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### Stabilization of the lumbar spine with pedicle screws and Steffee plates

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Between May 1986 and May 1987, the lumbar spine in 24 patients was stabilized with pedicle screws and Steffee plates. Indications were spondylolisthesis in 7 patients, degenerative spondylolisthesis in 3, fracture in 1, and so-called failed back surgery syndrome in 13 cases (following 25 previous operations), which required redecompression and in which abnormal mobility seemed partly responsible for the complaints.

With internal fixation, stability increases and consolidation can be achieved in a large percentage of cases. It is also possible to reduce vertebral fractures and maintain reduction until consolidation.

The follow-up is very short, but findings are encouraging: 22 of the 24 patients showed improvement, while in the remaining 2 this cannot yet be established. Consolidation has been achieved in all the cases.

The mean stay in the hospital was 14 days. There were no infections and no clinical evidence of deep venous thrombosis. In 1 case a technical error was committed causing a screw to enter the disc; this (female) patient required reoperation. In another female patient the screws broke. No neurologic complications have developed.

If an abnormally mobile vertebra is to be stabilized, this technique of fixation seems to give good results.

### Chemonucleolysis in the treatment of herniation of a lumbar disc in patients aged 60 years and over

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A consecutive series of 702 patients treated for herniation of a lumbar disc by chemonucleolysis included 21 patients aged 64 (60–74) years.

One patient after a few weeks required a facetectomy in view of persistent complaints. No other operations proved necessary. There were no complications.

A follow-up was done after an average of 44 (9–76) months. Two patients (therapeutic results classified as successful at the last follow-up) died in this period. Their deaths were unrelated to the chemonucleolysis.

The remaining 18 patients were all interviewed and examined. In 15 the result was classified as excellent (more than 85 per cent alleviation of pain, no limitations of general daily activities and no abnormalities at physical examination); in 1 patient the result was judged as good (some residual back pain) and in 2 as unsatisfactory (less than 50 percent alleviation of pain), but there was no indication for further treatment.

*Conclusion*: Although in older patients other pathology has to be excluded, true herniation of a lumbar disc does occur in this category, and chemonucleolysis has proved to be successful in these cases.

## Transplantation of perichondrium to repair articular cartilage in rabbits

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This study was performed in order to establish whether costal perichondrium can be used to repair a defect in the knee cartilage. The subjects were 30 rabbits divided into 3 groups of 10 animals each, and the follow-up time was 4, 8, and 16 weeks, respectively. Perichondrium was dissected from the cartilaginous part of one of the lowest ribs. After arthrotomy of the knee, a defect was created in the cartilage of the trochlea. The dissected perichondrium was fixed in this defect with the aid of Tissucol®, a two-component fibrin adhesive. The knee was immobilized by external pin fixation for 2 weeks. A similar defect was created in the contralateral knee, which served as a control.

The results of the graft were assessed macroscopically, histologically, and immunohistologically. When the knee joints were opened, 26 of the 30 grafts were found in situ.

The features of the newly formed cartilage improved as the follow-up period increased. After 16 weeks there was no longer any discernible difference between the acceptor site and the adjacent cartilage. The histologic specimens showed defined and better arranged chondrocytes as the postoperative period increased. In the neocartilaginous tissue a decrease in Collagen 1 and an increase in Collagen 2 were immunologically demonstrated. The results obtained indicate that transplantation of perichondrium is an adequate method for repairing articular cartilage in rabbits.

## An atraumatic method of treating neglected and irreducible fresh carpal dislocations

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Reduction of a neglected carpal dislocation requires extensive soft-tissue dissection, which increases the risk of arthrosis of the wrist joint.

The following technique was developed to circumvent this problem. The first step is distraction of the radiocarpal joint with the aid of external pin fixation. An ulnovolar stab incision is then made and a blunt probe is used to turn the lunate bone over dorsad. With dislocation of the lunate bone, the reduction maneuver is completed by abolishing the distraction. In the case of perilunar dislocation or dislocation fracture, reduction of the carpal bones may be precluded by interlocking of the (likewise dislocated) triangular bone with the lunate bone. By introducing an elevator between these carpals via a dorso-ulnar incision, this interlocking can be abolished. Reduction should be followed by triquetro-lunate Kirschner-wire fixation and open reduction with screw fixation of an existing navicular fracture. For exact assessment of the result of reduction, a lateral and an anteroposterior radiograph are required. Using external pin fixation for immobilization, correction of intercarpal and radiocarpal alignment (if necessary) is still possible. Secondary carpal collapse during the period of immobilization is thus excluded.

## Effect of elctromagnetic stimulation on osteogenesis following distraction physiolysis in the proximal tibia of the rabbit

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Recent reports mention good results by distraction physiolysis as a leg-lengthening procedure. The long duration of this treatment remains a problem. The aim of this study was to establish whether osteogenesis in the distracted zone might be electromagnetically stimulated to reduce the duration of the healing process. A specially designed device was used to effect 10-mm of leg lengthening in rabbits by distraction physiolysis in the proximal tibia (12 rabbits). Electromagnetic coils were fixed to the distraction device. In 6 rabbits electromagnetic stimulation was performed for 18 weeks following distraction physiolysis; the 6 controls were given the same treatment, but without stimulation. Osteogenesis in the distracted zone was quantified weekly using CAT scan and bone scintigraphy with $^{99m}$Technetium-MDP.

The follow-up study by CAT scan revealed that osteogenesis in the distracted zone took an identical course in both groups of test animals.

The amount of bone increased until 3 weeks after completion of distraction. Next came a period of remodeling during which the newly formed bone mass changed to a diaphyseal structure as a result of bone resorption in the central part. Weekly CAT scan measurements were compared with the results of bone scintigraphy. An effect of electromagnetic stimulation on the process of osteogenesis and remodeling following distraction physiolysis was not demonstrable in these rabbits.

## Surgery to increase the height of small persons

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Lengthening the legs of small persons is a prolonged and stressful procedure that requires 1 or a few years. During this period the person in question has to undergo several operations, and weight bearing is only partly possible or not at all possible for some considerable time.

We lengthened the legs of 2 patients with achondroplasia: in 1 patient both upper and lower legs, and in the other only the lower legs. Corticotomies in the metaphyses were performed, whereupon an external stretching apparatus was applied. This remained in situ on the lower legs until a sufficient amount of osseous tissue had formed in the lengthening zone. The upper legs were treated by corticotomy of the metaphyses followed by internal fixation with a lock pin introduced atraumatically. The advantage of medullary pin fixation is that the external fixation device can be removed earlier. The patient can then exercise his joints properly and hydrotherapy, for instance, is also possible.

With this operative technique (corticotomy in the metaphysis), sufficient osseous tissue formed in the lengthening zone within a reasonable time. Bone grafts were therefore unnecessary in these 2 cases.

In 1 patient, we achieved a total lengthening of 16 cm (2×8 cm in upper and lower legs); in the other patient, only the lower legs were lengthened by 9 cm.

On the basis of our limited experience, we conclude that corticotomy in the metaphysis has many advantages in comparison with a lengthening osteotomy in the shaft of a long bone.

## Ankle fractures with rupture of the deltoid ligament – indications for suturing?

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Ankle fractures with rupture of the deltoid ligament are severe lesions. Anatomic reduction with internal fixation is to be preferred. The question is whether in this procedure the deltoid ligament should be explored and sutured. During 1984 and 1985, we treated 290 ankle fractures, 169 (58 percent) of which were treated surgically. In 28 patients (10 percent) the fracture was associated with rupture of the medial ligament. All were treated surgically, the deltoid ligament being systematically not explored. The patients were 2 women and 26 men with a mean age of 28 (16–68) years. Twelve had Weber type B and 16 had Weber type C fractures. Ten fractures were displaced and 2 were compound. Postoperative therapy was functional.

A follow-up was done after an average of 18 (8–30) months. Three patients complained of (sometimes disabling) pain; 5 other patients reported morning stiffness, and the remaining patients were asymptomatic. The mobility of the ankle joint was limited in 5 cases.

Radiographic examination revealed evidence of arthrosis in 7 cases. Eversion stress radiographs showed no signs of ligament instability. A somewhat widened medial articular space was observed in 6 patients. Revision showed that in 5 patients this was visible also after the operation (result of imperfect reconstruction).

*Conclusion*: If after osteosynthesis the ankle is anatomically restored, then, the ruptured deltoid ligament need not be explored. Surgically treated fractures with an unexplored deltoid ligament can be subjected to functional postoperative therapy.

## Hemiarthroplasty of the shoulder

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Arthroplasties of the shoulder are not frequently performed. A retrospective clinical study of 31 such operations, performed during the period 1973–1985, revealed the following indications: rheumatic disease in 11 cases, Bechterew's disease in 1, omarthritis in 3, necrosis of the humeral head in 3, tumors in 6, fractures in 6 (including 1 pathologic fracture associated with multiple myeloma). These conditions involved 27 patients, of whom 24 (27 shoulders) were examined anamnestically, clinically, and radiographically after an average follow-up of 59 (8–160) months.

Wound infection developed in 1 case and was cured without residual symptoms; transient dysfunction of the ulnar nerve occurred in 1 case; 1 tumor patient showed a postoperative lesion of the brachial plexus.

In all except 4 tumor patients, a Neer prosthesis (type I) was used; it was implanted via an anterior approach and was left uncemented in more than half the cases.

The patients were satisfied or highly satisfied with 20 of the 27 shoulders. Five patients had expected more, and 2 reported deterioration (in both after tumor resection).

In the entire group, pain alleviation was much more marked than improvement in function and daily activities. One late complication was a stem fracture after 13 years, necessitating reoperation.

Hemiarthroplasty of the shoulder gives sufficiently good results to be preferred to arthrodesis in various types of shoulder destruction.

## The first branch of the lateral plantar nerve and heel pain syndrome

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One cause of heel pain is entrapment of the first ramus of the lateral plantar nerve. The literature also mentions other possible causes: bursitis, plantar fasciitis, and calcaneal spur. A possible structural basis of these causes was likewise included in the investigation.

Four fetal and 34 adult feet were submitted to an anatomic examination with special reference to the course, ramifications, and composition of the first ramus and the localization of any possible entrapment.

The first ramus is described in the literature as a motor ramus, but proved to be a mixed nerve, which better explains the pain sensation in the case of entrapment. The first ramus takes its course immediately anterior to the medial process of the tuber calcanei and at that site innervates the periosteum. In view of this course a calcaneal spur could cause compression of the first ramus. At resection of a calcaneal spur the first ramus may be injured, and this increases postoperative morbidity. In view of this neurolysis or neurectomy of the first ramus is to be recommended.

## Implantation of a bovine xenograft in the treatment of chronic instability of the knee ligaments

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A bovine xenograft was implanted in the knee joint to replace the anterior cruciate ligament in 158 patients and to replace the posterior cruciate ligament in 26 others. The graft was implanted via two bone tunnels in the femur and tibia, and fixation was effected with staples.

After 5 years, three fourth of the posterior cruciate ligament group showed good to excellent results.

In the first series of 57 knees with anterior cruciate ligament insufficiency, results obtained with the same technique were unsatisfactory. In the second series of 101 knees, a wider aperture was created in the intercondylar sulcus to prevent incarceration of the xenograft. Moreover, an isometric position of the bone tunnels was ensured, and an extraarticular augmentation graft according to Lemaire was performed. In this second series, 90 percent of the knees showed a good result.

A bovine xenograft behaves like a true prosthesis, as demonstrated by the occurrence of fatigue fractures and synovial reactions to the implant.

## Hip implants with hydroxylapatite coatings

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As an addition to earlier research, progress made in studies of fixation of implants with apatite coatings is reported. In the study of plug implants, 2-year follow-up results are available, which show that the implant-bone adhesion, as measured in push-out tests, is undiminished. A tangential pressure of about 60 MPa was measured after 2 years.

Two-year follow-up data are also available on apatite-coated hip implants in dogs. From six months after implantation on, an increasing difference in bone quality is observed between dogs with apatite-coated prostheses and those with uncoated prostheses. The latter show unmistakable radiographic evidence of osteolysis. Histologic examination reveals a connective tissue interface between implant and bone. With the apatite-coated implants, however, the endosteal bone structure shows increasing density from the sixth month on in reaction to the implant. Microscopic examination reveals a direct bony link between implant and bone without connective tissue interface. The quality and density of the bone around the implant are evident.

The conclusion is that apatite-coated implants enable direct bony linkage with the bone. As a result, the implant can resist not only compression, but also (for the first time) traction and shear. The result is a more physiologic relation between implant and bone. Preliminary experience with implants in human subjects points in the same direction. Although the follow-up is still brief (up to 1 year in 25 patients), the radiographic changes visible after 6 months indicate a similar process of endosteal bone densification. These changes are a distinct measure of the degree of bone remodeling and implant stress around the prosthesis. The Harris hip score after 6 months averaged 94, indicating that a good functional result can be obtained in a relatively short time. Particularly so-called midthigh pain has so far been rare. Long-term results are, of course, more important and will be reported in the future.

## Properties of human chondrocytes cultured in vitro in relation to the severity of arthrotis

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An in-vitro culture model gives excellent opportunities to study factors that play a role in the pathogenesis of arthrosis. Fundamental research is being done concerning the properties of chondrocytes isolated from cartilage of patients with arthrosis of the hip or knee. The hypothesis that chondrocytes show specific behavior related to the severity of arthrosis can thus be tested. The severity of arthrosis is determined histopathologically and correlated with the matrix production and rate of mitosis of the chondrocytes in the culture model.

A pronounced positive correlation was found between matrix production and rate of mitosis, on the one hand, and the severity of arthrosis, on the other. Another finding was that the quality of the matrix formed (expressed as possibility of aggregation of matrix constituents) decreased markedly with increasing severity of arthrosis.

The results confirm the hypothesis that intrinsic abnormalities of the chondrocytes correlate with the degree of severity of arthrosis. The in-vitro behavior of chondrocytes directly reflects the severity of arthrosis. The in-vitro model therefore facilitates the study of certain modulant substances that may play a significant role in the arthrotic process.

## Tissue pressure measurements in compartment syndromes

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A compartment syndrome may be defined as a situation in which, within an enclosed space, the function of the tissue is impeded due to insufficient tissue perfusion resulting from increased pressure within that space. Acute and chronic compartment syndromes are distinguished. In both cases an excessive tissue pressure gives rise to ischemia.

Early diagnosis of excessive tissue pressure (before irreversible damage occurs) is often a problem, particularly in acute compartment syndromes. Measuring the tissue pressure in the compartment involved is of importance in determining indications for decompression.

Although the needle manometer technique was developed as early as 1884, it was not until 1962 that it was first applied in chronic compartment syndromes of the leg. Several measuring techniques have since been developed: continuous infusion, the wick catheter and the slit catheter technique.

## Short-term results of uncemented PCA total-knee replacements

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The aim of this retrospective study was to evaluate the short-term results of 35 uncemented PCA total-knee replacements performed in 34 patients. The mean follow-up time was 24 (18–24) months. Evaluation took place using Insall's 100-point system; the position of the implant and the presence/absence of radiolucency were determined.

*Results*: The mean preoperative score was 48.5 and the mean postoperative score 78.9. The score was excellent in 12 patients, good in 19, and moderate in 2; there were 2 failures. Mean flexion was 101° (40–130°) before and 99° (45–125°) after the operation.

In all the cases the mean values of the positions of the components were ideal, but standard deviations were considerable. Small zones of radiolucency were visible in most knees, but in no case did these exceed 2 mm. Three patients showed significant migration of the tibial plateau, but without clinical consequences.

*Complications*: Patellar dislocation occurred in one patient; loosening required arthrodesis in one patient and revision in another.

*Conclusion*: The short-term results of uncemented PCA total-knee replacements are good. The mean values of the positions of the components are ideal, but there are marked individual variations.