p<0.05$ by repeated measures ANOVA) for the lateral and central regions, but not for the medial side. There were no significant differences between the various defect shapes. In the contact condition the principal direction of the surface strains were in parallel with the longitudinal axis of the quadriceps mechanism for all regions. After graft harvesting the direction did not change, except for the medial region where a significant shift occurred from longitudinal towards more transverse when the dome shaped shallow defect was made.

Discussion: Removal of a B-T-B patellar tendon graft results in significantly higher strains in the surface of the patella in a cadaver model. The lack of differences in strain patterns among the various defect geometries may be related to the location of strain measurement. Differences may be more significant nearer to or at the edges of the graft site. Our findings may help to explain some of the clinical complications encountered after ACL reconstructive surgery using patellar tendon autografts. It is hoped that the data can form a basis for mathematical modeling of the patella so that a more comprehensive analysis on the effect of graft removal on patella biomechanics can be performed.

Rheumatoid arthritis

Surgical treatment of patients with rheumatoid arthritis in Norway

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During the summer of 1993, The Norwegian Society for Surgery of Rheumatoid arthritis sent a questionnaire to all hospitals in Norway. We wanted to register the rheumasurgical activity throughout the country.

Method: The questionnaire was sent to 75 hospitals. We wanted information about the number of surgeons involved in the treatment of patients with rheumatoid arthritis and the frequency of these operations. The capacity of educating young surgeons was also registered.

Results: The operation frequency was lower than 5 operations/month in 20 units, between 5 and 10 in 5 units and higher than 10 in 15 units. Nine of the units operating more than 10 patients each month reported a considerable undercapacity. Operations per 100,000 inhabitants per year varied a great deal in the different counties (30–150). Two hospitals had young surgeons permanently attached to the rheumasurgical unit, three other units had a less permanent arrangement.

Conclusion: The rheumasurgical capacity is reported to be too low in many regions of Norway. There are great variations throughout the country.

Arthroscopic synovectomy of the shoulder joint

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From October 1991 to May 1993, 18 patients underwent arthroscopic synovectomy in 20 shoulder joints. 9 patients were followed one year, the rest at least three months. Indication for operation was pain and loss of function. 14 patients had the diagnoses rheumatoid arthritis or seronegative arthritis, 3 had psoriatic arthritis and 1 had polyarthrosis. Average duration of general disease was 14 (3–43) years, and average duration of actual joint involvement was 3 (1–7) years.

The operation was performed with the patient in the lateral position and the arm in 70° abduction with 3-5 kg traction. The arthroscope was inserted dorsal to the acromion and drain and shaver inserted through two ventral incisions. The subacromial bursa was resected from a lateral approach. Except for one patient who had skin wound secretion at a scopic site for about two weeks we had no postoperative complications.

Patients pain evaluation:	Preop.	3 months	1 year
Severe	17	2	2
Moderate	3	12	5
No/Minimal	0	6	2

Patient satisfaction:		3 months	1 year
Very good		9	2
Good		11	7
Poor		0	0

Average increase in range of movement:	
Abduction	36°
Flexion	30°
Extension	4°
Total rotation	50°

The total situation had changed little between the 3 month- and 1-year examination. One patient had changed his pain evaluation fron no/minimal to severe, because of increasing general disease activity.

The results so far are encouraging, and we will continue to perform arthroscopic synovectomies of the shoulder joint.

Arthroscopic synovectomy of the elbow joint

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Over an 18-month period we operated 9 patients with arthroscopic synovectomy of the elbow joint. 6 patients were followed for 1 year, whereas all the patients were controlled after at least 3 months. 8 patients had seropositive rheumatoid arthritis, and one patient had seronegative arthritis of the elbow joint.

The operation was performed with the patient in the lateral position, and the upper arm hanging over an elbow support. We used 4 incisions: straight lateral, anterolateral, anteromedial and posterolateral. The arthroscope and the 4.5 mm curved synovator were alternated between the portals to remove synovitis.

Patients evaluation of pain:	Preop.	3 months	1 year
Severe	6	0	0
Moderate	2	1	0
No/ignorable	1	8	6

Average increase in total ROM:	3 months	1 year
Extension/flexion	21°	26°
Pronation/supination	30°	43°

Patients evaluation of the operation:	3 months	1 year
Very satisfied	7	5
Fairly satisfied	2	1
Not satisfied	0	0

Average postoperative period of hospitalization was 4 (2–10) days. There were no complications in this series. The patients tolerated the operation well, we had no complications and the short term results are encouraging.

Arthroscopic synovectomy of the ankle joint

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Over an 18-month period we operated 16 ankle joints in 15 patients with arthroscopic synovectomy. 10 patients were followed 1 year, the rest at least 3 months. 10 patients had seropositive rheumatoid arthritis, 3 had psoriatic arthritis and 3 had seronegative monarthritis of the ankle joint.

In order to distend the ankle joint, an ankle distractor or a calcaneal pin with traction was used. As much synovitis as possible was removed with a 4.5 mm curved synovator from the anterolateral and the anteromedial portal.

Patients evaluation of pain:	Preop.	3 months	1 year
Severe	15	3	2
Moderate	1	7	4
No/ignorable	0	6	4

Average increase in total ROM:	3 months	1 year
Extension/flexion	15.5°	14.5°

Patients evaluation of the operation:	3 months	1 year
Very satisfied	4	4
Fairly satisfied	10	4
Not satisfied	2	2

Average postoperative period of hospitalization was 4 (1–14) days.

Complications: One patient had a subcutaneous bleeding and one patient had a spontaneous joint bleeding the third postoperative day. One patient had secretion from both incisions for ten days postoperatively.

The patients tolerated the operation well. The short term results seem to be fairly good. We will continue to do this operation for a period to see if we can improve our technique and perhaps thereby our results.

Varia

Operative treatment of slipped capital femoral epihysis

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At Haukeland Hospital, we have used different fixation

methods for slipped capital femoral epiphysis (SCFE). Because of difficulties when removing von Bahr screws, AO screws and Knowles pins, we have therefore from 1987 changed to Steinmann pins with diameter 2.4 mm (Richard's calibrated tip threaded guide pin). 3 parallelly placed pins which are cut off 1–2 cm lateral to the femur are used. In this way there is still a possibility for epiphyseal growth. This may be of importance in younger patients where continuous growth of the epiphysis is expected. The pins are removed when the epiphysis is closed (age 16-18).

Patients and methods: In the years 1984–1992, 9 boys and 3 girls were treated for SCFE. 3 patients were operated bilaterally. Median age at the time of operation was 12 (8–17) years. AO screws were used in 3 patients, von Bahr screws in 2 patients and Steinmann pins in 10 patients. The primary operation lasted for 39 (20–110) min. The patients used crutches for 6 weeks postoperatively and the pins were removed after 28 (12–52) months. The pin-removal operation lasted 48 (20–225) min. In 3 patients the pins could not be removed, 1 had von Bahr screws and 2 had AO screws. 2 patients had to be reoperated because of penetration into the hip joint. Follow-up after 17 (2–51) months showed that 12 patients were free of symptoms and 3 patients had some discomfort in the hip region.

Conclusion: Our experience with Steinmann pins in mild and moderate degrees of SCFE is good. It is a small surgical procedure with few complications.

Eden-Hybinette-Alvik's glenoplasty for anterior dislocation of the shoulder

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From 1969–1988, 171 shoulders were operated on with the Alvik glenoplasty. We still use this technique and wanted to evaluate our results.

Patients and methods: It was possible to trace 144 patients who received a questionnaire. 133 patients with 138 operated shoulders replied. In addition 124 were examined clinically and radiographically by the authors. The operation technique is described by Said & Medbøe (1970).

Results: Follow-up time was 9.4 (2.5–21.5) years. Median age at operation was 23.5 (15–70) years. We found 2 transient nerve palsies and 5 postoperative infections (3.6%). All but one were at the donor site on the iliac crest. Two patients developed intraarticular fibrosis and had to be reoperated. Recurrence of the dislocation occurred in 4 patients (2.9%) of whom 3 were reoperated. 11 patients reported a feeling of instability. Three were reoperated. Mean reduced outward rotation was 15°. One patient complained of constant pain of unclear origin. 18 patients (14%) had slight pain occasionally. According to Rowe's score, the result was excellent/good in 97 shoulders (77%), fair in 21 and poor in 7 (6%).

Conclusion: Our results compare favorably with other reports both of the Alvik glenoplasty and other techniques. The operations in this report were performed by many different orthopedic surgeons and trainees. We regard this method sufficiently safe and simple under these circumstances. An assessment of postoperative arthrosis will be published later. In our opinion the Alvik glenoplasty for recurrent anterior dislocation can still be recommended.

Curettage and bone cement in the treatment of giant cell tumor

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Giant cell tumors are usually benign lesions with a tendency for local aggressiveness. Traditionally the treatment has been intralesional curettage and autogenous bone grafts, or more radical removal necessitating large reconstructive procedures. More patients than in recent years were amputated, especially those with aggressive stage 3 lesions, or recurrent tumors.

There have been several reports on better tumor control when a thorough curettage is combined with PMMA-cement. The terminal effect on residual cells are probably important.

Since 1988, 13 patients have been treated with curettage and cement at our institution. Only one recurrence was noted, despite the fact that 4 of these tumors were aggressive stage 3 lesions. Functional results were excellent. This compares favorably with the result in our series of 7 patients from the period 1980 to 1988, where tumor control with curettage and bone transplant was achieved in only 3 patients.

If there is fracture and axial deviation near the cement this could be corrected with an osteotomy through the cement, adding more cement, after fracture healing. Two patients with satisfactory short-time results after this treatment are presented.

Surgical treatment of tumors in the sacrum and pelvic ring

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Introduction: Since 1986 we have treated tumors in the pelvis and sacrum. We have analyzed our results.

Patients: 28 patients were operated, 14 with benign and 13 with malignant tumor. Median age 35 (8.5–71.5) years.

The malignant diagnoses were chondrosarcoma 7, osteosarcoma 3, MFH 2, chordoma 3. The patients were divided in two groups; Group 1: the benign except the two giant cell tumors, and Group 2: the malignant tumors plus the two giant cell tumors. The benign tumors were treated by simple excision/curettage, and bone graft. Of the patients in group 2 (n 15), 4 had a hemipelvectomy, 7 had internal hemipelvectomy with conservation of the extremity. 3 chordomas in the sacrum were resected.

Results: All Group1-patients recovered full function after the operation. There was no mortality. *Complications:* After resection of the sacrum 2 of 3 patients had intestinal obstruction requiring intestinal resection. 1 patient had a fistula which dried up in 3 months.

Resources used to treat patients:

	Hospital stay (in days)	Blood loss (ml)	Operation time (in minutes)
Group 1	6.9	510	82
Group 2	45.5	7900	515

After sacral resection all patients lost sphincter control, but were able to empty the bladder without permanent catheter. All patients treated by extremity-conserving hemipelvectomy were able to walk and sit.

Oncologic results: 8 patients had no local recurrence, 4 had a local recurrence; 1 had a malignant recurrence of a giant cell tumor. 7 patients are NED, 5 have metastasis. 4 lives with disease and 4 are dead.

Conclusion: Benign tumors can be treated simply with good results. The treatment of group 2 tumors is technically demanding with risk of complications. The treatment should be highly centralized to accumulate experience in these difficult surgical problems.

Bilateral simultaneous lengthening of the lower leg by Ilizarov technique

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Introduction: Leg lengthening by callotasis is à time consuming procedure. In cases of short stature we have performed simultaneous lengthening of the lower leg in four cases. Three patients have completed the procedure so far.

Patients and methods: Stable frames and cooperative patients are neccessary to ensure success. We have used different modifications of the Ilizarov frame. Our frames have been stable and in one case we have been able to correct a substantial varus deformity in addition to performing the lengthening via two corticotomies. All patients were able to ambulate with support during the procedure.

Results: All patients achieved the preoperative goal of length gain. Healing time in patients with one corticotomy was shorter than previously noted in our series of unilateral lengthening. The reason may be that the patients were forced to weight bear because of the bilateral procedure. Lengthening via two corticotomies carries the risk of neural damage because of the increased stretch on the neural structures. One patient had a temporary reduced sensation on the dorsum of the foot, and the speed of lengthening was reduced until the nerve had recovered. One lengthened segment fractured two days after removal of the fixator, but healed eventually in a brace.

Conclusion: Bilateral simultaneous leg lengthening for short stature is possible with an ambulatory patient and significantly shortens the treatment-time. The patient needs to be cooperative and the social conditions adequate for this extensive procedure. An Ilizarov frame with two distal rings and one and one half proximal rings attached by K-Wires only gives adequate stability and excellent patient acceptability.

Correction of recurrent club foot by Ilizarov external fixation

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Introduction: For many years operations described by Johanning and Evans have been the standard methods at our hospital for correction of recurrent club foot that previously has been treated with redression etc. The main problem using these methods has been the shortening on the lateral side of the foot. During the last 1.5 years we have used the Ilizarov external fixation technique in the treatment of recurrent club foot by slow traction of soft tissues and correction of all deformity components.

Material: The patients were two girls and one boy; 8, 6 and 5 years, respectively. The all had been treated with primary redression and plaster of Paris during the first 2 weeks of life and later with elongation of the achilles tendon and radical loosening of soft tissues. In addition one of the patients had been treated with the Evan's operation. At the time of Ilizarov operation the patients had relapse of all components (equinus, varus, adduction and supination of the forefoot), dense scar tissue posteriorly and a hypoplastic achilles tendon.

Results: The average treatment time in the Ilizarov frame was 96 (78–115) days. After removal of the frame the patients were treated with a spica cast for 6 weeks and later with a redressing splint orthosis and orthopaedic footwear. Superficial pin secretion occured during use of the frame in all patients and was treated with antibiotics. The observation time after removal of the cast was 16–52 weeks in this study. One patient had a moderate recurrence of the forefoot adduction which was treated with redressment. The final

clinical result was excellent in all patients.

Conclusion: The Ilizarov method for external fixation and correction represents a useful alternative in the treatment of recurrent club foot in previously operated children. The method allows for a controlled correction of soft tissues without shortening of the foot. The patients tolerated the treatment well and with the frame on they participated actively in playing at school and in kindergarten.

Ultrasonography in the diagnosis of congenital hip dysplasia

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The aim was to evaluate to what extent ultrasonography (US) can replace radiography as the primary imaging technique in clinical suspicion of hip dysplasia (HD).

Patients and methods: 566 children, 1–23 months of age, were referred for clinical suspicion of HD. Their hip joints were examined by US, using longitudinal scanning from the lateral aspect. In infants without ossification center, the coverage of the cartilaginous femoral head was measured (femoral head coverage, FHC). When the ossification center had appeared, the distance from the lateral tangent of this center to the lateral bony acetabular rim was measured (lateral head distance, LHD). In patients with pathological findings by US, a conventional radiograph was obtained.

Results: By ultrasonography, 95% of the children had normal hip joints. The mean FHC in normal hips was 59% and the lower normal limit (mean – 2SD) was 48%. The mean LHD in normal hips was 0 mm and the upper normal limit (mean + 2SD) was 3 mm. There was a good accordance between US and radiography. All 18 hips with the most serious HD by ultrasound, i.e. subluxation and dislocation, had similar findings by radiography. The lateral head distance was measured by both methods; the correlation was high (r=0.93).

Conclusions: When ultrasonography is used as the primary imaging method in patients referred for clinical suspicion of HD, radiography can be omitted in more than 90% of the patients. Measurements of femoral head coverage and lateral head distance are reliable methods in the assessment of hip joints in infants.