# Biomechanics Of The Lumbar Spine

Annotation. The "Bone and Joint Decade" draws our attention with increased intensity to the problem of the changes related to aging of our musculoskeletal system and the associated socioeconomic implications. In view of the increasing age of the worldwide population the impact seems to be tremendous. The editors of The Aging Spine pick up this interesting topic and engage opinion leaders to contribute their knowledge in this supplement. The various contributions cover most of the important problems, which are included in the vast specter of aging spine: osteoporosis, spinal stenosis, and tumors of the spine. The aging spine will be an everpresent issue in the life of a physician taking care of the different pathologies of the spine. This text will help to better understand the nature of the different changes in the spine of the elderly. It contributes to enabling us to diagnose and to treat this complex problem in an appropriate way.nbsp.
Biomechanics of the Spine encompasses the basics of spine biomechanics, spinal tissues, spinal disorders and treatment methods. Organized into four parts, the first chapters explore the functional anatomy of the spine, with special emphasis on aspects which are biomechanically relevant and quite often neglected in clinical literature. The second part describes the mechanics of the individual spinal tissues, along with commonly used testing set-ups and the constitutive models used to represent them in mathematical studies. The third part covers in detail the current methods which are used in spine research: experimental testing, numerical simulation and in vivo studies (imaging and motion analysis). The last part covers the biomechanical aspects of spinal pathologies and their surgical treatment. This valuable reference is ideal for bioengineers who are involved in spine biomechanics, and spinal surgeons who are looking to broaden their biomechanical knowledge base. The contributors to this book are from the leading institutions in the world that are researching spine biomechanics. Includes broad coverage of spine disorders and surgery with a biomechanical focus Summarizes state-of-the-art and cutting-edge research in the field of spine biomechanics Discusses a variety of methods, including In vivo and In vitro testing, and finite element and musculoskeletal modeling
Spinal disorders are among the most common medical conditions with significant impact on health related quality of life, use of health care resources and socio-economic costs. This is an easily readable teaching tool focusing on fundamentals and basic principles and provides a homogeneous syllabus with a consistent didactic strategy. The chosen didactic concept highlights and repeats core messages throughout the chapters. This textbook, with its appealing layout, will inspire and stimulate the reader for the study of spinal disorders.
Chronic low-back pain is the focus of this book. Presented in a systematic manner, this work reviews epidemiological studies which have shown that various mechanical factors play a significant role in the onset of chronic low-back pain. To provide you with a better understanding of the information in these chapters, ample illustrations and tables are included. At the end of each chapter, the reader is directed to even further in-depth information. It is the intent of the authors that this writing will promote further biomechanical research. Written in an instructional format, this text is ideal for training bioengineering and medical students. This volume is also of practical value to practicing surgeons and scientists who are interested in seeking solutions to the low-back pain problem.
Experimental Methods in Orthopaedic Biomechanics is the first book in the field that focuses on the practicalities of performing a large variety of in-vitro laboratory experiments. Explanations are thorough, informative, and feature standard lab equipment to enable biomedical engineers to advance from a ‘trial and error’ approach to an efficient system recommended by experienced leaders. This is an ideal tool for biomedical engineers or biomechanics professors in their teaching, as well as for those studying and carrying out lab assignments and projects in the field. The experienced authors have established a standard that researchers can test against in order to explain the strengths and weaknesses of testing approaches. Provides step-by-step guidance to help with in-vitro experiments in orthopaedic biomechanics Presents a DIY manual that is fully equipped with illustrations, practical tips, quiz questions, and much more Includes input from field experts who combine their real-world experience to provide invaluable insights for all those in the field
Biomechanics and Mechanobiology of the Lumbar Spine: Computational Approaches: From Research to In Silico Medicine aims to outline how major decision points-such as goal-adapted numerical approximations-infer in the capability of lumbar spine models to provide valuable cause-and-effect relationships in the study of organ conditions and treatments. The spine presents an astonishing balance between mechanical resistance and flexibility in the human body, provided by complex interactions that are extremely difficult to restore when altered in disease. Given that these interactions are difficult to assess in situ, designing efficient treatments for low back pain remains a grand challenge in medicine. Numerical methods can greatly help to acquire educated views on the transfer of mechanical loads among spine tissues, in relation to both the biological maintenance and the pathogenesis of the organ. Along more than 10 years of activity in research, the author has explored in depth the capability of finite element models to capture the functional load transfers within the lumbar spine. Readers are expected to identify useful guidelines for model developments in both research and clinical applications. Offers an overview of modelling approaches for the development of lumbar spine finite element models towards different types of applications Evaluates methods based on both commonly accepted and the most advanced modelling solutions Uniquely links simulation techniques and practical knowledge about the functional biomechanics of the lumbar spine Outlines how major decision points-such as goal-adapted numerical approximations-infer in the capability of lumbar spine models to provide valuable insight for organ conditions and treatments
Biomechanics of the SpineBasic Concepts, Spinal Disorders and TreatmentsAcademic Press
This book provides a state-of-the-art look at the applied biomechanics of accidental injury and prevention. The editors, Drs. Narayan Yoganandan, Alan M. Nahum and John W. Melvin are recognized international leaders and researchers in injury biomechanics, prevention and trauma medicine. They have assembled renowned researchers as authors for 29 chapters to cover individual aspects of human injury assessment and prevention. This third edition is thoroughly revised and expanded with new

chapters in different fields. Topics covered address automotive, aviation, military and other environments. Field data collection; injury coding/scaling; injury epidemiology; mechanisms of injury; human tolerance to injury; simulations using experimental, complex computational models (finite element modeling) and statistical processes; anthropomorphic test device design, development and validation for crashworthiness applications in topics cited above; and current regulations are covered. Risk functions and injury criteria for various body regions are included. Adult and pediatric populations are addressed. The exhaustive list of references in many areas along with the latest developments is valuable to all those involved or intend to pursue this important topic on human injury biomechanics and prevention. The expanded edition will interest a variety of scholars and professionals including physicians, biomedical researchers in many disciplines, basic scientists, attorneys and jurists involved in accidental injury cases and governmental bodies. It is hoped that this book will foster multidisciplinary collaborations by medical and engineering researchers and academicians and practicing physicians for injury assessment and prevention and stimulate more applied research, education and training in the field of accidental-injury causation and prevention.

With an ever-expanding array of biomaterials and implant devices appearing in the field, this source helps surgeons assess and utilize the latest technologies to improve the reconstruction of the spine and enhance the reconstitution of diseased spinal segments. With illustrative descriptions of specific clinical scenarios, this guide helps surgeons select the best devices and materials for reconstructive procedures and considers issues in biocompatibility, biostability, and structure-function relationships for enhanced patient outcomes and mobility.

Every year workers' low-back, hand, and arm problems lead to time away from jobs and reduce the nation's economic productivity. The connection of these problems to workplace activities-from carrying boxes to lifting patients to pounding computer keyboards-is the subject of major disagreements among workers, employers, advocacy groups, and researchers. Musculoskeletal Disorders and the Workplace examines the scientific basis for connecting musculoskeletal disorders with the workplace, considering people, job tasks, and work environments. A multidisciplinary panel draws conclusions about the likelihood of causal links and the effectiveness of various intervention strategies. The panel also offers recommendations for what actions can be considered on the basis of current information and for closing information gaps. This book presents the latest information on the prevalence, incidence, and costs of musculoskeletal disorders and identifies factors that influence injury reporting. It reviews the broad scope of evidence: epidemiological studies of physical and psychosocial variables, basic biology, biomechanics, and physical and behavioral responses to stress. Given the magnitude of the problem-approximately 1 million people miss some work each year-and the current trends in workplace practices, this volume will be a must for advocates for workplace health, policy makers, employers, employees, medical professionals, engineers, lawyers, and labor officials.

Abstract: Significant effort has been invested in developing finite element models in the field of spinal biomechanics. However, nearly all previous studies have applied artificially set static or short duration dynamic loads (

The intervertebral disc is a complex structure that separates opposing vertebrae, permits a wide range of motion, and accommodates high biomechanical forces. Disc degeneration leads to a loss of function and is often associated with excruciating pain. Written by leading scientists and clinicians, the first part of the book provides a review of the basic biology of the disc in health and disease. The second part considers strategies to mitigate the effects of disc degeneration and discusses the possibility of engineering replacement tissues. The final section is devoted to approaches to model normal development and elucidate the pathogenesis of degenerative disc disease using animal, organ and cell culture techniques. The book bridges the gap between the basic and clinical sciences; the target audience includes basic scientists, orthopaedists and neurologists, while at the same time appealing to the needs of graduate students, medical students, interns and fellows.

Biomechanics of Spine Stabilization, Third Edition, is a comprehensive and highly readable reference that helps spine specialists understand the clinically important biomechanical principles underpinning spinal surgery and instrumentation so that the best clinical decisions can be made for patients. This new edition includes coverage of the latest spine technology that has evolved over the past decade, such as motion preservation technologies and minimally invasive spine surgery. Features: Single-authored text with the consistent, authoritative voice of world-renowned expert Dr. Benzel More than 350 new figures and original line drawings help clarify information in the text Extensive glossary of basic terminology on biomechanics for quick, easy reference More than 400 review questions at the back of the book for help with exam preparation This book is an excellent clinical reference for spine surgeons, residents, and fellows in the fields of orthopedic surgery and neurosurgery, neuroradiologists, and engineers working for spine device companies. Thieme eNeurosurgery is the worlds most comprehensive neurosurgical resource online. For a free trial, go to: thieme.com/eneurotrial

The amount of load that can be borne by the different components of the lumbar region is fairly well understood, as are resulting injuries from overloading. Less severe lumbar injuries involve a wide range of factors, including: heredity, obesity, age, occupation, sports, cardiovascular risk factors, and depression. Some of the most painful conditions that require high levels of care involve lumbar spine fracture or soft tissue injury from falls, contact sports, vehicle collisions, aircraft ejection, and underbody blasts from roadway explosions (military injuries). Each of these injury scenarios elicits a different kinematic response of the spine as a result of load direction, magnitude, and duration. Updated from a popular earlier volume, this new compendium includes landmark papers from 1994 through 2013 that focus exclusively on lumbar injuries. It also features an introductory chapter, "Blunt Lumbar Trauma" that provides an overview of the anatomy of the lumbar region, injury, and injury mechanisms, as well as an extensive literature update. This edition is the third in a series of biomechanics compendia edited by Mr. Pike. Earlier editions covered injuries of the neck and head. For this volume, Mr. Pike and the advisory panel selected 15 of the best papers from a variety of sources including SAE International, IRCOBI, Stapp, NHTSA, ESV, and the Association for the Advancement of Automotive Medicine. The book will be helpful to those studying lumbar injury from a broad range of causes, including transportation, falls, sports, personal violence, and blast-related. Professionals from a variety of disciplines will find the book useful: biomechanics, accident reconstruction, medical and rehabilitation, insurance, legal, and law enforcement.

Authored by experts of international renown, the new edition of The Biomechanics of Back Pain forms a bridge between the latest research and the effective clinical management of patients with back problems. Now published for the first time in full colour, the volume presents a unique synthesis of the latest research findings and explains its recent changes in emphasis - from trying to understand and reverse age-related spinal degeneration to addressing the soft tissue causes of pain. New chapters are devoted to Sensorimotor Control, and Cervical Spine Anatomy and Biomechanics, while a bonus website contains useful PowerPoint presentations, which include seminars entitled Back Pain and Forces on the Spine as well as an overview of the Psychosocial Flags Framework. Clinically orientated and highly practical throughout, The Biomechanics of Back Pain has become the standard platform by which readers keep abreast of research and developments in the field and is essential for all clinicians involved in the care and treatment of patients with back pain, as well as for those studying its causes and methods of prevention. Established authoritative text for clinicians, lecturers, researchers and those working in the medico-legal arena Emphasizes the latest perspectives in research and shows how it is now leading to advances in clinical methodology Provides an

overview of the best original research – including more than 350 new references – to provide researchers with the latest and most important information relating to back pain Contains over 150 full-colour line artworks and more than 60 photographs Additional chapters devoted to Sensorimotor Control, and Cervical Spine Anatomy and Biomechanics Includes more than 350 new references Now published in full colour with improved page design and navigation Bonus website containing useful PowerPoint presentations, which include seminars entitled Back Pain and Forces on the Spine as well as an overview of the Psychosocial Flags Framework

This book is a new encyclopedia. It explains how the horseâ€™s vertebral column actually works. Each pertinent finding is explored from the rider and trainer perspective; how such new knowledge does modernize previous perceptions in terms of riding and training techniques.

This practical text, written by four key researchers in the field, offers an effective approach to the management and treatment of back pain based on applications of biomechanics. By linking the clinical anatomy of the spine to biomechanics principles, it provides a bridge between anatomy and practical applications. This highly illustrated, up-to-date book is essential reading for anyone involved in the care and treatment of patients with back pain, as well as for those studying its causes and methods of prevention. Addresses the important and prevalent problem of back pain thoroughly from a unique biomechanics perspective. Written especially for practitioners, the book presents information in a way that is relevant to therapists who treat patients with back pain. Authored by four of the leading researchers in the field from different professional backgrounds, the book comprehensively examines back pain from diverse perspectives. Provides an understanding of back mechanics that is necessary in order to form an accurate diagnosis and treatment plan. Six new chapters are included: Growth and Aging of the Lumbar Spine; Spinal Degeneration; Biomechanics of Spinal Surgery; Surgery for Disc Prolapse; Spinal Stenosis and Back Pain; and Conservative Management of Back Pain. Expanded sections on spinal growth and aging provide additional comprehensive information on this important topic. Includes additional and updated information on the interpretation and explanation of spine research literature. An expanded color plate section with 23 new black-and-white photographs and 21 new line drawings illustrate the content clearly.

A microdiscectomy is the surgical standard of care for a lumbar disc herniation and is the most common lumbar spine surgery performed in the United States. The procedure can be done in “partial” (PD) and “subtotal” (SD) fashions, with the latter being the more aggressive of the two techniques. Currently, there is limited information regarding the effects of microdiscectomy on the biomechanics of the lumbar spine. As a first step in addressing this issue, this research aimed to understand how PD and SD affect the mechanics of the lumbar facet joints at the level of surgery. The response of the facet joints was described by (1) the three-dimensional kinematics (3D) of the facets and (2) the strains in the capsular ligament surrounding the joint. These metrics were explored in two separate in vitro investigations using human cadaveric spinal specimens. In both studies, the specimens were tested with a spine simulator that applied pure moments to the superior vertebra while allowing unrestricted motion of the specimen. The specimens were tested during physiological motions of: flexion-extension (FE), lateral bending (LB), axial rotation, and combined FE with LB. The studies employed a repeated measures approach whereby each specimen was tested with its disc intact and in post-PD and -SD states. The kinematics of the facets were determined via a rigid-body, point-based registration technique; and the capsular strains were measured with a custom 3D digital image correlation system. Of the two procedures, only SD was shown to significantly increase the motion of the facets and the strains in the capsular ligament. Increased motion could lead to mechanical overload of the facets, potentially resulting in degenerative changes at the joint and subsequent pain. Additionally, neuroanatomical studies have shown that the capsular ligament is innervated with mechanosensitive nociceptors. Thus, SD patients may also be at risk of experiencing pain that originates from the capsule. These potential outcomes should be weighed by clinicians when deciding on the best course of treatment for their patients.

The Routledge Handbook of Biomechanics and Human Movement Science is a landmark work of reference. Now available in a concise paperback edition, it offers a comprehensive and in-depth survey of current theory, research and practice in sports, exercise and clinical biomechanics, in both established and emerging contexts. Including contributions from many of the world's leading biomechanists, the book is arranged into five thematic sections: biomechanics in sports injury, orthopedics and rehabilitation health and rehabilitation training, learning and coaching methodologies and systems of measurement. Drawing explicit connections between the theoretical, investigative and applied components of sports science research, this book is both a definitive subject guide and an important contribution to the contemporary research agenda in biomechanics and human movement science. It is essential reading for all students, scholars and researchers working in sports biomechanics, kinesiology, ergonomics, sports engineering, orthopaedics and physical therapy.

Contains 58 papers published between 1968 and 1994, on the anatomy of the human abdomen, lumbar spine, and pelvis and the biomechanics of impact injury and injury tolerances of these body segments. Six sections cover the human abdomen, lumbar spine, and pelvis complex; biomechanics, impact response,

Clinical and Radiological Anatomy of the Lumbar Spine 5e continues to offer practical, comprehensive coverage of the subject area in a unique single volume which successfully bridges the gap between the basic science of the lumbar region and findings commonly seen in the clinic. Prepared by an author of international renown, Clinical and Radiological Anatomy of the Lumbar Spine 5e provides clear anatomical descriptions of the individual components of the lumbar region, as well as the intact spine, accompanied by a full colour artwork programme. Detailed anatomical descriptions are followed by an explanation of the basic principles of biomechanics and spinal movement together with a comprehensive overview of embryology and the influence of age-related change in the lumbar region. The problem of low back pain and instability are also fully explored while an expanded section on medical imaging completes the volume. Clinical and Radiological Anatomy of the Lumbar Spine 5e offers practical, validated and clinically relevant information to all practitioners and therapists working in the field of low back pain and will be ideal for students and practitioners of chiropractic, osteopathic medicine and osteopathy, physiotherapy, physical therapy, pain medicine and physiatry worldwide. Presents a clear and accessible overview of the basic science relating to the structure and function of the lumbar spine Written by an internationally renowned expert in the fields of both clinical anatomy and back pain Describes the structure of the individual components of the lumbar spine, as well as the intact spine Goes beyond the scope of most anatomy books by endeavouring to explain why the vertebrae and their components are constructed the way they are Provides an introduction to biomechanics and spinal movement with special emphasis on the role of the lumbar musculature Explores both embryology and the process of aging in the context of spinal structure and function Explores mechanical back pain within the context of the structural and biomechanical principles developed earlier in the volume Extensive reference list allows readers seeking to undertake research projects on some aspect of the lumbar spine with a suitable starting point in their search through the literature Perfect for use both as an initial resource in undergraduate training in physiotherapy and physical medicine or as essential reading for postgraduate studies Greatly expanded

section on medical imaging Increased elaboration of the regional anatomy of the lumbar spine Includes chapter on reconstructive anatomy, which provides an algorithm showing how to put the lumbar spine back together Presents an ethos of ‘anatomy by expectation’ - to show readers what to expect on an image, rather than being required to identify what is seen

It was found in 2016 by the Bureau of Labor Statistics that manual material handlers have the highest incidence rates for the development of an LBD. This is in part due to the fact of the work environment in which they are exposed. Half of MMH task include pushing and pulling, which poses a need to investigate how various cart designs effect the workers. While there are a vast array of pushing and pulling studies, this study is among the first to investigate how handle height, hand width, and orientation effect the biomechanical loading on the spine. The objective of this study was to use 3D EMG-assisted biomechanical model to determine how changing handle configurations influence the biomechanical loading to the lumbar spine. 12 subjects performed simulated pushing and pulling tasks in a laboratory setting. Handles were attached to an overhead rig that was used to provide resistance to the subject via a magnetic particle braking system. The resistance incrementally increased as subjects translated the rig during pushing or pulling tasks until the subject reached their maximum voluntary exertion (MVE). A dynamic, 3D EMG-assisted biomechanical model was used to estimate spinal loads and measures of the external hand forces. The tradeoffs various handle configurations offered were analyzed to find the most optimal. Resultant hand forces and spinal loads were highly sensitive to handle height and hand width. It was found that for pushing, handle height (p

Dynamic Reconstruction of the Spine is an essential reference on the current techniques and equipment for dynamic stabilization of the spine.Covering both anterior and posterior approaches to dynamic stabilization, the book presents a complete overview of the state-of-the-art technologies in spinal arthroplasty and instrumentation for dynamic stabilization. Each chapter of this authoritative text focuses on a different technology. The authors illuminate the key concepts of each implant device and provide concise discussion of the rationale, indications, contraindications, surgical techniques, and postoperative results. Highlights: Synthesizes the vast amount of literature on the newest implantable artificial disks for restoring and preserving motion of the spine Features contributions from the inventors of or experts on these systems Demonstrates key concepts of instrumentation and techniques with more than 400 instructional illustrations Dynamic Reconstruction of the Spine is an indispensable reference for all spine specialists, neurosurgeons, orthopedic surgeons, radiologists, fellows, and residents seeking the latest information on this emerging technology.

Here is a how-to manual For The conservative treatment of everyday back problems. Clinical Implications combines theories of spinal biomechanics with thorough instructions for prevention, therapy, and follow-up care of spinal disorders. This manual is comprehensive in its coverage of spinal anatomy, physiology, function, biochemistry, and pathology; influences of daily activities; examination and treatment; effects of individual sports on spinal function; and much more. Extensively illustrated and referenced.

Owing to their frequency and possible consequences and considering the fact they frequently affect young people, trauma tic lesions of the thoraco lumbar spine represent a special point of interest within the field of Neurotraumatology. Traffic accidents are the commonest cause, which accounts for the high peak of occurrence between 15 and 24 years of age. It is also worth noting that according to published series nearly 50% ofthe cases affect the thoraco-lumbar junction. From an anatomical point of view, we must note the severity of thoracic spinal cord lesions especially of the thoraco-lumbar junction and of the lumbar region and be able to associate injuries ofthe conus medullaris and of the ca uda equina where there is a possibility of neurological recovery. Clinical evaluation is not always easy, but remains the basis for diagnosis and prognosis. The neurological classification proposed by FRANKEL et al. in 1969 and used at STOKE MANDEVILLE Hospital seems to retain its value. A more sophisticated study of medullary evoked potentials, as described by TsUBOKAWA can allow a more precise localisation and appreciation of the extent ofthe lesion as well as a better evaluation ofthe prognosis and ofthe evaluation of treatment in the acute phase. The neuro-radiological study should include standard views ofthe whole of the spine with antero-posterior and lateral tomograms of the fractured or luxated area. At present, the unquestionable contribution of the CT.

Lumbar disc arthroplasty is a novel technology which may provide a more physiologic alternative to fusion for patients suffering from a variety of conditions related to lumbar intervertebral disc. There are various designs proposed for discs. Most of these designs require an anterior surgical procedure for placement of the implant at designated level. There are numerous clinical, experimental and computational biomechanical studies available on present disc arthroplasty systems. Some of these studies have shown satisfactory clinical and biomechanical outcomes following replacement of such devices. However, facet pain and degeneration, improper load balance and spinal alignment have surfaced the main deficiencies of such devices. The difficulties in surgical approach and revision surgery are other disadvantageous of current anterior disc arthroplasty procedures. In this thesis in vitro testing and finite element modeling are used to design and biomechanically evaluate a new 360 motion preservation construct which included a matched pair posterior disc and dynamic stabilization system. Biomechanical studies were done to optimize the design of this construct through measuring parameters such as range of motion, stresses in implants, center of rotation and intradiscal pressure (IDP). Based on the parameters evaluated in the study, the new 360 motion preservation system was found to be able to preserve the normal kinematics at index and adjacent segments of spine. The 360 arthroplasty construct preserved the normal quality of motion by having extension-to-flexion center of rotation close to that of intact. Having relatively low stresses at implant components at full motion was a good indicator of satisfactory long term performance of the system in vivo. The intact like load sharing at the intervertebral disc adjacent to 360 system would lessen the risk of disc and facet degeneration as well. The developed 360 system has the advantage of relatively easier surgical procedure compared to the available anterior disc designs. Also the revision surgery becomes easier compared to anterior approach. The proposed design has the potential to address posterior joint degeneration which is the main contradiction of available anterior disc arthroplasties. Moreover this new design broadens the indications for disc replacement to low back pain patients due posterior joint degeneration, like spinal stenosis. Further biomechanical studies were done on components of the poster dynamic stabilization system (PDS) to find a proper configuration for standalone PDS for application in treatment of lumbar spine stenosis. The proposed PDS configurations were able to provide the spinal segment with a constrained range of motion and stability while maintaining lower stresses at pedicle screws compared to traditional rigid fixation systems. Unlike some available semi-rigid stabilization constructs, the PDS was shown to have more restricted flexibility in transverse plane while maintaining a favorable kinematics in other planes of motions.

Advances in Spinal Fusion reveals a new generation of materials and devices for enhanced operations in spinal fusion. This reference showcases emerging research and technologies in areas such as biodegradable implants, drug delivery, stem cell isolation and transfection,

cell encapsulation and immobilization, and the design of 2D and 3D scaffolds for cells. It captures a cascade of innovations crucial to increased healing and decreased morbidity in spinal fusion methods and mechanics and addresses current standards in analytical methodology and quality control, it describes the selection of biomaterials for improved biocompatibility, biostability, and structure/function relationships.

This clinically oriented text focuses on biomechanics as it relates to spinal manipulative treatment, emphasizing the applications to daily practice. Chapters cover basic mechanics, functional anatomy, mechanics of spinal manipulation, and the effects of spinal manipulation. A chapter of case studies illustrates the application of biomechanics to spinal manipulation. (Product Description).

Knowledge of lumbar spine biomechanics in living human subjects is fundamental for understanding mechanisms of spinal injury and pathology, for improvement of corresponding clinical treatments, and for design of spinal prosthesis. However, due to the complicated spine anatomy and loading conditions as well as high risks in these direct measurements, it has been a challenge to determine the in vivo biomechanics of the lumbar spine. To address this problem, the overall objective of this thesis was to develop and implement a dual fluoroscopic imaging system to non-invasively study human lumbar spine biomechanics. In line with this objective, the first goal was to quantify the ability of the dual fluoroscopic imaging system to determine vertebral kinematics. The second goal was to implement this technique to investigate spinal motion in both healthy subjects and patients with pathology. The third goal was to explore the feasibility of using kinematic data obtained from this system as boundary conditions in finite element analysis to calculate the physiological loads on the intervertebral disc. The system was shown to be accurate and repeatable in determining the vertebral kinematics in all degrees of freedom. For the first time, six degree-of-freedom motion of different structures of the spine, such as the vertebral body, intervertebral disc, facet joint and spinous process were measured in vivo in both healthy subjects and subjects with pathology during functional activities. In general, the group of subjects with pathology showed a significantly abnormal kinematic response during various physiological functional activities. Preliminary studies have shown the applicability and high accuracy of finite element modeling to calculate disc loads using in vivo vertebral kinematics as displacement boundary conditions.