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General Summary

Basic Research

The trauma team reported on their treatment of intertrochanteric femoral fracture with bone defect using β-tricalcium phosphate (β-TCP), hyaluronic acid, and the fibroblast growth factor (FGF) 2 complex. The team developed an injectable complex that promotes synostosis of the fracture of the displaced lesser trochanter and repair of cortical bone deficiency; they applied the complex to treat intertrochanteric femoral fractures with an AO classification of 31-A2. The complex supposedly exerted its effects on synostosis of the displaced fracture of the lesser trochanter.

The knee surgery team reported a technique for reconstructing the anterior cruciate ligament which uses a rectangular retrodilator they designed. Using the newly developed technique of making bone tunnels with the rectangular retrodilator, better clinical results can be obtained in anatomical reconstruction of the anterior cruciate ligament with rectangular bone-patellar tendon-bone grafts.

Clinical Research

Our clinical practice has been divided into 10 subspecialties to cover a wide range of musculoskeletal disorders and has been managed by different specialist teams: knee joint, hip joint, spine, shoulder joint, foot surgery, trauma, osteoporosis, rheumatic diseases, and sports. All teams maintain a high level of expertise and are actively involved in scientific activities.

The spine team focused on the effectiveness of percutaneous dual sacral-alar-iliac (SAI) screw fixation for the treatment of spinal deformity in adult patients.

Two SAI screws arranged linearly on the sacrum are used for correction, and the method allows shortening of both the time of surgery and irradiation while being minimally invasive; strong fixation is usually obtained.

The foot and ankle joint team performed a 3-dimensional (3D) image analysis of hallux valgus pathology. In 2018, this team focused on the 3D shape of the metatarsals and found that internal torsion of the first metatarsals is significantly more pronounced in feet with hallux valgus than in control feet.

Through this range of clinical research activities, all teams fulfill their important roles at a clinical academic hospital, and their commitment is highly valued.

Research Activities

Results of nonsurgical treatment for complete dislocation of the acromioclavicular joint
Outcomes of conservative treatment were evaluated for 43 patients who had complete dislocation of the acromioclavicular joint. In addition, the outcomes were compared with the results of 63 patients who underwent surgical treatment. The average score at final follow-up examinations was 95 points. Calcification and osteoarthritis were observed on X-ray images from 35% of the patients; however, these findings were not correlated with clinical scores. Thirty-seven athletes returned to their previous levels of sports activities within 2 months after injury. Neither the clinical results nor the incidence of posttraumatic roentgenographic changes differed significantly between patients who were surgically treated and patients who were not.

The current activities of the hand surgery division
XIAFLEX® (Endo Pharmaceuticals, Inc., Malvern, PA, USA), an injectable collagenase preparation that digests pathological palmar fascia as a treatment for Dupuytren contracture, is available at our institution. We have used XIAFLEX® to treat many cases and have obtained good results. For this reason, surgery is performed less often for pathological fascia resection in cases of Dupuytren contracture. Furthermore, patients make favorable comments about treatment with XIAFLEX® because it is, unlike conventional surgical treatment, minimally invasive.
We reported the usefulness of dual-energy computed tomography (CT) for the diagnosis of gouty tophi in the carpal tunnel. With dual-energy CT, a target is imaged with X-ray examinations of 2 different energies. The technique of using the difference in the attenuation coefficient of each energy enables the materials to be discriminated. Dual-energy CT helps with the diagnosis of and surgical planning for atypical tophi and is extremely useful for postoperative evaluation to determine whether the lesion has been removed.

Percutaneous dual SAI screw fixation for spinal deformity in adult patients
The SAI screws are now recognized as effective anchors for long-term fixation. However, clear zone areas around SAI screws have occasionally been reported, and the technique of rod connection between the S1 vertebra and the SAI screw requires specific operative skills. Our present method is based on percutaneous insertion of 2 SAI screws on each side with a modified J-probe under X-ray fluoroscopy. In addition, the correction is strengthened by 2 SAI screws arranged linearly on the sacral bone. The duration of surgery and intraoperative irradiation can be effectively shortened. While being minimally invasive, the surgery is expected to provide strong and lasting fixation.

Clinical results of flat-tapered-wedge short stem insertion in primary total hip arthroplasty for hip dysplasia in an Asian population
Cementless femoral reconstruction in patients with hip dysplasia is challenging. We studied postoperative clinical outcomes of primary total hip arthroplasty in 257 hips using flat-tapered-wedge short femoral stems for hip dysplasia in Asian patients (postoperative follow-up period, 2 years to 6 years 11 months; mean, 4.5 years). Obtained in all patients

were favorable clinical outcomes with satisfactory functional ranges were, including radiologically confirmed biological fixation. Regarding complications, split fracture of the femoral calcar region during stem insertion did not occur, and postoperative dislocation occurred in only 1 case (0.4%). The flexibility of the flat-shaped short low-volume stem used in our study allows more accurate stem positioning in patients with hip dysplasia. Better and easier positioning might reduce fractures when sufficient and secure fixation is achieved.

Osteoporosis treatment soon after total knee arthroplasty
The use of bisphosphonates soon after total knee arthroplasty has been shown to reduce the rate of replacement, 15 years later, by half. In our cases of total knee arthroplasty, when osteoporosis treatment was applied, each drug suppressed the bone resorption, which usually exacerbates postoperatively, while maintaining bone formation without decreasing bone quality.

Anterior cruciate ligament reconstruction with an originally designed rectangular retrodilator
Good clinical results have been reported with anatomical anterior cruciate ligament reconstruction with rectangular bone-patellar tendon-bone grafts. We developed a new technique for making bone tunnels with a rectangular retrodilator. Although long-term results need to be examined, our new technique is a promising procedure without major perioperative or postoperative complications.

3D image analysis study of the hallux valgus pathology
The foot and ankle team, in collaboration with the Institute for High Dimensional Medical Imaging, has been studying the pathophysiology of hallux valgus using load position CT and a 3D analysis system. Last year, we reported instability in the intercuneiform 1-2 joint in valgus feet. This year, we focused on the 3D structure of metatarsals and found that internal torsion of the first metatarsal was significantly more pronounced in feet with hallux valgus than in control feet. However, the twist was not correlated with the severity of hallux valgus, suggesting that the twist is the cause rather than an aggravating factor of hallux valgus deformity.

Comprehensive analysis of advanced glycation end-products using liquid chromatography mass spectrometry
The accumulation of advanced glycation end-products (AGEs) in bone collagen reportedly decreases bone quality. Although more than 40 AGE structures have been identified *in vivo*, a precise determination was difficult, except for pentosidine. We established a method to quantitate the amounts of Nε-carboxymethyl-lysine, Nε-carboxyethyl-lysine, methylglyoxal-derived hydroimidazolone 1, Nω-carboxymethylarginine, and pentosidine with liquid chromatography mass spectrometry. Analysis of 182 specimens of human cancellous bone dissected during total knee replacement revealed that AGEs newly determined with our research were at levels approximately 100 times as high as that of pentosidine and showed similar tendencies of accumulation. A multiple linear regression

analysis identified the independent determinants of high AGE levels to be male sex, aging, low turnover, high HbA1c level, and obesity.

Treatment of intertrochanteric femoral fractures with bone defects using an injectable complex of β-TCP, hyaluronic acid, and FGF-2

We developed an injectable complex of β-TCP, hyaluronic acid, and FGF-2, which promotes synostosis of the fracture of a displaced lesser trochanter and repair of cortical bone deficiency. We applied the complex clinically to treat intertrochanteric femoral fractures of AO classification 31-A2 in 7 patients. The complex (combining 2 g of β-TCP granules with 60% of porosities, 2.5 ml of hyaluronic acid, and 1 mg of FGF-2) was injected, under the guidance of X-ray images, into the gap between the displaced lesser trochanter and diaphysis. An intramedullary nail was then inserted. By 12 weeks after surgery, most of β-TCP had been partially absorbed into the bone, and the trochanter part had promoted its synostosis, which was shown in all cases. The complex likely effects the synostosis of displaced fractures of the lesser trochanter.

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