S. Niwa · S.M. Perren
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 musculoskeletal 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

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