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T. Hattori (Eds.)

Biomechanics in Orthopedics

With 210 Figures

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Preface

A major part of orthopedics is the treatment of musculoskeletal diseases caused by structural disorders and mechanical breakdown of living tissue. Therefore, biomechanical consideration of static structures and dynamic mechanisms is compulsory for both diagnosis and treatment of orthopedic diseases.

Previous biomechanical studies have enabled great advances in orthopedic implant technology, such as artificial joint replacement and instrumentation for spinal fusion. Consequently the importance of biomechanics is increasing more and more in daily clinical practice and development. In addition, biomaterial research into mechanical properties and tissue reactions of implant materials is certainly an important area of related study.

This book is comprised of 22 papers presented at the International Seminar on Biomechanics in Orthopedics and the 17th Annual Meeting of the Japanese Society for Orthopedic Biomechanics, held in Nagoya in 1990. The volume contains full descriptions of both conventional and updated knowledge of the spine, ligaments, artificial joint replacement in the hip and knee, fracture treatment, and gait analysis, as well as biomaterials. I earnestly hope that this book will be of benefit to readers in daily clinical work and research.

To close, I would like to thank profoundly the two coeditors, Prof. S.M. Perren and Mr. T. Hattori, and also a quiet supporter Mrs. J. Buchanan in Davos, for their cooperation in producing this book.

SHIGEO NIWA

Preface

In recent years orthopedic biomechanics has become of increasing interest worldwide. The International Seminar on Biomechanics in Orthopedics in Nagoya, Japan, covered a wide spectrum of topics. The study of the mechanics of living things has become inseparable from the manual and instrumental measures involved in the assessment and corrective treatment of musculo-skeletal deformities and diseases. The diversity of this field of investigation encompasses progress in the area of implants and prostheses and aims to expand our knowledge of the biomechanical properties of molecular, cellular, and organ material. This knowledge facilitates the selection of optimal forms and ideal materials which will harmonize with the conditions in the human body. The important evolution of acetabular prostheses and artificial limbs in the last few years and the efforts to find a nickel-free, non-allergenic material for their construction has been addressed in this volume. The role of materials and coatings as part of the wider issue of biocompatibility has been recognized as an essential factor in the consideration of the biomechanical properties of tissues, in particular, in the stages of healing after fracture.

Stimulating material was presented on topics relating to the locomotor system. This includes information on the kinematics of the musculoskeletal system and the quantification of forces, the knowledge of which provides the basis for optimal engineering design of implants.

The heterogeneous nature of the presentations at this seminar underlines the interdisciplinary nature of orthopaedic biomechanics.

The seminar itself and the keen interest of the participants has certainly contributed to stimulating thought and further experimentation in this area, in particular, by the advancement of international cooperation. The contribution of the Japanese Society of Orthopaedic Biomechanics and Prof. Niwa to these fields of research should be acknowledged here. I feel sure that the readers of this volume will profit greatly and be encouraged to pursue their research with renewed zest.

STEPHAN M. PERREN

Preface

As an engineer studying biomechanics in orthopedics, it was a great opportunity to undertake co-editorship of this book, the proceedings of the International Seminar on Biomechanics in Orthopedics with several papers from the 17th annual meeting of the Japanese Society for Orthopedic Biomechanics, both held in 1990.

It goes without saying that orthopedic biomechanics is an interdisciplinary field consisting of orthopedics and engineering. Recently there has been remarkable progress in research and development technology, including the Finite Element Method for stress analysis, computerized control and measurement systems, various fine sensors, and CT and NMR imaging systems. So we have received a great deal of benefit from systems providing more accurate information on living tissue as well as fine prototype products. However, we are also faced with new complicated problems requiring broader and deeper knowledge of both the living body and engineering. Under these circumstances, a stronger link between orthopedics and engineering is surely essential in future research.

I hope that this book will be a milestone in our interaction, and that previous annoying problems will be solved by collaboration of the authors here and readers who have a strong interest in biomechanics. To end, I would like to sincerely thank Prof. S. Niwa for assigning me to this worthwhile work, and also to thank all authors for their contributions to this book.

TOMOKAZU HATTORI

Contents

Prefaces — SHIGEO NIWA	V
— STEPHAN M. PERREN	VI
— TOMOKAZU HATTORI	VII
List of Contributors	XIII

New Aspects of Orthopedic Biomechanics

Fracture

Stability and Bone Healing	3
STEPHAN M. PERREN	

Ligament

The Human Anterior Cruciate Ligament and Its Replacement: Biomechanical Considerations	13
SAVIO L-Y. WOO, DOUGLAS J. ADAMS, and SHINRO TAKAI	

Spine

Clinical Biomechanics of the Spine	31
JOHN H. EVANS	

Hip Joint

Biomechanical Advances in Total Hip Replacement	46
PHILIP C. NOBLE	

Knee Joint

Biomechanics of Knee Replacement	76
JOHN J. O'CONNOR and JOHN W. GOODFELLOW	

X Contents

Gait

Current Trends in Gait Analysis: Advanced Techniques for Data Acquisition and Analysis 102
TOMOKAZU HATTORI

Knee Joint Force in Normal and Pathological Gait 121
IAN J. HARRINGTON

Biomaterials

Materials for Bone Repair, Augmentation, and Implant Coatings 147
RACQUEL Z. LEGEROS

Modern Trends of Orthopedic Biomechanics in Japan

Fracture

Visco-Elastic Behavior of Callus in Rabbit Femurs 177
YOSHINORI MIYASAKA, MINORU SAKURAI, TOSHIMITSU A. YOKOBORI,
and SHIGERU SASAKI

A New Methodology with an Application of Robotics to Control the Mechanical Environment Around Experimentally Fractured Bone 183
KIYOSHI MABUCHI, HIROMICHI FUJIE, YOSHIRO YAMATOKU,
MAKOTO YAMAMOTO, and TADASHI SASADA

Spine

Three-Dimensional Kinematic Analysis of the Human Whole Lumbar Spine and Natural Lumbosacral Spondylolysis 194
ISAO YAMAMOTO, KIYOSHI KANEDA, and MANOHAR M. PANJABI

Hip Joint

Micromotion and Strains of Cementless Femoral Prostheses 204
YASUHIRO OKUMURA, SHINICHI IMURA, HIRONORI OOMORI,
KOUZOU ICHIHASHI, and HIDEYUKI TAKEDANI

A Finite Element Analysis for the Dysplastic Hip: About Rotational Acetabular Osteotomy 210
YUKIO YOSHIDA, NOBUO MATSUI, YOICHI TANEDA, and HIROTAKA IGUCHI

Knee Joint

Function of the Ligament Augmented Device Under Simulated Anterior Cruciate Ligament Reconstruction and Rehabilitation 220
HIROYUKI NAKAMURA, MASAHIRO INOUE, KONSEI SHINO,
NORIMASA NAKAMURA, and KEIRO ONO

Topographic Variation of Indentation Stiffness in the Tibial
Subchondral Plate of the Knee Joint 229
SENEKI KOBAYASHI and TSUNENORI TAKEI

The Effect of Flexibility and Central Stem of the Cementless Total
Knee Tibial Tray on Initial Fixation 237
ICHIRO YOSHII and LEO A. WHITESIDE

Stress Analysis of the Proximal Tibia After Total Knee Arthroplasty
with the Finite Element Method 253
N. YOSHINO, N. INOUE, Y. WATANABE, F. YAMASHITA, Y. HIRASAWA,
T. HIRAI, and T. KATAYAMA

Intraoperative Evaluation of Component Stability in Total Knee
Arthroplasty 263
KENJIRO YOSHIDA, KANJI ASADA, AKIRA SHIMAZU, and HIROSHI SAKANE

Gait Analysis

Three-Dimensional Measurement of Pelvic Rotation 273
KENJI KAWATE, YUTAKA OHNEDA, and SUSUMU TAMAI

Miscellaneous

Biomechanics of Natural and Artificial Joints 282
MASANORI OKA, KEN IKEUCHI, SADAMI TSUTSUMI, TAKAO YAMAMURO,
TAKASHI NOGUCHI, and TAKASHI NAKAMURA

Validation Study of the Rigid Body Spring Model Using the
Metacarpophalangeal Joint 299
TAKATOSHI IDE, YASUHIRO YAMAMOTO, and SHIGERU TATSUGI

Interfacial Reactions to Bioactive and Non-Bioactive Biomaterials 307
HIRONOBU OONISHI

Index 323

List of Contributors

- Adams, D.J. 13
Asada, K. 263
Evans, J.H. 31
Fujie, H. 183
Goodfellow, J.W. 76
Harrington, I.J. 121
Hattori, T. 102
Hirai, T. 253
Hirasawa, Y. 253
Ichihashi, K. 204
Ide, T. 299
Iguchi, H. 210
Ikeuchi, H. 282
Imura, S. 204
Inoue, M. 220
Inoue, N. 253
Kaneda, K. 194
Katayama, T. 253
Kawate, K. 273
Kobayashi, S. 229
LeGeros, R.Z. 147
Mabuchi, K. 183
Matsui, N. 210
Miyasaka, Y. 177
Nakamura, H. 220
Nakamura, N. 220
Nakamura, T. 282
Noble, P.C. 46
Noguchi, T. 282
O'Connor, J.J. 76
Ohneda, Y. 273
Oka, M. 282
Okumura, Y. 204
Ono, K. 220
Oomori, H. 204
Oonishi, H. 307
Panjabi, M.M. 194
Perren, S.M. 3
Sakane, H. 263
Sakurai, M. 177
Sasada, T. 183
Sasaki, S. 177
Shimazu, A. 263
Shino, K. 220
Takai, S. 13
Takedani, H. 204
Takei, T. 229
Tamai, S. 273
Taneda, Y. 210
Tatsugi, S. 299
Tsutsumi, S. 282
Watanabe, Y. 253
Whiteside, L.A. 237
Woo, S.L-Y. 13
Yamamoto, I. 194
Yamamoto, M. 183
Yamamoto, Y. 299
Yamamuro, T. 282
Yamashita, F. 253
Yamatoku, Y. 183
Yokobori, T.A. 177
Yoshida, K. 263
Yoshida, Y. 210
Yoshii, I. 229
Yoshino, N. 253