

## Department of Orthopaedic Surgery

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### General Summary

We have focused on topics that require originality of the highest level, necessitate a long-term vision, and call for constant reconsideration of research validity in clinical practice, i.e., topics within the field of translational research.

We developed the world's first system for comprehensive analysis of collagen cross-links. Using the technology we developed, we discovered a biochemical compound that forms upon excessive aging of collagen fibers. In a clinical study we confirmed that this substance can be used as a marker to predict fractures. This marker is now routinely analyzed at medical institutions throughout Japan. Furthermore, in a research project on beta-tricalcium phosphate, a bone-filling material previously designed at our laboratory, we developed a novel carrier material with unique structural characteristics. Its successful application in animal studies allowed for clinical trials in joint surgery, which are now under way.

As interest in minimally invasive surgery has increased in recent years, so has the need for improved surgical skills to obtain better postoperative outcomes. With these developments in mind, we installed a computer-assisted surgery system in our department and are now examining its efficacy for simulating knee and hip reconstruction operations with artificial joints.

### Research Activities

#### *Morphologic and immunohistologic study of the acromion in patients with rotator cuff tears*

It was thought that spur formation is induced by various mechanical stimuli acting at the coracoacromial arch. Prolonged stimulation results in proliferation of fibrous cartilage, its transformation into hyaline cartilage and simultaneous enchondral ossification, especially in patients with a small angle of the acromial slope.

#### *Distal radius fractures*

A morphometric evaluation was performed in a case of transformed distal radius fracture reconstruction. We obtained good results with a conventional plate instead of a locking plate. Further analysis based on fracture examination is under way.

*Postoperative degeneration at adjacent segments following L5/S1 fusion for isthmic spondylolisthesis at L5*

The L5/S1 fused angle and preoperative L5/S1 range-of-motion percentage were considered to be risk factors, according to stepwise logistic regression analysis. It became clear that surgical methods (posterolateral fusion/posterior lumbar interbody fusion) did not affect the clinical results or degeneration at adjacent segments.

*Clinical results of cementless total hip arthroplasty with the Trifix-J Cup and the Primaloc Stem*

We found that large spikes were beneficial for initial fixation of the acetabular cup but that strict indications of this cup must be established because complications occurred in cases of severe hip dysplasia. On the femoral side, excellent biological fixation was obtained in the proximal region of the Primaloc stem (Ortho Development Corp., Draper, UT, USA).

*Quantitative assessment of postoperative range-of-motion during computer-assisted total knee arthroplasty*

Through the use of a tension balancer designed exclusively for computer-assisted surgery, the soft-tissue balance and various joint angles produced by joint repositioning procedures could be quantitatively measured during total knee arthroplasty. Thus, in comparison with previous nonrepositioning reconstruction techniques, computer-assisted surgery allowed analysis of range of motion, an additional postoperative outcome factor that could easily be examined intraoperatively. Research on the usefulness and accuracy of the measurement is under way.

*Achilles tendon ruptures in patients older than 50 years*

In all cases we recognized edema of the leg and claudication. The Thompson test was positive. The patients could walk but could not stand tiptoe on the affected side. We concluded that Achilles tendon rupture might occur due to application of a relatively slight force in patients older than 50 years.

*Reduction surgery with intraoperative irradiation for high-grade malignant soft-tissue tumors*

Intraoperative irradiation of the neurovascular bundle was considered useful for reduction surgery of high-grade malignant soft-tissue tumors.

*Involvement of neutrophils and natural killer cells in reactive arthritis after bacille Calmette-Guerin vaccination*

Leukocytes, most of which were neutrophils, increased in number at the onset of reactive arthritis. The number of lymphocytes was unchanged, but the numbers of natural killer (NK) cells and NK T cells increased. The levels of neutrophils, NK cells, and NK T cells decreased as arthritis resolved.

*Is there a link between bone collagen abnormalities and arteriosclerosis?*

We found that mild hyperhomocysteinemia and vitamin B6 or vitamin D insufficiency are crucial determinants of detrimental crosslinking of bone collagen in patients with hip fracture.

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