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HAND/UPPER EXTREMITY

The treatment of subcapital fractures of the fourth and fifth metacarpals—a prospective randomised study of three different types of immobilisation

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The aim of the study was to compare three different types of immobilisation in treating subcapital fractures of the fourth and fifth metacarpals.

A total of 105 patients with subcapital fractures of the fourth or fifth metacarpal bone were randomised into three different types of immobilisation: dorso-ulnar plaster of Paris from PIP-joint to elbow, functional brace around the wrist or elastic bandage. Twenty patients (19%) had to be excluded for different reasons leaving 85 patients in the study.

Follow-up examination after 4 weeks and 3 months.

At the 4-week follow-up the patients treated with an elastic bandage alone claimed significantly more pain than patients in the other 2 groups, but there was no difference between the 3 groups concerning fracture tenderness. Patients treated with a plaster of Paris had significantly less movement in the MP-joint compared to the two other groups.

At the 3-months follow-up the group treated with elastic bandage alone had significantly less movement in the MP-joint compared to the 2 other groups. There was no difference in patient satisfaction between the 3 different groups.

In conclusion, there was no difference between patient satisfaction in the three different types of treatment. The functional brace was in our opinion superior to the two other types of immobilisation: the patients had as little pain as the patients treated with plaster of Paris and less pain than patients treated with elastic bandage. Patients treated with functional brace was mobilised as fast as patients treated with elastic bandage and faster as patients treated with plaster of Paris.

Based on these findings, we recommend the functional brace for immobilisation of subcapital fractures of the fourth and fifth metacarpals.

Bias in measuring fracture angulation in distal radius fractures as a result of rotation of the object

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The aim of the study was to investigate the bias in measuring fracture angulation on radiographs as a result of rotation of the x-ray camera or the object from the direct AP-view or side-view.

We did the following investigations:

1. *In vivo model.* In a Colles-fracture with a dorsal angulation of 32° (in the direct side-view) we rotated the x-ray camera 10° in each direction and measured the angle on the new radiograph. In both directions the angle after the rotation was measured to be 31°.

2. *Experimental model.* In a bone from a Deer we made an osteotomy of 50° and a K-wire fixation. We then rotated the x-ray camera 10°, 20° and 30° and measured the change in the measured angle to 50°, 48° and 42° respectively.

3. *Computer simulation.* In a 3-D simulation we were able to measure the change in different angles as a function of rotation. The results showed, p. ex. in an true angle of 20° rotation had to be more than 20° to result in a bias of more than 10%.

4. *Mathematical formula.* In order to make a universal way to determine the bias in measuring fracture angulation, we developed a mathematical formula. This formula confirmed the findings from the three other investigations, and is in our opinion capable of giving an impression of the bias in measuring a given angle with a given rotation.

In conclusion, rotation of 20°–30° does in most instances not result in a bias of more than 10–15%. Using a mathematical formula, it is possible to calculate the exact bias resulting from rotation.

Management of the minimally displaced Colles fracture—a controlled study on 1 or 3 weeks of immobilisation

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Reduction of the immobilisation period in the treatment of patients with Colles fractures may enhance recovery but carries with it an increased risk of malunion. A controlled randomised study was performed to assess if the immobilisation period in minimally displaced Colles fractures could be reduced to one week without jeopardising union.

Patients and methods: 62 consecutive patients with undisplaced or minimally displaced Colles fractures were allocated at random for immobilisation in a dorsal plaster slab for one week (group A) or three weeks (group B). Clinical and radiological follow-up was undertaken after 12 weeks and clinical evaluation after 26 weeks.

Results: 22 patients in group A and 26 patients in group B completed the study. Age and gender did not differ.

The functional and radiological outcome showed no statistical difference in the two groups.

Conclusion: Patients with undisplaced or minimally displaced Colles fractures can be safely managed with only one week of immobilisation in a plaster slab. However, the short treatment period does not accelerate recovery.

T-plate fixation in unstable Smith fractures

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Fractures of the distal radius with volar displacement are often too unstable for treatment with manipulation under anaesthesia followed by plaster immobilisation. In a number of patients we observed collapse of the fracture in spite of initial anatomical reduction and T-plate fixation.

A retrospective study was conducted in order to assess the radiographic and functional outcome in these very unstable fractures.

Patients and methods: From 1988 and 1994, 33 patients with Smith type fractures too unstable for non-operative treatment underwent open reduction and internal fixation with a T-plate. In two patients additional external fixation was applied and 7 patients were immobilised in a plaster.

Follow-up of 19 patients was done after median 43 (27–66) months as 7 patients were too weak for participation and 7 patients died from unrelated reasons prior to follow up.

Results: The median shortening of the radial styloid was 5 (–1 to 17) mm. The median angulation amounted to 8° (–2° to 50°). Ten patients showed no signs of osteoarthritis, whereas 9 had mild OA changes.

Employing the Gartland & Werley functional score as modified by Solgaard, 14 patients were classified as excellent or good and 4 as fair. 1 patient was classified as poor. 16 patients were satisfied with the outcome. 3 patients complained of pain and limitation of function.

Conclusion: In spite of initial anatomical reduction and fixation, a number of Smith fractures redisplace or collapse. Radiographic control 10 to 14 days after surgery may be indicated allowing for additional external fixation should redislocation occur.

Follow-up in replantation in children

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All traumatic amputations in children should be seriously considered for possible replantation. In attempt to salvage even very severely damaged parts the indications are therefore more inclusive than in adults. Long term follow-up showed that epiphyseal growth do occur after successful replantation.

Patients and methods: The replantation centre performed replantation/revascularisation in 43 children under 16 years of age in the 15-year period from 1980 to 1994. The average age was 8 (1.5–15.7) years. Macro-replantations included 9 children (5 replant./ 4 revasc.) and micro-replantation 34 children (17 replant./ 17 revasc.). The most frequent type of accident were amputation caused by lawn mowers. Of the 10 children in this group, 7 had amputations of the foot. Agriculture machinery caused amputations in 9 children, and saw blades were responsible for another 6 amputation. Most mutilating were meat mincers. In 4 children of this group 17 fingers were replanted, but only 7 fingers survived.

Results: All the macro-replantations survived. There were 11 failures among the micro-replantations, which was an over-all survival rate at 75%. About 25% had reiterated surgery of the vessels, and 55% had other re-operations, only 10% because of infection. The results of the follow-up are presented including functional status according to Tamai and to Ipsen et al., assessment of bone growth evaluated by radiography, influence on the course of school and education, and the patient's and families' impression of the operative and post-operative procedures and results. The follow-up time is in average 7 years and 10 months (10 months to 15 years and 10 months).

Conclusion: The main impression is that the children cope with the replanted extremities quite well. However, about 60% of the amputations were sustained in accidents, which might have been avoided by preventive measures and caution.

Results of conservative treatment of traumatic primary anterior shoulder dislocation correlated to initial arthroscopic findings—a prospective study of 39 young patients

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Traumatic primary anterior shoulder dislocation (TPASD) is associated with intraarticular lesions in young patients. The aim of the present study was to evaluate intra- and extraarticular prognostic factors for recurrence after conservative treatment of young patients after TPASD.

Patients and method: 76 patients were arthroscoped after TPASD and 39 patients were randomised to conservative treatment. Postoperatively the patients were immobilised and received standard rehabilitation. Activity level prior to arthroscopy was recorded and at follow-up 6, 12 and 24 months post-op instability, Constant score, apprehension/load and shift test were recorded.

Results: Average age was 21 (15–31) years with 32 men and 7 women. Arthroscopic examination revealed 39 anterior/extralabral lesions (24 total, 12 glenolabral and 3 isolated capsulolabral) and 29 Hill Sachs lesions and 5 osseous Bankart lesions. Median follow-up was 36 (24–46) months. Median Constant Score after 6 months was 93 (77–100), 12 months 89 (74–100) and 24 months 95 (83–100). 20 patients had recurrence (1–12), 80% of the recurrent dislocations occurred within the first two years. 16 of all patients with recurrence had a total capsulolabral lesion involving the IGHL-complex and 70% of the patients who redislocated within 12 months had an extensive total capsulolabral detachment combined with a Hill Sachs lesion. Among those without recurrent dislocations 11 complained of instability (subluxation), 10 had an apprehensive shoulder, 9 experienced clicking sensations and 7 had symptoms of a dead arm syndrome. 65% of the patients with subluxations and an apprehensive shoulder had a capsulolabral lesion with an associated IGHL-lesion.

Conclusion: This study revealed that treated conservatively a recurrence rate of 51% was found after 3 years. A total extralabral anterior detachment with lesion of the IGHL-complex was found in 80% of the TPASD-patients with recurrence. 65% of the TPASD-patients without recurrence had severe shoulder symptoms after 3 years.

SPINE/PELVIS/MULTITRAUMA

Spondylolisthesis and degenerative disease of the lumbar spine—a comparative study with four years of follow-up

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Posterolateral lumbar fusion with pedicle screw technique is generally accepted as an option treating spondylolisthesis with intractable pain. The technique however is more controversial when dealing with degenerative disease of the lumbar spine. The purpose of this study was to compare the clinical outcome after spinal fusion of spondylolisthesis and degenerative disease of the lumbar spine.

Patients and methods: 127 patients were included in the study. 71 had a primary arcolytic spondylolisthesis (group 1) and 56 had degenerative lumbar disease (group 2). All patients were operated on by two surgeons in the same period of time. 112 (88%) of the patients returned a questionnaire median 4 years after surgery. Median age at time of operation was 45 years.

Results: There were no differences in clinical outcome between the groups. Thus 71% of the patients in group 1 stated satisfaction with the postoperative result compared to 68% of patients in group 2. In group 1, 66% of the patients had reduced the use of analgesics compared to 58% in group 2. About 22% in both groups had improved their vocational status. The overall refusion rate was 9% in both groups. The rate of operatively verified pseudarthrosis was 6% in group 1 and 4% in group 2.

Conclusion: These results shows that clinical outcome after fusion of the degenerative lumbar spine is satisfactory and comparable to the outcome after fusion of primary arcolytic spondylolisthesis and should as such be considered as an option for degenerative disease of the lumbar spine.

Partial reduction and 360° fusion in grade III–V spondylolisthesis in adolescent and young patients

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The purpose of this study was to describe and evaluate the radiographic and functional outcome in spondylolisthesis grade III–V, treated with neural decompression, partial reduction and 360° fusion.

Material and methods: 11 patients treated with posterior L4–S1 CDI, partial reduction and posterolateral fusion followed by anterior fusion L5–S1 a.m. Kellogg-Speed. Mean follow-up was 18 (6–52) months. Indications for surgery

were spondylolisthesis grade III-V combined with pain and/or neurological deficit. Anterior slip, slip angle, L4/S1 and the sagittal rotation angle was measured. Functional outcome was evaluated by pain and work status.

Results: Mean age was 23 (11–31) years. All were women. Mean anterior slip was 82% preoperatively, 75% postoperatively and 75% at follow-up. Mean slip angle was 10° preoperatively, -2° postoperatively and 1° at follow-up. The anterior slip, slip-angle, L4/S1 and SRA were significantly improved from preoperative to follow-up. Mean back pain score was 1.5 (0–6) and mean leg pain score was 1.3 (0–7). Complications: one patient developed a hematoma. None had neurological, thromboembolic or lung complications. There were no implant failures, late infections, pseudoarthrosis or reoperations. 73% were back to previous levels of employment at follow-up.

Conclusion: 360° fusion and partial reduction was a safe method and provided a stable and rigid fixation with partial reduction of the deformity, permitting neural recovery and a satisfactory functional outcome.

Reference: Mannicke C et al. Low back pain rating scale: Validation and tool for assessment of low back pain. *Pain* 1994; 57: 317

Surgery of malignant curves in children with subcutaneous Harrington rod

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Scoliotic curves in small children are a challenge to treat. In some children you are able to control the curves in braces or plastercast. Despite bracing some curves will progress.

The aim of the present study was to evaluate the curve corrections in scoliotic children operated with a subcutaneous Harrington rod followed by distraction on the rod.

Patients and methods: The material consists all children referred to the pediatric orthopedic department with progressing curves. A total of 9 patients, 6 girls and 3 boys were treated. 3 patients suffered of Recklinghausen's disease, 2 juvenile scoliosis, 1 myelomeningocele, 1 cerebral palsy, 1 congenital scoliosis and 1 radiotherapy sequelae.

The curves were measured with Cobb's method and the inclination of the End Vertebra Angles (EVA). The rotation of the apex vertebra were measured with Pedrioli's method. The range of Cobb angles were 81° (62°–116°). The mean age at surgery were 6.3 (3.5–9.9) years.

Results: In all patients the curves progressed, 23° (59°–81°), from the time of referral to the operation. At the operation the mean correction of the Cobb angles were 20° (-6° to 46°). There was no change in the inclination of the vertebra where the hooks were attached.

There were no reduction of the patients neurological status and no infections. In one patient the proximal hook cut through the lamina, which required reoperation.

Conclusion: A progressive curve can be controlled with a

subcutaneous rod with some reduction of the Cobb angle. It is a safe procedure with no serious complications.

Predictability of spinal fusion by autologous bone culture

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In a attempt to create a clinical predictor for patient related factors we investigated the relationship between *in vitro* osteoblast proliferation from autologous bone graft in lumbar spinal fusion. The aim of the study was first to analyse the relationship between *in vitro* osteoblast proliferation and clinical bony fusion in the individual patient and secondly to measure the effect of preoperative tobacco smoking on the osteoblast proliferation.

Patients and methods: This prospective study comprised 61 patients, mean age 46 (21–73) years, 22 men and 39 women, underwent one- or two-level lumbar spinal fusion in the period 1994–1995 due to disc degeneration (33) or isthmic spondylolisthesis (28). 37 received pedicle screws and 24 posterolateral fusion alone. Spine fusion was blindly evaluated at 1-year follow-up (AP and flexion/extension radiographs). Functional outcome was measured by Dallas Pain Questionnaire. During surgery 1 gram of autogenous iliac bone graft was harvested and used for culturing. The osteoblast were grown in Earle's MEM, supplemented with 10% heat-inactivated fetal calf serum, streptomycin and penicillin G. The cultures were classified as excellent (near confluence and passage with in 4 weeks), good (passage 4 to 6 weeks) and negative (no or poor growth).

Results: Bone fusion was obtained in 77% of patients. A poorer osteoblast proliferation was found by age ($p < 0.01$). There were no significant influence of sex, diagnosis, previous spine surgery, preoperative walking distance or preoperative tobacco consumption on osteoblast proliferation. We found no correlation between osteoblast proliferation and functional outcome. Likewise there was no significant correlation between osteoblast proliferation and spinal fusion.

Conclusion: In the present study there was no influence of the osteoblast proliferation on radiological- and functional outcome. The negative correlation between age and osteoblast proliferation supports the important negative biological influence on bone fusion by age. The lack of influence of preoperative tobacco consumption in relation to osteoblast proliferation is in accordance with the concept of an inhibition of angiogenesis in the fusion mass by nicotine.

3D-surface measurement in adolescent idiopathic scoliosis during CD-instrumentation

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The most important parameter for the surgeons in measuring the scoliosis curve have always been the Cobb-angle, which describes the magnitude of the lateral curvature. In Adolescent Idiopathic Scoliosis, the Patients sees the Ribhump as the most important problem.

The ribhump, the ribcage deformity, is the result of asymmetric ribchanges and rotation of the vertebrae at the apex of the curve. Some authors claim that the ribhump is corrected by derotation of the vertebrae, but only few have analysed the correction, and none have focused on the peroperative correction in the different operative procedures during the CD-instrumentation.

Patients and methods: We used a Spinal Pantograf, which delivers a copy of the contours of the patients backsurface. This was done peroperatively, after insertion of the first rod and the derotation procedure, and after insertion of the second rod. 8 patients with flexible King Type 3 adolescent idiopathic scoliosis, i.e. thoracic single curves, underwent this former measurement during a normal CD-instrumentation.

From these drawings we measured the angulation of the most tilted thoracic and lumbar contourline, relative to the horizontal sacral line.

Results: The median values were 12° preoperatively, 9.9° after insertion of the first rod, and 9.1° after insertion of the second rod in the thoracic area. Only small and clinical insignificant changes occurred in the lumbar area. The corrections were therefore 2.1° (80%) and 0.8° (20%) for the first and second rods, respectively. The total correction was 2.9°; 25% under the preoperative value.

Conclusion: The 80% correction by the first rod is in conjunction with the clinical findings by most surgeons. The reduction of the ribhump by 25% corresponds to earlier findings that the operative derotation in CD-instrumentation are around the same figures. Although the main goal of the operation is to stop progression, it is somewhat disappointing that the ribhump correction is no better than 25%, and one could say, that the contentment of the patients regarding correction of the ribhump, could be explained by the inability in performing the forward bending test postoperatively.

School-screening for adolescent idiopathic scoliosis—a prevalence study

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During the last years the question has been brought up, if the prevalence of adolescent idiopathic scoliosis (AIS) is declining, or if the referral rate is decreasing.

These questions has led us to the study of the prevalence of the AIS among children of 10–12 years of age.

Patients and method: All children in the town of Hillerød who attended 3. or 5. grade in the school year of 1995/1996 were offered to participate in the screening-programme. Of the 628 children, 456 were examined (73%). The children were examined by forward bending test and measurement of the trunk rotation, if any, was done by scoliometer. The limit of referral to radiography was an axial trunk rotation of >7°.

Results: Of the 456 examined children we detected 14 children with axial trunk rotation >7°. That is a prevalence of 3%.

Conclusion: This study shows the same prevalence of AIS as Bunell & Willner demonstrated in earlier studies. As we found no indication of the prevalence of scoliosis being declining a decreased referral rate must imply that we are missing some children with a significant scoliosis.

Cannulated screw fixation of sacral fractures and sacroiliac joint disruptions

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A number of techniques has been introduced to obtain reduction and fixation of horizontal and vertical unstable SI joint disruption and sacral fractures. Posterior plating with heavy metal plates gives skin and soft tissue problems and infection. Anterior plating might be technically difficult as a result of bleeding and there is also a potential risk of injury to the lumbo-sacral trunk. The purpose of this work is to report our experience with posterior percutaneous cannulated ASIF screw across the joint or fracture line.

Patients and methods: 15 consecutive patients (7 male) were operated Dec. 1994 to June 1996. All patients had a rotational and vertical unstable SI joint disruption type C (Tile). 9 patients had severe associated visceral organ injuries.

Results: 6 patients with only bony damage were operated with cannulated screws only. Operating time approx. 1 hour, little blood loss. Patient with organ injuries (9) underwent a much prolonged operation due to the surgical needs. Operating time approx. 5 hour, blood loss approx. 1.5 l. No non-union was seen and there was no deep infection. In two patients the material had to be removed.

Conclusion: Cannulated screws gives adequate fixation of vertical and rotational unstable SI joint disruptions and sacral fractures. Short operating time, minimal bleeding and no soft tissue damage allows immediate non-weight bearing mobilisation and short hospitalisation time. The method is technically difficult as malposition of the screws might cause fatal perioperative complications.

Serum Gc-globulin in multi-trauma patients

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Late death after multi-trauma is predominately caused by multiple organ failure (MOF), but the pathophysiology behind this condition is far from understood. Gc-globulin is a plasma protein synthesised in the liver, and it plays an important role in the binding and removal of actin released into the extracellular space after cell death. Clinical data have shown that reduced levels of serum Gc-globulin, may play a role in the development of MOF in sepsis and hepatic failure. The purpose of the present study was to measure serum Gc-globulin and Gc-globulin complexed to actin in patients with multiple trauma.

Patients and methods: 12 patients were included in the study. 6 men and 6 women, with a median age of 31 (19–79) years. The median ISS was 22 (15–50). All patients had blood samples taken at the arrival to the emergency department, and daily during the following week. The method of analyses was rocket immunoelectrophoresis, and normal values of serum Gc-globulin and Gc-globulin complexed to actin were obtained from 12 blood donors. Mann-Whitney test was used for comparison between survivors and non-survivors, and Spearman's test was used for correlation between serum Gc-globulin and ISS. A significance level of 0.05 was chosen. The study was approved by the local ethics committee.

Results: In all the patients the Gc-globulin level on admission was significantly reduced compared with normal controls: 143 (84–215) mg/L vs. 365 (308–422) mg/L and the complex ratio was increased to 44% (26–62%) vs. 15% (5–20%). The level of Gc-globulin within the first week after the trauma was significantly correlated to the ISS ($r = -0.72$). 4 patients died, and the mean level of Gc-globulin the first week after trauma, was significantly reduced compared to the 8 patients who survived.

Conclusion: To our knowledge these data are the first to show that the serum level of Gc-globulin is significantly reduced in trauma patients. The reduction takes place within 60 minutes after injury. This could indicate that Gc-globulin plays a role in the early inflammatory systemic stress response after trauma, since the normal plasma half time of Gc-globulin is in the order of 12 to 24 hours. Finally, the results suggest that serum Gc-globulin in the early phase after multi-trauma may be predictive of survival.

HIP

Boneloc cement and the Exeter hip—5-year results

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At an elapsed time of 5 years, we re-reviewed a consecutive series of 42 primary Exeter hip replacements in which Boneloc cement had been used. Clinical and radiographic examination was performed with special interest in subsidence and early aseptic loosening.

Material and methods: At the follow-up, 35 hips were available. 20 women and 14 men with a diagnosis of primary osteoarthritis in 33 patients and rheumatoid arthritis in one patient were examined at a mean time of 57 (51–62) months postoperatively. Clinical results were evaluated by Harris hip-score.

Results: Subsidence ≥ 2 mm was found in 31 of 35 hips (88%) without relation to clinical results. The mean value of subsidence was 3.34 (0–10) mm. Osteolysis in cement-bone interphase in more than one zone was found in three hips without clinical symptoms and in one hip with definite loosening.

Conclusion: The 5-year results after primary Exeter hip replacement and Boneloc cement do not seem to indicate greater tendency of early aseptic loosening in comparison with materials where Simplex cement has been used. However, there is an increased subsidence between femur stem and Boneloc cement. At the 2-year follow-up on the same group of patients, subsidence ≥ 2 mm was found in 62% of the hips. The mean value of subsidence was 2.14 (0–8) mm. Whether this creep will continue after 5 years will require further observation time.

Boneloc cemented Exeter hip arthroplasty—5 years follow up

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Boneloc cement was introduced in our department in January 1991 because of environmental reasons. Unfortunately unacceptable high rates of aseptic loosening especially of Boneloc cemented Charnley prosthesis have been reported, why the quality of Boneloc in hip arthroplasty has been queried.

The aim of the present study is to evaluate the frequency of aseptic loosening in and the clinical performance of Boneloc cemented Exeter hip arthroplasty.

Patients and methods: From January 1991 to March 1992 129 Boneloc cemented Exeter arthroplasties were performed by six surgeons. Two hips were revised because of deep infection, 21 patients have died, to our knowledge all with the prosthesis in situ. Six patients would not or could not attend

follow up examination but reported good hip function by telephone. This leaves 100 hips in 93 patients for clinical and radiographical follow up examination 56.6 (50–62) months after the operation.

Results: In 2 patients the femoral stem was revised because of aseptic loosening between 4 and 5 years after the operation. The acetabular cup was revised too in both patients but was found loose in only 1 patient. In a third patient the metal backed acetabular cup was revised because of aseptic loosening. For the surviving 98 prostheses the average Harris Hip Score was 87.6 (43–100) and the average Pain Score 42.2 (10–44). 89 % of the patients were satisfied or very satisfied with their hip and 11 % were more or less unsatisfied (revisions included).

Radiographs revealed definite loosening of 2 stems and 2 cups, probably loosening of 1 stem and 2 cups and possibly loosening of 4 stems and 1 cup. In the remainder the prosthesis-cement-bone interfaces looked quite good, except for a significant subsidence of the stem averaging 4.2 (0–16) mm. In 56 hips the stem subsided averagely 1.5 mm/year during the first 28 months, but only 0.3 mm/year during the following 31 months.

Conclusion: In this series of hip arthroplasty with the polished tapered collarless Exeter stem, Boneloc cement has performed quite well for 5 years with a low revision rate for aseptic loosening, but a worrisome radiographical appearance in a few patients.

Uncemented hip arthroplasty with the Profile stem—7 years experience

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Uncemented hip arthroplasty still is controversial because of reported high rates of aseptic loosening, progressive osteolysis and inferior clinical performance, especially thigh pain. This study presents the short to intermediate clinical and radiographical results of a new anatomic femoral stem design.

Material and methods: From a series of 338 uncemented Profile femoral stems performed from June 1989 to February 1996, two consecutive prospective and pseudorandomized series of 59 and 100 hips respectively were followed clinically and radiographically for 2–5 years. Every second patient received a hydroxyapatite coated stem and the remainder a control stem, pressfit in the first and porous coated in the second series. A porous coated hemispherical acetabular cup with three spikes was implanted in all hips. Average age of the 139 patients was 54.8 (22–66) years and only two surgeons performed the operations.

Results: Peri- and postoperative local complications were few except for prosthetic dislocation in 8%, and polyethylene failure in 4% causing a reoperation rate of 5%. No deep infections have developed. Three pressfit stems have been revised, two because of aseptic loosening and one because of traumatic fracture around the stem. Life tables reveal a cumulative survival of the Profile stem of 98.7% at 5 years and

100% for both hydroxyapatite- and porous stems at 5 and 4 years respectively. In the total population of 338 Profile stems the revision rate was 1.5 % within 7 years.

The clinical performance is outstanding with a Harris Hip Score of 94.4 to 95.7 and a Pain Score of 42.7 to 43.2 from 1 to 5 years after the operation. Only a few patients experienced intermittent slight thigh pain. The radiographic evaluation is very encouraging with osseointegration in all but 2 Pressfit stems, stress-shielding in 12 hips, subsidence in 14 hips, minor osteolysis in 3 hips and significant radiolucent lines in only 5 hips.

Conclusion: The uncemented hydroxyapatite- and porous coated Profile stem has performed very satisfactory both clinically and radiographically in the short to intermediate term.

10-year follow-up study of 347 non-cemented Harris-Galante I hemispheric acetabular cups

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We present a 10-year follow-up study of the non-cemented Harris-Galante I acetabular cup (HGI).

Patients and methods: The HGI was introduced in our department July 1985. 347 primary total hip arthroplasties were performed consecutively with this cup in 146 male and 175 female patients from July 1985 through December 1987. This was combined with a cemented (324 cases) or uncemented (23 cases) Müller type femoral component. 26 patients were operated bilaterally. The age of the patients at the time of operation was 67 (19–86) years. 76% of the arthroplasties were performed due to arthrosis, 5% due to rheumatoid arthritis, 11% due to problems following fracture in the hip region and 8% due to other reasons. In the first part of 1996 all patients with a non-revised cup were called for a clinical and radiological examination.

Results: At follow-up 106 patients representing 113 hip replacements had died. 17 HGI had been revised: 2 due to aseptic loosening, 5 due to infection, 6 due to recurrent dislocations, 4 due to other reasons. 16 femoral components had been revised leaving the HGI intact, while another 3 femoral components are planned to be revised. 24 patients representing 29 hips were unwilling or unable to participate in the study, while 2 hips could not be traced. 177 patients with 190 cups had a radiological and clinical examination. The median follow-up was 111 (101–131) months. At the follow-up examination 1 cup was loose. The median pain score (limits 0–44) in the Harris Hip pain rating system in the non-revised cups was 44 (average 39). 85% classified the result 10 years after the operation as excellent or good.

Conclusion: The radiological and clinical results of non-revised patients operated with the HGI cup reveal satisfying results, and so far only two patients have been revised for aseptic loosening.

Bone remodelling following Ranawat/Burstein vs. Bi-metric uncemented femoral stem—a prospective randomised study with 1 year follow-up

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Bone loss in the proximal femur is commonly seen after total hip arthroplasty both cemented and uncemented but the significance of implant design on bone remodelling remains unclear.

Materials and methods: 12 consecutive patients were randomised. BMD was measured by DEXA postoperatively and at 3, 6, and 12 months follow-up. Five regions of interest (ROI) were chosen in the proximal femur. ROI-1: at the calcar and ROI-2 just below it. ROI-3 and 4 were at the same level but lateral of the stem. ROI-5: beneath the tip of the stem.

Results: BMD decreased up to 21% in the medial regions in the proximal femur when comparing postoperative values with the 12 months values. At 12 months follow-up the BMD at the medial site decreased 5% (ROI-1) to 15% (ROI-2) more in the Ranawat/Burstein group than in the Bi-metric group. The difference between the two groups were even greater during the first 6 months followed by a tendency towards equalised levels of BMD at 12 months follow-up. At the tip of the stem the BMD increased in both groups from 3 to 12 months exceeding the preoperative level in the Bi-metric group giving a net gain of bone mineral in this group.

Conclusion: These preliminary 1 year results shows greater bone loss especially at the medial proximal femur after insertion of Ranawat/Burstein stem compared to Bi-metric stem.

Hip revision without changing the acetabular cup

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In hip revision for aseptic loosening of the femoral stem we have preserved the acetabular cup when it was found well fixed. The aim of the present study is to assess if this treatment policy is justified.

Patients and methods: 154 consecutive uncemented hip revisions were followed for 2 to 10 years, averagely 68 months. In 70 of these hips the cemented acetabular cup was not considered loose and therefore not revised. During the follow up period 10 patients with 11 hips died. The remainder was called for a radiographical and clinical examination including a Harris hip score from 28 to 115 months after the revision operation.

Results: Two patients could not attend because of poor

general health, but both reported good hip status. Three hips had been revised because of deep infection, and 11 hips (16%) have had a secondary operation with revision of the acetabular cup because of aseptic loosening. Life tables reveal a cumulative cup survival of 89% at 5 years and 62% at 10 years, which is well within the survival range for cemented cup revision reported in the literature. In the remainder 43 hips radiographs did not show significant loosening of the acetabular cup and the average Harris hip score in these patients was 89 with a pain score of 42, supporting the good function of these cups. In the 11 hips with secondary acetabular cup revision all radiographs were scrutinised, but no cup migration or osteolysis was revealed. However, radiolucent lines of maximum 2 mm in three or more zones were found in 7 of these hips and cement fracture in further 2 hips. Seen in retrospect these 9 cups probably should have been revised at the index revision operation.

Conclusion: In hip revision for aseptic loosening of the femoral stem it is not necessary to revise well fixed acetabular cups carefully judged by preoperative radiographs and during the operation. Our current policy is to revise the cup, if radiographs show continuous radiolucent lines in more than 3 zones, cement fracture, cup migration, osteolysis or if the cup is not absolutely stable tested during the operation.

Dall Miles system in revision hip surgery

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The treatment of fractures around the femoral part of hip prostheses is a serious problem. Partridge cables and stainless steel cables have a great tendency to break or kink and thereby fail. The Dall Miles system is based on multifilament vitallium cables and plates in varying lengths. For the treatment of osteotomies on the greater trochanter a special trochanter grip is used. The system has been used in our department from January 1993 for the treatment of fractures and cortical windows in revision hip arthroplasty.

Patients and method: During a 3-year period from January 1993 we have done 121 revision arthroplasties. In 33 of these we have used the Dall Miles system. 2 patients died before 3 months postoperatively and are not included in the study. The system was used prophylactically in 5 cases, to treat a fracture around the prostheses in 22 cases, and to treat a cortical window in 4 cases. There is a mean follow-up at 12 (3–36) months. In all, we have used 168 cables, 11 plates and 2 trochanter grips.

Results: 9 patients were mobilised with no support restrictions from the first postoperative day, 20 were mobilised with limited support for 6–8 weeks and 2 patients were not allowed full weight-bearing before 3 months postoperatively. We have had no serious failures and no refractures. We have experienced loosening of two cables and that happened in connection with a traumatic luxation of the prosthesis more than 3 months postoperatively when the patient had been fully mobilised. In 3 patients we saw usurs under a total

number of 5 cerclages, range 1–3. None of these patients have had any symptoms from the hip prostheses. One patient had superficial infection treated with antibiotics and no deep infections were observed. The cables are tightened manually until taut and in 4 patients we have observed a depression in the cortex on the first postoperative radiograph taken. It does not seem to be of significant importance.

Conclusion: The Dall Miles system has proved its value in our department. It is relatively simple to handle and we have had no serious failures. The development of usurs under the prosthesis does not seem to be of significant importance even though a study has been published on fractures in revision hip arthroplasties because of cortical resorption under Dall Miles cerclages. This study included 6 patients with 4 fractures. We have had no re-fractures and all fractures and cortical windows have healed.

Evaluation of femoral hip arthroplasty revisions using impacted cancellous bone grafting

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Patients and methods: Hip revision arthroplasty was performed in 118 patients from June 1992 until December 1995. In 22 patients massive impacted cancellous bone grafting was performed with a cemented standard Exeter femoral prosthesis as the only revision procedure.

Results: The mean preoperative Harris Hip Score was 39.

At follow-up 18 (6–41) months postoperative, no patient had been revised, no case of deep infection, no case of deep thrombosis. A mean Harris Hip Score of 88 (65–100). 19 patients had a pain score of 40 or more. Radiographs showed subsidence less than 1 mm.

Conclusion: Using a standard cemented Exeter prosthesis with impacted cancellous bone grafting of femur is in our hands a reproducible procedure which in the short term shows promising results.

Revision THA by uncemented femoral stem and morcelized impacted bone grafting technique—a study on bone remodelling using DEXA

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In the present study we prospectively measured the changes in BMD in the proximal femur after revision of cemented femoral components using uncemented proximal porous coated, Titanium long-stem prosthesis with morcelized impacted bone-grafting technique.

Patients and methods: BMD was measured by DEXA in 8 consecutive patients. Measurements of periprosthetic BNM

and BMC bilaterally in the proximal tibia were performed postoperatively and at 3, 6, and 12 months follow-up. Five regions of interest (ROI) were measured in the femur. ROI-1: at the calcar and ROI-2 just below it. ROI-3 and 4 were at the same level but lateral to the stem. ROI-5: just below tip of the stem.

Results: BMD decreased 20–33% in the proximal femur with the greatest loss in ROI-1. Correspondingly at the tip of the stem a decrease of 12% was seen. In the proximal tibia on the non-operated site an increase of 16% was found during the first 6 months. In the same period of time the BMC increased 28% on the operated site. An overall loss of bone of 20% was found at the non-operated site at 12 months follow-up compared to an increase of 7% on the operated site.

Conclusion: A net bone loss of only 13% has been found in the region at the calcar site. This and the fact that the bone mineral content in the proximal tibia at the operated site showed an increase, support the aim of the treatment of failed primary hip prosthesis with this technique.

Finite element analysis of a Ranawat/Burstein femoral stem and bone remodelling correlated to bone mineral density measurements *in vivo*

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Stress shielding is considered one of the factors causing bone loss in THA. We have correlated changes in bone mineral density (BMD) measured by DEXA to modified remodelling rules based on strain energy density (SED) in order to calculate the time constant: t .

Material and methods: The 2D side-plate FE-models were built based on a DEXA scanplot from a patient operated on with insertion of an uncemented Ranawat/Burstein femoral stem. The bone-implant interface was defined non-linear. Material properties were assigned based on the specific BMD measurements in Gruen's zones postoperatively, 3, 6 and 12 months after surgery.

In order to evaluate material properties: DEXA-scans and Compression tests were performed on the proximal tibia in 14 cadaveric knees. Multiplicative regression analysis showed a relationship between BMD and Young's Modulus ($r^2 = 53.53$):

$$E \text{ (MPa)} = 5.6436 * \text{BMD (g/cm}^2\text{)}^{2.42}$$

The modified 'non-site-specific' remodelling rules were based on a signal derived over a representative set of daily loading cycles:

$$\frac{dr}{dt} = t * (S_x - S_{x-1})^y = t * \left(\frac{\text{SED}_{r_x} - \text{SED}_{r_{x-1}}}{r_x - r_{x-1}} \right)^y$$

if $S_x < S_{x-1}$ $y=2$ or if $S_x > S_{x-1}$ $y=3$

Results: t was for the Gruen zone 4 (6–12 months postop.) 8.21 gr/(m²(j/gr)*6 month).

Conclusion: It is possible to determine the time constant t for remodelling rules based on SED for Gruen zone 4 in one

patient and the postoperative period from 6-12 months.

The method is based on exact data. Further studies should include bone remodelling for more patients in order to find a mean value of the time constant t .

HIP FRACTURES

Treatment of femoral neck fractures in Denmark

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There is no consensus in the treatment of femoral neck fractures in Denmark. Hip arthroplasties are expensive and osteosynthesis bear a high failure rate in displaced femoral neck fractures. We made this study to evaluate the present state in the treatment of femoral neck fractures in Denmark.

Material: A nation-wide enquiry including 56 hospitals treating femoral neck fractures.

Results: 86% (48/56) responded. The priority for operation was within 6 hours in 2% (1/48), the day of admission in 27% (13/48), the day after in 65% (31/48) or when possible in 6% (3/48). Preoperatively skin or skeletal traction was used as routine in 65% (31/48) and when needed in 35% (17/48). Treatment of displaced femoral neck fractures with primary hemiarthroplasties was used in 83% (40/48). 23 (42%) departments had preoperative criteria for the use of hemiarthroplasties. In the treatment of failed osteosynthesis of femoral neck fractures 38% (18/47) used cemented bipolar hemiarthroplasties, 21% (13/47) used uncemented bipolar prosthesis, 6% (3/47) used cemented unipolar prosthesis, 13% (6/47) used uncemented unipolar prosthesis and 15% (7/47) used total hip arthroplasties. The use of total hip arthroplasties in the treatment of failed femoral neck osteosynthesis was based on acetabular status in 26% (13/39), age in 18% (7/39) and age combined with preoperative status in 23% (9/38). The number of planned postoperative controls after osteosynthesis was 0-5, after hemiarthroplasties 0-3 and after total hip arthroplasty 0-4. 29% (14/48) of the departments could estimate their costs in the treatment of femoral neck fractures. 14 (29%) departments had routine registration of pre-, per- and postoperative data adherent to a protocol.

Discussion: We recommend treatment protocols and registration for patients with femoral neck fractures. Prospective randomised trials for pre-, per- and postoperative treatment of patients with femoral neck fractures are needed, especially concerning the use and type of hip arthroplasties.

Uppsala screws versus dynamic hip screw for internal fixation of femoral neck fractures

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In a prospective randomised study, 2 methods of internal fixation of femoral neck fractures, percutaneous osteosynthesis with 2 Uppsala screws and osteosynthesis with a dynamic hip screw (DHS) were compared.

Material and methods: During 27 months (March 1991—June 1993), 314 patients with 316 fractures were randomly assigned to treatment with either Uppsala screws or DHS. 174 were allocated to Uppsala and 142 to DHS. There were 64 nondisplaced (Garden 1 + 2) and 252 displaced (Garden 3 + 4) fractures. All patients were followed with clinical and radiographic examinations after 3, 12 and 24 months. Major (fracture) complications were registered as: early re-displacement, avascular necrosis in a non-united fracture, late segmental collapse, and deep infection.

Results: Median operation time: in the DHS group: 45 (15-125) min and in the Uppsala group: 25 (10-125) min. Median intraoperative bleeding, in the DHS group 100 (10-700) mL and in the Uppsala group 10 (0-300) mL. There was no difference in mortality rate after 3, 12 and 24 months. In the Uppsala group 125 and in the DHS group 103 patients could be followed until healing or failure. The overall healing rate were 75% in the Uppsala group and 69% in the DHS group. The corresponding figures in displaced fractures were 69% (Uppsala) and 60% (DHS). Complication rates in the 2 groups were 35% (Uppsala) and 36% (DHS). Reoperations (excl. removal of implant) in the 2 groups were 22% (Uppsala) and 23% (DHS).

Conclusion: Our results showed that percutaneous osteosynthesis with 2 Uppsala screws can be performed significantly quicker and with less blood loss than after DHS. Healing, reoperations and complications did not differ significantly in the 2 groups.

Although a significant rate of complications and reoperations, internal fixation with 2 Uppsala screws will still be our choice of treatment in most patients with femoral neck fractures.

Bipolar hemiarthroplasty vs. fixation with Olmed screws in the treatment of displaced fractures of the femoral neck

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It is still a matter of debate, whether to treat displaced (Garden type 3 and 4) fractures of the femoral neck in the elderly with screw fixation or with primary prosthetic replacement.

The purpose of this study was to compare these methods regarding consumption of resources, complications and failures during the follow-up period.

Patients and methods: Patients >74 years old primarily treated with uncemented bipolar Hastings hemiarthroplasty at SH (n=78), and patients from OUH matched with respect to age and type of fracture treated with fixation with two Olmed screws (n=98). The study comprised patients treated from 1989, Jan. 1 until 1991, Jan. 31. The two populations live under almost equal economic and social conditions.

Retrospective study of the medical records during primary hospital stay, and follow-up upon medical events and deaths until 1995, Dec. 31 using the database recordings of patients in the county of Fuenen. **Statistics:** Median values with 95% confidence intervals.

Results: (Selected): Primary hospital stay: Hastings (H) = 21 (14–28) days, Olmed (O) = 14 (11–17) days.

Operating time: H = 90 (82–98) min, O = 35 (25–45) min.

Mortality: 1 year postoperatively: H = 28%, O = 32%. 5 years postoperatively: H = 67%, O = 66%.

Serious complications: H = 9 (12%), O = 18 (18%).

Reoperations: H = 5 (6%), O = 18 (18%).

Conclusion: In our study, there seems more often to be serious complications and reoperations with screw fixation compared with the more resource consuming primary hemiarthroplasty, while mortality is equal. To decide, which standard method to prefer, a future randomised, prospective study is needed.

KNEE

10-year results of cementless total knee arthroplasty

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Whereas several reports have been published concerning long-term results after cemented total knee arthroplasty (TKA), the literature concerning cementless TKA is more sparse. We present the 10-year results of cementless TKA from Hillerød Hospital.

Patients and methods: Cementless implantation of TKA (AGC 2000) was introduced April 1984 in Hillerød. During the first two years, a total of 114 cementless TKA's were performed in 102 patients. Preliminary, 3- and 5-year results have been reported previously. At 10-years follow-up, 46 patients with 52 knees had died, leaving 56 patients with 62 knees. Five patients (5 knees) would/could not participate in the study. Thus, 57 knees were evaluated 10 years (112–130 months) after surgery with patient assessment, HSS knee rating scale, and radiographs performed under fluoroscopic control. Finally, a survivorship analysis was done.

Results: Patient assessment was enthusiastic about 44 knees, satisfied about 8 knees, non-committal about 3 knees, and disappointed about 2 knees. There was no pain in 52 knees; only one knee had a pain score of 15 or less. The median maximal flexion was 110° (65°–130°). The median knee score was 91 (66–98), and excellent or good results were obtained in 54 of the knees. Two tibial components had been revised due to aseptic loosening, and one due to septic loosening. No revisions were done after the third year. The radiographic evaluation showed that all components were stable, that none had migrated since the 5-year evaluation, and that none of the few isolated radiolucencies beneath part of the tibial tray were progressive. Osteolysis presenting as an isolated cyst was found in one knee in the lateral tibial condyle. Three knees with medial overhang ≥ 3 mm of the tibial tray were asymptomatic. No cases of polyethylene failure were seen. The cumulative success rate after 10 years was 97.1% (lower limit of 95% confidence interval = 92.9%).

Conclusion: The 10-year survival of this cementless TKA is as good as any cemented series. The radiographic evaluation shows, that when biological fixation is achieved, the bone-prosthesis interface is long-term durable.

The natural history of patellofemoral pain syndrome in athletes

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Previous studies regarding The natural history of patellofemoral pain syndrome (PFPS) has been somewhat conflicting. We therefore have acknowledged the necessity for a more profound study.

Patients and methods: 306 athletes attending the Sports Clinic of Hillerød during the period 1984 to 1993, were diagnosed as having PFPS. All patients were recommended the use of a knee brace and given a short, introduction in m. vastus medialis exercises and various types of stretching. During 1996 all 292 patients were sent a questionnaire concerning duration, grade and frequency of their knee pain, as well as consequence for job and sports.

Results: After average 5.7 years follow-up period, 266 returned a completed questionnaire. 16 patients were excluded, largely as a result of misdiagnosis, leaving a remainder of 250 athletes - 122 women and 128 men (mean age 21.1 years). 27% were pain-free, for an average of 8.1 months - 25% women and 75% men. As to the remaining 182 who were still suffering, 52% experienced a decrease in pain, 35% were unchanged and 13% experienced an increase in pain. 37% described the pain as being mild, 48% as moderate, and 15% severe. Athletic activity was affected in 74% of the cases, employment in 16 cases. The prognosis was not correlated to a history of trauma, overuse, or age.

Conclusion: Generally, the prognosis is poor, using a self-training program and reassurance.

References:

1. Karlson S: Chondromalacia patellae. Acta Chir Scand 1940; 83: 347-381
2. Hvid I, Andersen LI, Schmidt H: Chondromalacia Patellae. The Relation to Abnormal Patellofemoral Joint Mechanics. Acta Orthop Scand 1981; 52: 661-666
3. Devereaux MD, Lachmann SM: Patello-femoral arthralgia in athletes attending a sports injury clinic. Brit J Sports Med 1984; 18: 18-21
4. Jensen D, Albrektsen S: The natural history of chondromalacia patellae – A 12-year follow-up. Acta Orthop Belg 1990; 56: 503-506.

Meniscus allograft transplantation prevents osteoarthritis

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The objective of this study was to examine the macroscopic effect of medial meniscus allograft transplantation with reference to the development of tibial osteoarthritis and transplant behaviour.

Animals and methods: Six months after medial meniscal operation, 25 sheep knees were evaluated for osteoarthritic changes and meniscal size relative to the medial tibial plateau. Eight knees were allograft transplanted, eight were meniscectomized. Nine sham operated knees served as normal controls.

The area of the meniscus, the tibial plateau and the osteoarthritic dissemination were obtained by computer image analysis based on digitised photo. These served as measurements of size. Osteoarthritic changes were visualised with methylene blue.

Results: Osteoarthritic changes covered 9.1% of the medial tibial plateau in meniscectomized knees, compared with only 2.3% in transplanted knees ($p < 0.001$).

The mean area of the sheep medial tibial plateau was 4.14 cm². The mean area of the medial meniscus was 62% of the medial tibial plateau in a normal knee, similar to the area of the transplant after 6 months, which was 64% of the host medial plateau. The central area of the medial plateau not covered by the meniscus was 15% in normal knees, whereas 39% was exposed in the transplanted knees ($p < 0.001$), suggesting a medial displacement of the graft.

Conclusion: Medial meniscus allograft prevents short-term development of osteoarthritis in the sheep. Sizing of the graft seems suitable, but displacement of the transplant remains unsolved.

Double-blind comparison of low-field magnetic resonance imaging (MRI) and arthroscopy in knee joint disorders

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Imaging technology has improved considerably during the recent years allowing detailed non-invasive visualisation of the knee joint. The aim of the present study was to evaluate the accuracy of MRI compared to diagnostic arthroscopy in diseases of the knee joint.

Patients and methods: In a prospective study, 50 consecutive patients (16 women and 34 men, median age 37 (19–54) years), seen in our outpatient clinic with suspected internal derangement of the knee joint, had MRI performed previous to arthroscopy. Results of the MRI examination was not known by the surgeon before arthroscopy, and likewise, the result of the arthroscopy was unknown to the radiologist. At the end of the study the result of the MRI examination and arthroscopy were compared. We primarily focused on tears of the meniscus and ACL/PCL lesions.

Results: 48 patients completed the study as 2 patients refused arthroscopy following MRI because of spontaneous improvement.

At MRI 12 lesions in the medial meniscus, 2 lesions in the lateral meniscus and 8 ACL-lesions were found. At arthroscopy 14 lesions of the medial meniscus, 5 lesions of the lateral meniscus and 10 ACL-lesions were found. None PCL lesions was founded neither at arthroscopy nor at MRI.

Using arthroscopy as the golden standard, we found a sensitivity and specificity of MRI to be

	medial meniscus	lateral meniscus	ACL-lesions
Sensitivity	0.86	0.40	0.80
Specificity	0.66	0.90	0.91
Pos. pred. value	0.52	0.33	0.73
Neg. pred. value	0.91	0.93	0.94

Conclusion: We found a high negative predictive value of MRI, while the predictive value of a positive MRI was less pronounced. MRI is recommended before diagnostic arthroscopy in knee joint disorders.

Reconstruction of the anterior cruciate ligament using bone-tendon-bone technique—a 2 year follow-up study

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The purpose of the study is to evaluate the results 2 years following reconstruction of the anterior cruciate ligament using bone-tendonbone technique.

Patients and methods: 51 consecutive patients with persistent instability after rupture of the ACL had open reconstruction using the central third of the ligamentum patellae. 20 patients did not want to attend the examination. The remaining 31 patients (14 women and 17 men) were reviewed after 26 (21–35) months. Age range from 23 to 51 years (average 35). Time from injury to operation was 34 (2–132) month. None of the reviewed patients had reoperations in the follow-up period.

Results: Mean preoperative Lysholm score was 54 (28–82) and at follow-up 76 (51–100). Mean preoperative Tegner score was 5 (3–9) and at follow-up 5 (1–9). Sick leave post-operatively was 4.8 months (10 days to 20 months). 5 patient had continued giving way, and Pivot shift was positive in 11 patients. Lachmann test was positive in 14 cases. 3 patients had extension defects up to 5 degrees. Mean flexion 140° (110°–160°). 7 patients had anterior knee pain. Quadriceps atrophy greater than 2 cm was found in 3 patients. 25 patients were satisfied with the reconstruction and only 3 patients would not undergo the same operation again.

Conclusion: 81 % of the reviewed patients were satisfied with the ACL reconstruction using bone-tendon-bone technique. This is comparable to other similar studies. Tegner score did not improve, maybe because we recommended the patients not to do cutting sports after the reconstruction.

Patient satisfaction and long-term prognosis after knee arthroscopy

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Knee arthroscopy is performed often and is regarded a simple procedure by most orthopaedic surgeons. We wanted to see if the patients find the operation equally simple and how the long-term prognosis was after knee arthroscopy.

Patients and methods: From the patient files for all patients arthroscoped in the knee under local analgesia 1985–1990 (incl.) information about pathological findings and procedures performed was extracted. A questionnaire was sent to all patients.

Results: 371 patients were arthroscoped. 279 returned the questionnaire. 21% found that the analgesia hurt significantly, and 21% that the arthroscopy was very painful. In 77% the postoperative pain only lasted few days, and 79% had to stay home from work for less than 3 days. Only 10% stated that they would never want an arthroscopy in local analgesia again.

Only 30% felt that the arthroscopic procedure had decreased their symptoms, and 77% stated that they still have trouble with the knee. The best prognosis was seen after partial resection of the medial meniscus (62% with persisting symptoms), the worst after ACL injury (90% with persisting symptoms).

Conclusion: For 3/4 of the patients arthroscopy was a simple procedure. Only 10% never wanted it performed un-

der local analgesia again. The long-term prognosis regarding the knee symptoms was bad, and the arthroscopic procedures had a positive effect in only 30% of the cases.

Meniscal repair using fibrin sealant, GH and IGF-1

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In animal studies we have previously shown that there is no spontaneous healing of lesions in the avascular zone of menisci. This study evaluates the healing effect of fibrin sealant, in this area, alone or combined with Growth Hormone (GH) or Insulin like Growth Factor (IGF-1).

Material and methods: Ten, 4–5 month old New Zealand white rabbits were used for the experiment. All rabbits underwent a full-thickness, surgical lesion in the avascular portion of the medial meniscus of the right knee. One rabbit had no further treatment. Three rabbits were treated with fibrin sealant (group 1), 3 with fibrin sealant containing GH (group 2), and 3 with fibrin sealant containing IGF-1 (group 3). All rabbits had a sham operation on the left medial meniscus. The menisci were examined after 12 weeks.

Results: No menisci had healed. An extrinsic pannus-like tissue containing many capillary vessels extending from the meniscosynovial junction toward the defect was found in all treated groups. The amount of pannus-like tissue seemed to vary with group number.

Conclusion: The combination of fibrin sealant and GH, or fibrin sealant and IGF-1, seems to enhance the synovial reaction with synovial thickening. Synovial activity is believed to effect the healing capacity of meniscal lesions in the avascular zone. Further studies with longer observation periods and other growth factors are progressing.

Dynamic compression properties of normal and meniscectomized knees—development of an experimental testing model

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The biomechanical compression properties of the knee joint in its entirety are of major clinical interest. These properties are complex, influenced by factors such as joint stability, alignment, joint angle, the construction of composite tissues and external forces. The aim of this study was to introduce a reliable model for testing compression properties of the whole knee joint and to examine the immediate effect of meniscectomy.

Material and methods: Twelve hind limbs of sheep were

exarticulated at the hip and osteomized at the distal tibia. The knees were clamped in a material testing machine (Instron® 8500+) for dynamic compression tests. The knees were loaded cyclically for 2 minutes with 500 N in each cycle at 1 Hz and 3 Hz. After the first test, the knee was removed from the testing device, and mounted again later on for double retesting. Finally the medial meniscus was excised and the test procedure was repeated one last time.

Results: In general, joint hysteresis decreased ($p < 0.001$) and stiffness increased ($p < 0.001$) initially during the 2 minute of testing period, whereas both parameters tended towards steady state later on in the test. There were no detectable differences in hysteresis and stiffness between the initial test and the first re-test, whereas stiffness increased 15% ($p < 0.001$) in the second re-test. Meniscectomy increased hysteresis 19% ($p < 0.001$) and decreased stiffness 21% ($p < 0.001$).

Conclusion: The developed model is a reproducible test for compression properties of the whole knee joint, but repeated testing of the same knee influences the result. Meniscectomy causes an immediate change in the material properties of the knee.

ANKLE/FOOT

The impact of multiple observers on kappa statistics in the assessment of radiographs of ankle fractures

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Kappa statistics has been used to assess the reliability of classification systems. Previous studies have been conducted with a varied number of observers. The aim of this study was to evaluate the impact of multiple observers on the kappa statistics as a measurement of observer variation.

Material and methods: One hundred orthopedic surgeons, randomly selected from the register of the Danish Medical Association, were asked to assess a random sample of ten sets of standard radiographs out of 94 consecutive patients with ankle fractures. The observers were randomly allocated to 4 groups which again were divided into subgroups with an increasing number of observers per group.

Results: Random subgroups of 3 observers revealed kappa-values from 0.20 to 0.64 in the Lauge-Hansen classification and 0.27 to 0.90 in the Weber classification system. With an increasing number of observers in the subgroups kappa stabilises with values of 0.38 in the Lauge-Hansen classification and 0.57 in the Weber classification system.

Conclusion: Kappa is known to depend on the prevalence of the sign in question. Our study demonstrates that kappa also varies with the number of observers. Therefore, we find it questionable to let kappa stand alone as a simple measurement of observer variation.

Aftertreatment with Donjoy R.O.M. Walker bandage in operatively treated achilles tendon ruptures

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The aftertreatment of ruptured Achilles tendons traditionally have been immobilisation in an above-the-knee plaster cast for six to twelve weeks, with or without surgery. The purpose of this study, which was set up in 1989, is to evaluate the aftertreatment with the "Donjoy R.O.M. Walker". The idea was to minimise the inconvenience for the patient, and through early mobilisation to optimise and shorten the rehabilitation time.

Patients and methods: 103 patients has until now been examined. In the aftertreatment a Donjoy R.O.M. Walker bandage was used for eight weeks. The first 3 weeks in 30 of plantarflexion. After 3 weeks the bandage was changed towards neutral with 10 every week, and the patient was allowed to take of the bandage while in rest. No weight bearing was allowed the first 5 weeks. Complications, return to work/sport, muscle strength, range of motion, patient satisfaction, and overall patient compliance were among the parameters registered.

Results: The mean follow up time was 42 (12–84) months. The mean age at trauma for the patients were 40 (20–76) years. There were 79 men and 16 women and there were 83 sports injuries (88%). We found no reruptures, four patients with a superficial wound infection, on case of skin necrosis and one case of scar neuroma. There were no difference in muscle strength, and range of motion in extension, but significant difference in flexion. The patients returned to sport in 26 (10–104) weeks, and to work after a median time of 6 (0–56) weeks. The patients were satisfied with the treatment given in a median time of 22 weeks, and mean VAS-score at follow-up was 88%.

Conclusion: The Donjoy R.O.M. Walker proved to be a useful and safe alternative to plaster immobilisation, with few complications and a high patient compliance. The bandage allows the patients to return to sport and work at a mean time comparable to other studies.

PEDIATRIC ORTHOPEDICS

Danish results after femoral lengthening using the intramedullary Albizzia lengthening device

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Lengthening of the femur using an intramedullary device instead of an external distractor is a relatively new method. Until now, 8 cases of femoral lengthening using the Albizzia intramedullary lengthening device has been performed in Denmark; 7 of these have terminated the treatment period. This investigation is based on a review of these cases.

Patients and methods: 7 patients, all adolescents or adult, with shortening of one or both lower extremities, due to fracture/epiphyseolysis, Ollier's disease or vitamin D resistant rickets were included. In one patient, both femora's were elongated.

Results: For all patients, the aim was fulfilled, i.e. a lengthening of the femur, leaving none or a minor anisomelia. In no case any failure of the apparatus occurred, nor any serious complications. Nor was it necessary to give up the lengthening procedure too early. Problems were typically knee contractures, premature consolidation and pain during manipulation, overcome by manipulation in general/epidural analgesia. Formation of solid bone took place at a acceptable rate. The lengthening was from 4.0–8.7 cm, with distraction periods from 37 to 78 days. Full weight bearing was achieved after 73–215 days, depending on the distraction distance (16–33 days per cm). Lengthening index was 0.54–1.11 month per cm.

Conclusions: We find that this method of femoral elongation shows many advantages: Little use of antibiotics, no risk of axial deviation during distraction and easy handling for the patients. Thus we find the method useful in femoral elongation in patients after cessation of growth.

Incidence of clubfoot in Frederiksborg County, Denmark

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Clubfoot is one of the most common congenital deformities of the foot. The incidence in Scandinavia is reported to be 1 per 1000 live births. In the present study, we investigated the incidence of clubfoot in Frederiksborg County, Denmark, over a period of 16 years (1979–1994).

Patients and methods: The number of children, born alive, in Frederiksborg county each year in the period is registered in the Danish Statistical Yearbook. With combined use of a central register and reviewing patients records, we were able to determine the incidence of clubfoot. A questionnaire were sent to the parents, trying to reveal possible causality.

Results: Altogether 60,186 living infants were born, and of these 72 had a congenital clubfoot. 25 children (35%) had bilateral clubfoot and 54 (75%) were boys. The overall incidence was 1.20 per thousand children. The incidence increased significantly during the observation period. In 1994 the incidence was 2.41 per thousand.

Conclusion: The incidence of clubfoot increased significantly between 1979 and 1994. We cannot explain the rising incidence.

TUMORS

Prognosis in soft-tissue sarcomas

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The purpose of this study was to evaluate the outcome and possible prognostic factors of patients with soft-tissue sarcomas after surgical treatment.

Material and methods: From Jan. 1979 to July 1993, 316 patients with malignant soft tissue sarcomas in the extremities or truncus, without distant metastasis at first admission, were treated surgically at the Sarcoma Centre in Aarhus. Age ranged from 1 to 94 years (median 56). 48 patients presented a tumor in the truncus, 185 in the lower extremity and 83 in the upper extremity. 67 patients were amputated and 249 had a local resection. We found 155 who had a small tumor (<5 cm) and 158 who had a large tumour (>5 cm.). 52 had a low grade tumor, 60 had an intermediate and 204 a high grade tumor. The median follow-up was 95 (37–208) months. For the statistical analysis the log-rank test were used.

Results: Local control was influenced by the surgical margin (intralesional/marginal versus wide/radical) in patients with high-grade tumours who did not receive adjuvant radiotherapy ($p=0.02$) and the histopathological grading ($p=0.01$), but not tumour size. The 5-year survival rates were 100%, 93% and 62% for low-grade, intermediate and high-grade tumour ($p < 0.0001$) and 61% and 86% for large and small tumours ($p < 0.0001$). The surgical margin did not influence survival.

Conclusion: Surgical margin and histopathological grading are prognostic for local control. Tumor size and histopathological grading are strongly prognostic for survival in non-visceral soft-tissue sarcomas.

EXPERIMENTAL ORTHOPEDICS

First report on vascular reactivity in human bone tissue

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Recently, a new model for in vitro investigation of isolated bone arteries was introduced (1). The purpose of the present study was to apply this model to arteries isolated from human bone biopsies and to characterise the adrenergic receptors in these vessels.

Materials and methods: Patients with osteoarthritis undergoing elective hip arthroplasty were chosen as bone do-

nors (age ranged from 26 to 92 years). After removal of the femoral head, a cancellous bone biopsy was taken from the centre of the femoral neck (approximately 2 x 3 x 1 cm). Arterial segments (diameter = 200 µm, length = 2 mm) were isolated from the bone biopsy and mounted as ring preparations on a myograph for measurement of isometric force development (2). Cumulative concentrations of noradrenaline (2×10^{-8} – 10^{-5} M); the selective (α_1 -agonist phenylephrine (10^{-8} – 10^{-4} M); and the selective (α_2 -agonist B-HT 933 (10^{-8} – $10^{-3.5}$ M) were added. Acetylcholine (10^{-10} – 10^{-5} M) was added to precontracted vessels, as was the unselective b-agonist isoprenaline (10^{-9} – 10^{-5} M) after α -blockade with phentolamine (10^{-5} M).

Results: 14 arteries (from 10 patients) were investigated. Internal diameter was 211 (116–363) µm. Noradrenaline induced concentration dependent vasoconstriction. Half maximal contraction was achieved at 3×10^{-7} (3×10^{-8} to 2×10^{-6}) M and maximal tension development was 1.35 ± 0.3 N/m (mean $\pm$ SEM, $n = 13$). This force development would allow contraction against a pressure of approximately 90 mm Hg. Acetylcholine (an endothelium dependent vasodilator) induced concentration dependent vasorelaxation in all vessels, suggesting preserved function of the vascular endothelium. The threshold concentration was approximately 10^{-9} M. At a concentration of 10^{-7} M, acetylcholine induced complete relaxation in precontracted arteries. Selective stimulation of α_1 -receptors with phenylephrine induced concentration dependent vasoconstriction, while stimulation of α_2 -receptors with B-HT 933 had no effect. Cumulative stimulation of b-receptors with isoprenaline had no effect, while a relaxation of 77% of the precontraction level was observed when a single vessel was stimulated with 10^{-6} M isoprenaline added as a single concentration.

Conclusion: The model is the first to allow investigations on vascular reactivity in human bone tissue and may become valuable for assessment of vascular receptors in normal as well as pathological bone tissue. While earlier studies showed that endothelial muscarinic receptors are not a consistent finding in porcine bone arteries (1), we found response to acetylcholine in all arteries in the present study. This finding indicates species differences as regards bone vascular receptors and stresses the importance of an available human model. The data suggest that α_1 -receptors are responsible for the constrictive adrenergic response in human bone arteries. Furthermore, the data indicate vasodilatory effect of Preceptor stimulation.

References: 1) Lundgaard A, Aalkjaer C, Mulvany MJ, Bjurholm A, Stender Hansen E. Trans Orthop Res 18:77, 1993. 2) Mulvany MJ, Halpern W. Circ Res 41: 19-25, 1977.

Formation of joint surfaces by traction

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Defects in joint surfaces often result in pain and instability,

and larger defects can be a problem in alloplasty operations when there is insufficient support for the prosthesis. We wanted to investigate the possibility to form joint surfaces by traction.

Methods: In 8 adult sheep an OrthoFix external fixator with 4 screws was operated onto the right olecranon, which was then osteotomized intraarticularly between the 2. and 3. screw. After 1 week, traction was applied with 1/2, 3/4 or 1 mm/day until a total traction of 1 cm. The sheep were mobilised without restrictions and killed between 2 and 9 months after the operation. The elbows were removed.

Results: One sheep died of lung infection after 2 weeks. Three sheep had infection in the osteotomy despite prophylactic antibiotics, and the elbows were destructed to varying degrees by the infection. In 4 sheep there was no complication.

Macroscopic investigation of these elbows showed that a smooth, solid joint surface which could hardly be distinguished from the surrounding joint surface, had formed as a result of traction.

Conclusions: It is possible to create solid joint surface by traction with an external fixator.

Documentation of arthroscopic operations

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There is an increasing need to document findings and procedures during arthroscopic operations (for statistic, scientific and patient related reasons).

The aim was to create one software system to do this, made up for Danish conditions and with possibilities to link with other software systems.

Methods: The program was created for a PC with the following requirements: PC486, 66 MHz, ≥ 8 Mb RAM, and at least Windows 3.11 or Windows 95.

Results: This program has the following functions:

1. A database with detailed information about the arthroscopic findings and procedures (for statistic and scientific use),
2. A documentation system in which pictures of findings and procedures can be stored for each patient (to print out in the patient files and to use for slides etc.),
3. Description of the operation, generated by the database (for the patient files),
4. A file for standard postoperative procedures (for a uniform patient treatment),
5. A tutorial file with illustrations of conditions and procedures,
6. It can be linked to other electronic patient files.

All functions can be adapted to local conditions and procedures, and can be combined as wished. The program has been tested for knee arthroscopy, and will be adapted for all arthroscopic and endoscopic operations.

MISCELLANEOUS

Lightning injuries in six cases

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Lightning strikes are still the most dangerous nature phenomenon in Denmark, where it strikes approximately 6 persons and kills 1 person each year. Most of the cases could have been avoided, if people would have followed the simple precautions against thunderstorms. Lightning bolts have charges of 10 to 30 million V and a current of 20 to 200 000 A. Such a discharge can produce temperatures of 5000 °C. The type of injury that results from lightning strikes to the body depends upon the type of energy (heat or pressure) imparted by the strike.

On one day in June 1996, 6 persons were brought into Viborg Hospital, as the only hospital in central, east, west and north of Jutland, after being injured from lightning. Five with injuries from being stricken by the lightning bolt and with fatal outcome in one case. One because he was hidden by a falling tree. Probably all these cases could have been prevented, if the victims had taken necessary precautions.

Case A: A 34 years old women was seeking shelter under a tree with her two children, when a lightning bolt stroke the tree. She was wearing a gold necklace which was blasted into pieces and caused first and second degree burns around her neck. She also had burning marks behind her right ear.

Case B: A 13 years old daughter of A had characteristic feathering pattern of erythema on her right arm and leg. These marks disappeared within the first 24 hours.

Case C: A 5 years old son of A had first degree burns on the lower right side of the abdomen.

Case D: A 22 years old man walking on top of an old castle, when he suddenly heard a loud crack, but didn't feel any pain. He started to run, but noticed weakness, coldness and blueness of his legs. He then lost consciousness, but regained it on the way to the hospital, where he felt weakness in the entire body. He had first degree burns behind his left ear and erythema on the left side of the neck down to his left shoulder as well as on the thorax, abdomen and right inguen, a first degree burn on his right forearm, and rupture of both the tympanic membranes.

Case E: A 14 years old boy, standing on a pier fishing, was stricken by a lightning bolt. He was brought in dead to Holstebro Hospital and later transferred to the chapel at Viborg Hospital. He had first degree burns in his face and second degree burns behind his right ear. Erythema was seen down the right side of his thorax and abdomen. Punctuate full-thickness burns was seen under both heels.

Case F: A 57 years old man seeking cover under a tree, as a lightning bolt stroke the tree, which fell over his right leg causing fracture of the tibia condyle.

Conclusion: One out of 6 died from being stricken by the lightning. On 5 of the patients we found the characteristic lightning injuries, but in three cases also burmarks behind one of the ears. The cases indicates, that it still seems neces-

sary to emphasise the rules of precautions during thunder storms.

Bicyclist-accidents in Viborg—results from the first year

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From the Danish hospital's Casualty Departments (C.D.) it is estimated, that 39,800 persons each year are injured from bicycle-accidents, but only 2,600 accidents are recorded in the national Register of Traffic Accidents based on police-reports. We therefore started a two-year prospective registration of details from all bicycle-accidents, where the injured bicyclist was brought to our C. D.

Patients and methods: In 1995 a total of 13,000 persons being injured from accidents of all types (1100 (8.5 %) from traffic-accidents) was seen in the Casualty Department.

From 1st of February 1995 all injured bicyclists admitted to the C.D. are given a questionnaire concerning the exact place of the accident, how the accident happened and details about the bicyclist and the bicycle at the time of the accident. Data is collected from the hospital concerning treatment, diagnoses, hospitalisations etc. After end of treatment, the degree of injury in each bicyclist is coded in accordance with the Abbreviated Injury Scale and Injury Severity Score. Finally data from the police-department concerning bicyclist-accidents in the same period are collected.

Results: In the first year, 522 injured bicyclists, equally male/female, were treated at the C. D. 85.4% (446) answered the questionnaire. 69% of the bicyclist were from 0 to 30 years of age – 42% between 10 and 19 years.

65.5% were solo-accidents, but 83.1% among children less than 10 years of age. 50% claimed, that hindrances on the road (stones, ice/snow, holes etc.) caused the solo-accident.

In counterpart-accidents, most often with cars or other bicycles involved, significantly more accidents took place in cross-roads (27%).

Among all accidents 45 were "school-way accidents". 9.1% of bicyclists aged 20–99 years were under the influence of alcohol at the time of the accident. Only 17% used helmets. 20.2% had a helmet at home, but did not use this helmet. This was especially present among children below 10 years of age (47%). The group of bicyclists wearing helmets had a significantly lower mean age (15.6 years) than the remainders (25.5 years). No difference could be found in the degree or relative number of head-injuries between those two groups, but a significantly higher number of traumas against the head happened in the younger age-groups. 10.2% of the bicycles had defects. In 67% of all these cases the defect caused the accident.

46% of the bicyclist did not need further treatment after discharge from the C. D. 15.9% was admitted to hospital. There was a significantly higher number and degree of injuries to the brain/scull in bicyclists aged 10–19 years com-

pared with other age-groups. No differences in MAIS or ISS was observed in the different age-groups or between solo-accidents and counter-part accidents. One bicyclist, 18 years of age, died from the injuries.

7.7% of the accidents treated at the C. D. were registered by the police.