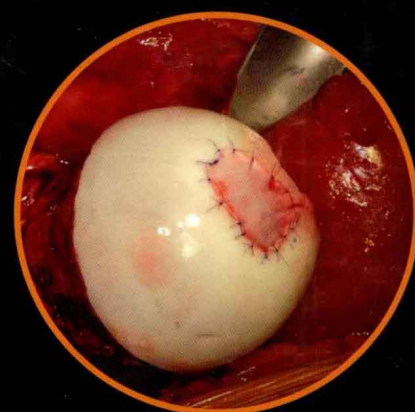




DVD inside

# **Techniques in Hip Arthroscopy and Joint Preservation Surgery**



**Jon K. Sekiya  
Marc R. Safran  
Anil S. Ranawat  
Michael Leunig**

# Techniques in **Hip Arthroscopy and Joint Preservation SURGERY** **With EXPERT CONSULT Access**

## **Jon K. Sekiya, MD**

Associate Professor and Team Physician  
MedSport  
Department of Orthopaedic Surgery  
University of Michigan  
Ann Arbor, Michigan

## **Anil S. Ranawat, MD**

Assistant Professor  
Orthopaedic Surgery  
Weill Medical College of Cornell University

Assistant Attending  
Orthopaedic Surgery  
Hospital for Special Surgery  
New York, New York

## **Marc E. Safran, MD**

Professor and Associate Director  
Sports Medicine  
Department of Orthopaedic Surgery  
Stanford University  
Redwood City, California

## **Michael Leunig, MD**

PD Dr. Med.,  
Department of Orthopaedic Surgery  
University of Bern  
Bern, Switzerland

Head of Orthopaedics  
Department of Orthopaedics  
Schulthess Clinic  
Zürich, Switzerland



TECHNIQUES IN HIP ARTHROSCOPY AND  
JOINT PRESERVATION SURGERY

ISBN: 978-1-4160-5642-3

Copyright © 2011 by Saunders, an imprint of Elsevier Inc.

**All rights reserved.** No part of this publication may be reproduced or transmitted in any form or by any means, electronic or mechanical, including photocopy, recording, or any information storage and retrieval system, without permission in writing from the publisher. Permissions may be sought directly from Elsevier's Rights Department: phone: (+1) 215 239 3804 (US) or (+44) 1865 843830 (UK); fax: (+44) 1865 853333; e-mail: [healthpermissions@elsevier.com](mailto:healthpermissions@elsevier.com). You may also complete your request on-line via the Elsevier website at <http://www.elsevier.com/permissions>.

**Notice**

Knowledge and best practice in this field are constantly changing. As new research and experience broaden our knowledge, changes in practice, treatment and drug therapy may become necessary or appropriate. Readers are advised to check the most current information provided (i) on procedures featured or (ii) by the manufacturer of each product to be administered, to verify the recommended dose or formula, the method and duration of administration, and contraindications. It is the responsibility of the practitioner, relying on his or her own experience and knowledge of the patient, to make diagnoses, to determine dosages and the best treatment for each individual patient, and to take all appropriate safety precautions. To the fullest extent of the law, neither the Publisher nor the Editors assume any liability for any injury and/or damage to persons or property arising out of or related to any use of the material contained in this book.

The Publisher

**Library of Congress Cataloging-in-Publication Data**

Techniques in hip arthroscopy and joint preservation surgery / [edited by] Jon K. Sekiya, Marc R. Safran, Michael Leunig, Anil S. Ranawat. – 1st ed.

p. ; cm.

Includes bibliographical references.

ISBN 978-1-4160-5642-3

1. Hip joint—Surgery. 2. Hip joint—Endoscopic surgery. I. Sekiya, Jon K. II. Safran, Marc R.  
III. Leunig, Michael. IV. Ranawat, Anil S.

[DNLM: 1. Hip Injuries—surgery. 2. Arthroscopy—methods. 3. Hip Joint—surgery. WE 855 T255 2011]

RD772.T43 2011

617.5'81059—dc22

2009039236

*Acquisitions Editor:* Daniel Pepper

*Developmental Editor:* Julie Goolsby

*Publishing Services Manager:* Anitha Raj

*Project Manager:* Beula Christopher/Sara Alsup

*Cover Designer:* Ellen Zanolle

Printed in the United States of America

Last digit is the print number: 9 8 7 6 5 4 3 2 1

Working together to grow  
libraries in developing countries

[www.elsevier.com](http://www.elsevier.com) | [www.bookaid.org](http://www.bookaid.org) | [www.sabre.org](http://www.sabre.org)

ELSEVIER

BOOK AID  
International

Sabre Foundation

Techniques in  
**Hip Arthroscopy and  
Joint Preservation  
SURGERY**

## Video Table of Contents

1. The Technique and Art of the Physical Examination of the Adult and Adolescent Hip – Hal David Martin
2. Complex Therapeutic Hip Arthroscopy Using a Femoral Distractor – Hassan Sadri
3. Arthroscopic Synovectomy and Treatment of Synovial Disorders – Christopher M. Larson
4. Surgical Hip Dislocation for Femoracetabular Impingement – Michael Leunig
5. Ceramic on Ceramic Total Hip Arthroplasty – Amar S. Ranawat and Chitranjan S. Ranawat
6. Arthroscopic Treatment of Cam Impingement – Marc R. Safran
7. Arthroscopic Femoral Osteoplasty – Jon K. Sekiya
8. Arthroscopic Iliopsoas Lengthening and Labral Repair – Anil S. Ranawat
9. Arthroscopic Labral Repair, Cam Decompression and Capsular Repair – Anil S. Ranawat
10. Arthroscopic Rim Trim/Acetabuloplasty with Labral Refixation and Repair – Jon K. Sekiya
11. Hip Arthroscopy by the Lateral Approach – Thomas G. Sampson
12. Arthroscopic Capsular Plication – Jon K. Sekiya
13. Arthroscopic and Open Iliotibial Band Lengthening and Bursectomy – Jon K. Sekiya
14. Arthroscopic Iliotibial Band Lengthening and Bursectomy – Champ L. Baker, Jr.
15. Arthroscopic Labral Reconstruction Using Iliotibial Band Autograft – Marc J. Philippon
16. Arthroscopic Microfracture of Peripheral Acetabular Lesion – Jason L. Koh
17. Arthroscopic Microfracture of Central Acetabular Lesion – Jason L. Koh
18. Appendix A - Physical Therapy and Rehabilitation of the Hip (Online only) – RobRoy L. Martin and Keelan R. Enseki
19. Hip Arthroscopy: Anatomy, Portals and Diagnostic Round – Marc R. Safran
20. Arthroscopic Acetabular Labral Surgery: Debridement and Repair – Marc R. Safran



## Foreword to "Arthroscopic Management of Hip Diseases"

Today, surgeons routinely use the arthroscope for the diagnosis and treatment of joint problems. However, few surgeons apply the arthroscope to the hip joint. The reasons for the lack of interest in this procedure are because the deep position of the hip joint which makes it difficult to reach and there is small number of indications. In order for the surgeon to be adept at a difficult operation, he must perform the surgery frequently. Because of the lack of indications for hip arthroscopy, it is almost impossible to perfect the technique. The surgeon will often discard the procedure or refer it to someone who has experience in it.

Unlike the knee, the hip joint is made up of two opposing joint surfaces. It is a well-contained and stable joint, so it is protected from trauma. Therefore, many of the problems that occur in the hip joint are chronic and result in conditions that are difficult to diagnose and treat. Although the arthroscope is invasive, it has a low potential for complications and its low morbidity make it very useful for these chronic hip conditions. For instance, what is a better way to remove a symptomatic loose body from the hip than with the assistance of the arthroscope? The alternative method would involve a large incision and dislocation of the hip.

I first performed hip arthroscopy in 1977 to evaluate a painful hip that had been nailed for a subtrochanteric fracture. Roentgenograms and laboratory studies were normal. I suspected that the problem was due to arthritis. At that time, I was using the arthroscope in other joints mainly as a diagnostic tool, so why not the hip? Since there were no procedural publications on the subject at that time, I performed a technique that Dr. Lanny Johnson<sup>i</sup> described to me. His method was first published in 1981.<sup>ii</sup> The procedure was performed with the patient supine on a fracture table. I visualized the hip through an anterior portal and arthritis was found. A hip replacement was carried out shortly thereafter.

Between 1977 and 1984, I performed a total of ten cases using the supine position. On occasion, it was difficult to enter the hip joint with this method, especially in obese individuals, because the instruments that were available were the same short instruments that were used in the knee. Therefore, I felt that a change was necessary. It all came about in the fall of 1983 when I was unsuccessful in the removal of loose bodies from a hip in a heavy woman placed in the supine position. Following the case, my partner, Dr. Tom Sampson, and I discussed the problem, and at his suggestion came to the conclusion that since the lateral approach permits the fat to drop downward, away from the operative sight, better access to the hip joint would be achieved. We started by supporting the patient's leg in a wrap around the calf, which was connected to overhead weights by a rope placed through pulleys hung from the ceiling. After performing the procedure successfully in several patients placed on their sides, including a 5 ft. 5 in. tall, 270 lb person, I contacted the woman who had loose bodies that I earlier failed to remove using the supine approach and scheduled her for another surgery in which I now successfully extracted five loose bodies by the lateral approach.<sup>iii</sup>

After using the overhead traction device in a dozen patients we found that more distraction was needed to adequately examine the joint and to keep from damaging the joint surfaces. The distraction necessary to achieve this could not be obtained with overhead traction. I then utilized a fracture table with the attachments adjusted for patients placed on their sides. Satisfactory distraction was achieved in every case with this device. However, there were drawbacks, which included difficulty in rearranging the table for the lateral approach, the inability to adjust the perineal post to prevent excessive pressure on the pudendal nerve, and the absence of a device to measure the amount of traction for safety reasons. In individuals with stiff joints, or in patients with hip contractures, a large amount of traction might be necessary to adequately distract the hip. In this situation a dangerous amount of pressure may be placed on the nerves of the limb and the perineum and if applied too long could cause paralysis.

Once publications on the subject began to appear, a few more surgeons began to perform the procedure and finally specific instruments and traction devices were developed, which made the procedure easier and safer. Drs. Thomas Byrd,<sup>iv</sup> Joseph McCarthy,<sup>v</sup> Henri Dorfmann,<sup>vi</sup> Eijner Eriksson,<sup>vii</sup> and Richard Villar<sup>viii</sup> led this early charge and were instrumental in refining the procedure to the extent that made it more feasible. Instruments exclusive for the hip were developed. These included longer arthroscopes and instruments that were essential to maintain the portals and reach the depths of the joint and curved instruments that helped in reaching the corners of the joint and made it possible to operate on the curved acetabulum. Despite these advancements, the procedure only gained a little of the popularity that arthroscopy of the other joints had gained. The reasons, at that time, appeared to be from a lack of indications and to poor outcomes due to the association of degeneration in so many of the cases. In the meantime, the few of us who were performing the procedure gained more experience.

In 2003, the work of Professor Reinhold Ganz<sup>x</sup> and his associates in Switzerland regarding hip impingement brought new light on the cause of degeneration in the hip joint. His

<sup>i</sup>Johnson LL: Personal Communication.

<sup>ii</sup>Johnson LL: *Diagnostic and Surgical Arthroscopy: The Knee and Other Joints*, 2<sup>nd</sup> Ed. St. Louis: CV Mosby, 1981, pp. 405-411. 292-6804.

<sup>iii</sup>Glick JM, Sampson TG, Gordon RB, Behr JT, Schmidt E: Hip Arthroscopy by the Lateral Approach. *Arthroscopy* 1987; 3: 4-12.

<sup>iv</sup>Byrd JWT: Hip Arthroscopy Utilizing the Supine Position. *Arthroscopy*. 1994; 10: 275-280.

<sup>v</sup>McCarthy JC, Day B, Busconi B: Hip Arthroscopy: Applications and Technique. *J Am Acad Orthop Surg*. 1995; 3: 115-122.

<sup>vi</sup>Dorfmann H, Boyer T, Henry P, de Bie B: A Simple Approach to Hip Arthroscopy. *Arthroscopy*. 1988; 4: 141-142.

<sup>vii</sup>Eriksson E, Arvidsson I, Arvidsson H. *Diagnostic and Operative Arthroscopy of the Hip*. *Orthopedics*. 1986; 9: 169-176.

<sup>viii</sup>Villar RN: *Hip Arthroscopy*. Oxford: Butterworth-Heinemann, 1992.

<sup>x</sup>Ganz R, Parvizi J, Beck M, Leunig M, Nötzli H, Siebenrock K: Femoroacetabular Impingement: A Cause for Osteoarthritis of the Hip: *Clinical Orthop*. 2003; 417: 112-120.

procedure to correct this was found to be adaptable to arthroscopy. The hip surgeons took notice and found arthroscopy to be beneficial in their practice and started to perform the procedure, greatly increasing the numbers that used it. As more arthroscopies were carried out, more refinements were made, more information about the anatomy of the hip was attained, and the outcomes of the procedure improved. This brings us to today where hip arthroscopy has become an integral part of the diagnosis and treatment of hip diseases. More advances will come in the future. Already there have been trials of the use of polymers for resurfacing knee joints in patients and hip joints in cadaver specimens.

The hip is the largest joint in the body and is the site of major diseases in patients of all ages from childhood to the elderly. Therefore, it is imperative for the surgeons who treat the hip to know all the treatment options available including arthroscopy. The significant features of arthroscopic surgery are not only the

fact that it uses minimal incisions and reduces morbidity, but also is designed to preserve the joint as much as possible. This book is valuable in that it combines both arthroscopy and the more established open techniques in the diagnosis and treatment of these hip conditions. It is not easy for surgeons to grasp the challenge of arthroscopy of the hip when it was hardly used just a decade or so ago. This text, with its combination of open and arthroscopic methods, should certainly expand surgeons' knowledge and give them more alternatives in the treatment of some of the most difficult conditions of the hip joint. It should also spark interest for traditional surgeons to attempt this procedure. Furthermore, the section on arthroscopy will help surgeons in their endeavor to learn the principles of arthroscopy as they relate to the more conventional open procedures and to hone the arthroscopic skills necessary to diagnose and treat the various hip diseases that they will encounter.

JAMES M. GLICK, M.D.



## Foreword to "Open Management in Joint Preservation Surgery"

The timing of this textbook consisting of chapters on the diagnosis and nonprosthetic surgical management of difficult yet common problems of the hip is propitious. Conservative management of hip arthrosis, usually through dropping the pressure in the joint, was widely written about in the seventies and early eighties has not been updated with a dedicated volume in the last fifteen years.

This is true, despite significant new observations about the etiology of hip arthrosis, new high-tech imaging techniques, new surgical approaches, and new procedures which have evolved to improve the outcome of treatment in this special group of patients.

The majority of these patients suffer from irritable hips and early arthrosis. Most have deformities and morphological abnormalities that are secondary to congenital or acquired disturbances of normal hip development.

Most of the innovations in diagnosis and treatment can be directly attributed to those that studied with or were influenced by the orthopedic department at the University of Bern, Switzerland. The chairman of the department during this time, Reinhold Ganz, was a master surgeon and successor to world-famous hip surgeon Professor Maurice Mueller.

Bern, always an active academic center, provided a fertile environment for further refinement of "the conservative approaches" to the problems of the young adult with painful hip joints.

In 1984, Professor Ganz with the collaboration of his team, focused on the problem of the residuals of hip dysplasia and developed a new "Periacetabular Osteotomy" that allowed unrestricted correction of the associated deformities. In addition, the procedure could be carried out through a single exposure.

Although there are many different surgical procedures for the correction of dysplastic hips, "the Bernese" periacetabular osteotomy became a popular and well-accepted procedure for the treatment of hip dysplasia in the patient with closed physal plates.

The long-term follow up of the patients who had undergone PAOs actually contributed to the identification of femoroacetabular impingement, the next major discovery in Bern during the Ganz tenure.

In Orthopedic Surgery, the sixties and seventies were dominated by teaching and studying outcomes of total hip arthroplasty. There was change in the focus of a majority of orthopedic surgeons from classical operations such as osteotomies, as postulated by Pauwels and his students, to the complicated subject

of hip replacement with synthetic materials. These materials were studied to understand their behavior under conditions of motion and load.

Indeed, study of factors producing accelerated wear in artificial hip joints or causes of their frequent dislocations identified the phenomenon of motion-induced impingement caused by mechanical conflict between the components of the hip joint replacement. This observation led to design modifications of both femoral and acetabular components to avoid this occurrence. Understanding of this problem in the setting of total hip arthroplasty strongly suggested the possibility of the existence of this problem in the natural hip and in hips treated with osteotomy.

Indeed in the relatively small group of patients with dysplastic hips who had pain following periacetabular osteotomy, physical findings on examination, and radiographic evidence identified impingement between the femur and the acetabulum as the cause of these residual symptoms. Many had classical findings of impingement on the femoral head and characteristic acetabular labral damage at the time of re-operation.

The paramount contribution that expanded the understanding of the pathological findings of hip impingement came with the study of the anatomical course of the medial femoral circumflex vessels. This doctoral thesis, by Katharina Ganz and Nathalie Kruegel, offered objective evidence that it was possible to dislocate the human hip joint without the complication of avascular necrosis.

This finding opened the door to surgical exploration of symptomatic hips in patients with what had been thought previously to be negative x-ray images. Quite rapidly the concepts of "cam" and "pincer" impingement became accepted as the cause of symptoms in these hips and the subtle radiographic and MRI findings were defined.

Finally, the interest in joint-preserving surgery continued at the Inselspital in Bern, but with a major difference. The goal of surgery was no longer to increase congruency and the relative area of the articular surface, but rather the elimination of the conflict between the femur and acetabulum during the functional motion of the joint.

This book is a much awaited reference on the details of these new concepts, including the very important subject of the role of arthroscopy in the management of these difficult cases.

JEFFREY W. MAST, M.D.  
RENO, NEVADA  
AUGUST, 2009



## Acknowledgments

I would like to thank the many people who have helped me develop into a hip arthroscopist from the very beginning in medical school, where my interest was first sparked by Evan Ekman, Dave Ruch, and Gary Poehling. Ed Wojtys furthered this interest in hip arthroscopy in my residency and has been a mentor to me since in all aspects of my career. Ron Delanois helped me when I was just starting out in the Navy with my first hip scopes teaching me his tricks. Freddie Fu gave me the opportunity to come back to Pittsburgh and join his outstanding group (my fellowship alma mater!) and develop a really busy hip arthroscopy practice. And of course Marc Philippon who was gracious enough to let me come to Vail and scrub with him and really teach me the art of hip arthroscopy of which he has been such a tremendous pioneer in developing many of these techniques and really pushing our field forward. I would like to thank my co-editors, Marc Safran, who has also been a real mentor to me in the hip surgery realm and in many other aspects of my career, and he is a good friend as well; and Michael Leunig, who lends such tremendous expertise to this book with his pioneering work in femoro-acetabular impingement and so much other groundbreaking hip research; and Anil Ranawat, who has done a lion's share of work toward getting this book completed and without his tremendous effort and his insight, ability, and energy, this book never would have been completed. I also want to thank the love of my life, my best friend, and ever supportive wife, Jennie: thanks for everything. And to my sons, 3-year-old Kimo and 1-year-old Koa, I love you guys more than you know.

JON K. SEKIYA

I would like to thank Jon Sekiya and Anil Ranawat for bringing me in to their vision (and doing the bulk of the work), and to Michael Leunig for bringing his knowledge, experience, and expertise to help round out this wonderful work. I am very thankful for and appreciate the friendship, expertise, professionalism, and efforts of my co-editors. I would also like to thank the many authors who contributed their knowledge and expertise to this compilation that I hope will serve as a reference and guide for many surgeons, experienced and novice, around the world as we embark on this new era of understanding and treating the non-arthritic hip. I also thank our development editors who have allowed us to put together a book that is first class.

I am particularly indebted to my many mentors for their help in my education as a clinician, surgeon, and researcher and the many sports medicine experts who have taken me under their wing over the years and helped guide me in my early years of hip arthroscopy. I am also very appreciative of my friends and colleagues in the MAHORN group who have shared the vision

of trying to collaborate and cooperate to solve the problems of understanding the non-arthritic hip. I think all hip arthroscopists owe a debt of gratitude for the foresight of Jim Glick as well as Reinhold Ganz for his contributions to the understanding of the pathophysiology of the non-arthritic hip.

And lastly, but most importantly, I want to thank my wonderful, saintly wife, Lee, for her unwavering support and her sacrifices to allow me to chase my professional dreams. And for my children, Janna, Nathan, and Clark, who have always supported me, no matter how late I come home or how many weekends I spend on these pursuits, with their unconditional love—thank you for your support and love. I love you with all my heart.

MARC R. SAFRAN

I would like to thank my mentors who have shaped my young surgical career and who have all been instrumental in unique ways in helping me with this book. I have been exposed to and trained by true giants in orthopedics. At my residency at the Hospital for Special Surgery, Drs. Russell Warren, Tom Wickiewicz and David Altchek first exposed me to arthroscopy and Sports Medicine. I first learned open hip surgery from Drs. Thomas Sculco, Paul Pellicci, Eduardo Salvati, and David Helfet. During my Sports fellowship at the University of Pittsburgh, Drs. Freddie Fu and Christopher Harner furthered my interest in joint preservation, arthroscopy, and Sports Medicine. It was there that I first met Jon Sekiya, who has been a great source of inspiration, teaching, and support for this book as a co-editor. After Pittsburgh, Dr. Robert L. Buly encouraged me to apply to the prestigious Maurice Mueller Hip Fellowship in Switzerland. My experience in Zurich and Bern was inspiring. It was here where I was introduced to Dr. Michael Leunig and Professor Reinhold Ganz. Michael Leunig has provided guidance, friendship, and tremendous support of this book and my career. After Switzerland, I traveled to the United Kingdom, where I met Mr. Derek McMinn and Mr. Richard Villar. When I returned to HSS, my friends and mentors have been Drs. Dean Lorch and Bryan Kelly, who have both supported, guided, and trained me throughout my entire career. There have been other notables like my co-editor, Marc Safran, who has been extremely supportive throughout this entire process as well as Larry Dorr, who has been a family friend for many years.

Lastly, I would like to thank my family. My oldest brother, Amar Ranawat, has been a friend, mentor, and a great curbside consult, even if he is a total joint surgeon. Most importantly, I thank the greatest anatomist, scientist, friend, and surgical mentor anyone could have, my father, Dr. C.S. Ranawat. My father never pushed me to be an orthopedist but rather provided lessons for success in life. His "Ranawat Rules" govern my approach to my own family as well as my work life. He has

always supported me, even my interest in this field, which at times he questioned. Thank you, Dad. I love you and you have no idea how much I respect you. Last but not least, I have to thank my wife, Dana, whose support and love have been unwavering, as well as my son, Cooper, and my little one on the way. I love you guys and this book is for you.

ANIL S. RANAWAT

The continuous questioning of the pre existing dogma concerning primary osteoarthritis has led to the novel concept of femoroacetabular impingement and its role in native hip osteoarthritis. All of us are indebted to Professor Reinhold Ganz for his contributions to our current comprehension of hip anatomy, pathology, and joint-preserving surgery.

MICHAEL LEUNIG



## List of Contributors

### **J. Mack Aldridge, III, MD**

Fellowship Director  
Triangle Research Associates, P.A.  
Orthopaedic Surgery  
Durham, North Carolina

### **Champ L. Baker III, MD**

Fellow  
Division of Sports Medicine  
Department of Orthopaedic Surgery  
Rush University Medical Center  
Chicago, Illinois

### **Champ L. Baker, Jr., MD**

Clinical Assistant Professor  
Department of Orthopaedics  
Medical College of Georgia  
Augusta, Georgia

Staff Physician  
The Hughston Clinic  
Columbus, Georgia

### **Nikolaos V. Bardakos, MD**

Consultant Orthopaedic Surgeon  
The South West London Elective Orthopaedic Center  
Epsom, Surrey, UK

### **Paul E. Beaulé, MD, FRCS**

Associate Professor  
Surgery, University of Ottawa

Head  
Adult Reconstruction Orthopaedics  
The Ottawa Hospital  
Ottawa, Ontario, Canada

### **Martin Beck, MD, PD**

Head  
Clinic for Orthopaedic Surgery  
Luzerner Kantonsspital  
Luzern, Switzerland

### **Michel P. J. v/d Bekerom, MD**

Department of Orthopaedic Surgery  
Academic Medical Center  
Amsterdam, The Netherlands

### **Benoit Benoit, MD, FRCS**

Division of Orthopaedics  
Ottawa Hospital General Campus  
Ottawa, Ontario, Canada

### **Karen K. Briggs, MPH**

Director of Clinical Research  
Steadman Philippon Research Institute  
Vail, Colorado

### **Robert L. Buly, MD**

Associate Professor  
Orthopaedic Surgery  
Weill Cornell Medical College

Associate Attending  
Orthopaedic Surgery  
Hospital for Special Surgery  
New York, New York

### **Denise Chan, BSc, MBT**

Orthopaedic Research Coordinator  
Sport Medicine Centre  
University of Calgary  
Calgary, Alberta, Canada

### **Lorenzo Childress, MD**

Rubin Institute for Advanced Orthopedics  
Center for Joint Preservation and Replacement  
Sinai Hospital of Baltimore  
Baltimore, Maryland

### **John C. Clohisy, MD**

Professor, Orthopaedic Surgery  
Co-Chief, Adult Reconstructive Surgery  
Director, Adolescent and Young Adult Hip Service  
Department of Orthopaedic Surgery  
Washington University School of Medicine  
St. Louis, Missouri

### **Ronald E. Delanois, MD**

Fellowship Director  
Rubin Institute for Advanced Orthopedics  
Center for Joint Preservation and Replacement  
Sinai Hospital of Baltimore  
Baltimore, Maryland

### **Octavia Devon, MD**

Resident  
Urology, University of Florida

Shands at the University of Florida  
Urology, University of Florida

Malcolm Randall VA Medical Center  
Urology  
Gainesville, Florida

**Michael Dienst, MD**

OCM Orthopaedic Surgery Munich  
Munich, Germany

**Keelan R. Enseki, MS, PT, ATC, OCS, SCS, CSCS**

Adjunct Instructor  
Physical Therapy  
Sports Medicine and Nutrition  
University of Pittsburgh  
Pittsburgh, Pennsylvania

**Teresa M. Ferguson, MD**

Department of Orthopaedic Surgery  
University of Iowa Hospitals and Clinics  
Iowa City, Iowa

**Reinhold Ganz, MD**

Professor and Chairman Emeritus  
Department of Orthopaedic Surgery  
University of Bern  
Bern, Switzerland

**Michael B. Gerhardt, MD**

Director, Center for Athletic Hip and Groin Disorders  
Santa Monica Orthopaedic and Sports Medicine Group  
Team Physician, CD Chiva USA  
Team Physician, US Soccer  
Santa Monica, California

**James A. Goulet, MD**

Professor  
Department of Orthopaedic Surgery  
University of Michigan Medical School

Director  
Division of Orthopaedic Trauma  
Department of Orthopaedic Surgery  
University of Michigan Hospitals  
Ann Arbor, Michigan

**Carlos A. Guanche, MD**

Southern California Orthopedic Institute  
Van Nuys, California

**Daniël Haverkamp, MD, PhD**

Academic Medical Center  
University of Amsterdam  
Department of Orthopaedic Surgery  
Amsterdam, The Netherlands

**Marcia A. Horner, BA**

Office Manager for William C. Meyers, MD  
Department of Surgery  
Drexel University College of Medicine  
Philadelphia, Pennsylvania

**Victor M. Ilizaliturri, Jr., MD**

Professor of Hip and Knee Surgery  
Universidad Nacional Autónoma de México  
National Rehabilitation Institute of Mexico

Chief  
Adult Hip and Knee Reconstruction  
National Rehabilitation Institute of Mexico  
Mexico City, Mexico

**Jon A. Jacobson, MD**

Professor  
Department of Radiology  
University of Michigan

Director  
Division of Musculoskeletal Radiology  
Department of Radiology  
University of Michigan  
Ann Arbor, Michigan

**David Kahan**

Department of Surgery  
Drexel University College of Medicine  
Philadelphia, Pennsylvania

**Bryan T. Kelly, MD**

Assistant Professor  
Orthopaedic Surgery  
Weill Cornell Medical College

Assistant Attending  
Orthopaedic Surgery  
Co-Director, Center for Hip Pain and Preservation  
Hospital for Special Surgery  
New York, New York

**Vikas Khanduja, MRCS(G), MSc, FRCS(Tr and Orth)**

Consultant Orthopaedic Surgeon  
Department of Trauma and Orthopaedics  
Addenbrooke's—Cambridge University  
Hospitals NHS Trust

Consultant Orthopaedic Surgeon  
Department of Trauma and Orthopaedics  
Cambridge Nuffield Hospital  
Cambridge, UK

**Mininder S. Kocher, MD, MPH**

Associate Professor  
Department of Orthopaedic Surgery  
Harvard Medical School

Associate Director  
Division of Sports Medicine  
Children's Hospital Boston

Department of Orthopaedic Surgery  
Children's Hospital Boston  
Boston, Massachusetts

**Jason Koh, MD**

Clinical Associate Professor  
Surgery, University of Chicago  
Pritzker School of Medicine  
Chicago, Illinois

Vice-Chairman  
Orthopaedic Surgery  
NorthShore University HealthSystem  
Evanston, Illinois



**David A. Koppersmith, BS**

Clinical Research  
Steadman Philippon Research Institute  
Vail, Colorado

**Christopher M. Larson, MD**

Director of Education  
Minnesota Sports Medicine Fellowship Program  
Minnesota Sports Medicine  
Twin Cities Orthopedics  
Eden Prairie, Minnesota

**Jo-Ann Lee, MS**

Nurse Practitioner  
Research Assistant, Orthopaedics  
Massachusetts General Hospital  
Boston, Massachusetts

**Michael Leunig, MD**

PD Dr. Med.,  
Department of Orthopaedic Surgery  
University of Bern  
Bern, Switzerland

Head of Orthopaedics  
Department of Orthopaedics  
Schulthess Clinic  
Zürich, Switzerland

**Kartik Logishetty, MD**

Guy's, King's and St. Thomas' Medical School  
King's College London  
London, UK

**Dean G. Lorich, MD**

Associate Professor  
Orthopaedic Surgery  
Weill Cornell Medical College

Associate Director  
Orthopaedic Trauma Service  
Hospital for Special Surgery  
New York, New York

**Travis Maak, MD**

Chief Resident  
Orthopaedic Surgery  
Hospital for Special Surgery  
New York, New York

**Tallal Charles Mamisch, MD**

Research Instructor  
Clinical Research  
MR Methodology and Spectroscopy Unit

Research Instructor  
Orthopaedic Surgery  
Inselspital, University of Bern  
Bern, Switzerland

Visiting Research Instructor  
Orthopaedic Surgery  
Children's Hospital, Harvard Medical School  
Boston, Massachusetts

**Aditya V. Maheshwari, MD**

Clinical Fellow  
Ranawat Orthopaedic Center  
Hospital for Special Surgery  
New York, New York

**David R. Marker, BS**

Rubin Institute for Advanced Orthopedics  
Center for Joint Preservation and Replacement  
Sinai Hospital of Baltimore  
Baltimore, Maryland

**René K. Marti, MD, PhD**

Professor Emeritus  
Orthopedics, University of Amsterdam

Professor Dr.  
Orthopedic Department  
Academical Medical Center  
Amsterdam, The Netherlands

Prof. Dr. Med.  
Klinik Gut  
St. Moritz, Switzerland

**Hal David Martin, DO**

Doctor of Osteopathy  
Sports Medicine/Hip Disorders  
Oklahoma Sports Science and Orthopaedics

Northwest Surgical Hospital  
Oklahoma City, Oklahoma

**RobRoy L. Martin, PhD, PT, CSCS**

Associate Professor  
Physical Therapy, Duquesne University  
Pittsburgh, Pennsylvania

Staff Physical Therapist  
Centers for Rehab Services/Center for Sports Medicine  
University of Pittsburgh Medical Center  
Pittsburgh, Pennsylvania

**Joseph C. McCarthy, MD**

Clinical Associate in Orthopaedic Surgery  
Department of Arthroplasty  
Harvard University  
Cambridge, Massachusetts

Vice Chairman  
Orthopaedic Surgery  
Department of Orthopaedics  
Massachusetts General Hospital  
Boston, Massachusetts

Director  
Center for Joint Reconstructive Surgery  
Department of Orthopaedics  
Newton-Wellesley Hospital  
Newton, Massachusetts

**Mike S. McGrath, MD**

Rubin Institute for Advanced Orthopedics  
Center for Joint Preservation and Replacement  
Sinai Hospital of Baltimore  
Baltimore, Maryland

**Morteza Meftah, MD**

Orthopaedic Fellow  
Ranawat Orthopaedic Center  
Hospital for Special Surgery  
New York, New York

**William C. Meyers, MD**

Chairman  
Department of Surgery  
Drexel University College of Medicine  
Philadelphia, Pennsylvania

**Nick G. Mohtadi, MD, MSc, FRCSC**

Clinical Professor  
Sports Medicine Centre  
University of Calgary  
Calgary, Alberta, Canada

**Michael A. Mont, MD**

Director  
Rubin Institute for Advanced Orthopedics  
Center for Joint Preservation and Replacement  
Sinai Hospital of Baltimore  
Baltimore, Maryland

**Ryan M. Nunley, MD**

Assistant Professor  
Department of Orthopaedic Surgery  
Washington University  
St. Louis, Missouri

**M. Elizabeth Pedersen, MD**

Orthopaedic Resident, R5  
Sport Medicine Centre  
University of Calgary  
Calgary, Alberta, Canada

**Murat Pekmezci, MD**

Assistant Clinical Professor  
Orthopaedic Surgery  
University of California  
San Francisco, California

**Aaron Perdue, MD**

Assistant Professor  
Department of Orthopaedic Surgery  
Vanderbilt University  
Nashville, Tennessee

**Marc J. Philippon, MD**

Associate Clinical Professor  
Department of Surgery  
Faculty of Health Sciences  
McMaster University  
Hamilton, Ontario, Canada

Managing Partner, Orthopaedic Surgeon  
The Steadman Clinic

Steadman Philippon Research Institute  
Vail, Colorado

**Mario Quesada, MD**

Rubin Institute for Advanced Orthopedics  
Center for Joint Preservation and Replacement  
Sinai Hospital of Baltimore  
Baltimore, Maryland

**Amar S. Ranawat, MD**

Assistant Professor of Orthopaedic Surgery  
Weill Cornell Medical College  
Hospital for Special Surgery  
New York, New York

**Anil S. Ranawat, MD**

Assistant Professor  
Orthopaedic Surgery  
Weill Medical College of Cornell University

Assistant Attending  
Orthopaedic Surgery  
Hospital for Special Surgery  
New York, New York

**Chitranjan S. Ranawat, MD**

Professor of Orthopaedic Surgery  
Hospital for Special Surgery  
New York, New York

**Margaret M. Rich, MD, PhD**

Assistant Chief of Staff  
Pediatric Orthopaedics  
Shriners Hospitals for Children  
St. Louis, Missouri

**Hassan Sadri, MD**

Consultant Orthopaedic Surgeon  
Clinic of Orthopaedic Surgery  
Geneva University Hospital  
Geneva, Switzerland

Head  
Department of Orthopaedic Surgery  
Hospital of Fribourg—Riaz  
Riaz, Fribourg, Switzerland

**Marc R. Safran, MD**

Professor and Associate Director  
Sports Medicine  
Department of Orthopaedic Surgery  
Stanford University  
Redwood City, California

**Thomas G. Sampson, MD**

Director of Hip Arthroscopy  
Post Street Surgery Center

Medical Director  
Total Joint Center  
Saint Francis Memorial Hospital  
San Francisco, California

**Perry L. Schoenecker, MD**

Professor  
Orthopaedic Surgery  
Washington University School of Medicine



Interm Chair  
Pediatric Orthopaedics  
St. Louis Children's Hospital

Chief of Staff  
Shriners Hospital for Children  
St. Louis, Missouri

### **Karl F. Schultz, MD**

Clinical Instructor  
Orthopaedic Surgery  
University of Michigan

Attending Physician  
Orthopaedics, Veterans Hospital of Ann Arbor  
Ann Arbor, Michigan

### **Jon K. Sekiya, MD**

Associate Professor and Team Physician  
MedSport  
Department of Orthopaedic Surgery  
University of Michigan  
Ann Arbor, Michigan

### **Michael K. Shindle, MD**

Fellow  
Orthopaedic Surgery  
Hospital for Special Surgery  
New York, New York

### **Klaus A. Siebenrock, MD**

Professor and Chairman  
Department of Orthopaedic Surgery  
Inselspital, University of Bern  
Bern, Switzerland

### **Moritz Tannast, MD**

Department of Orthopaedic Surgery  
Inselspital, University of Bern  
Bern, Switzerland

### **Mehul M. Taylor, MD**

Fellow  
Minnesota Sports Medicine Fellowship Program  
Minnesota Sports Medicine  
Twin Cities Orthopedics  
Eden Prairie, Minnesota

### **James R. Urbaniak, MD**

Virginia Flowers Baker Professor of  
Orthopaedic Surgery  
Orthopaedic Surgery  
Duke University Medical Center  
Durham, North Carolina

### **Zackary D. Vaughn, MD**

Fellow  
Orthopaedic Sports Medicine  
Stanford University  
Redwood City, California

### **Richard N. Villar, BSc, MA, MS, FRCS**

Consultant Orthopaedic Surgeon  
The Richard Villar Practice  
The Wellington Hospital  
London, UK

### **James E. Voos, MD**

Fellow  
Orthopaedic Surgery  
Hospital for Special Surgery  
New York, New York

### **Stuart L. Weinstein, MD**

Ignacio V. Ponseti Chair and Professor of Orthopaedic  
Surgery  
Department of Orthopaedic Surgery  
University of Iowa  
Iowa City, Iowa

### **Stefan Werlen, Dr. Med., MD**

Head  
Department of Radiology  
Klinik Sonnehof  
Bern, Switzerland

### **Yi-Meng Yen, MD, PhD**

Clinical Instructor  
Orthopaedics, Harvard Medical School,  
Children's Hospital Boston  
Boston, Massachusetts

### **Chad T. Zehms, MD**

Staff Orthopaedic Surgeon  
Orthopaedic Surgery  
Naval Hospital Great Lakes  
Great Lakes, Illinois

Staff Orthopaedic Surgeon  
Orthopaedic Surgery  
Prevea Health  
Green Bay, Wisconsin

## Contents

**Video Table of Contents** ix

**Foreword to “Arthroscopic Management of Hip Diseases”** xi

**Foreword to “Open Management in Joint Preservation Surgery”** xiii

**Acknowledgments** xv

**List of Contributors** xvii

## SECTION 1 General Topics 1

### CHAPTER 1

**History and Evolution of Hip Surgery** 2  
*Nikolaos V. Bardakos and Richard N. Villar*

### CHAPTER 2

**Arthroscopic and Open Anatomy of the Hip** 9  
*Michael B. Gerhardt, Kartik Logisbetty, Morteza Meftab, and Anil S. Ranawat*

### CHAPTER 3

**Imaging: Plain Radiographs** 23  
*Moritz Tannast and Klaus A. Siebenrock*

### CHAPTER 4

**Magnetic Resonance Imaging of the Hip Joint** 35  
*Stefan Werlen, Tallal Charles Mamisch, Reinhold Ganz, and Michael Leunig*

### CHAPTER 5

**Computed Tomography, Ultrasound, and Imaging-Guided Injections of the Hip** 43  
*Jon A. Jacobson*

### CHAPTER 6

**The Technique and Art of the Physical Examination of the Adult and Adolescent Hip** 57  
*Hal David Martin*

### CHAPTER 7

**Nonoperative Management and Rehabilitation of the Hip** 67  
*RobRoy L. Martin and Keelan R. Enseki*

### CHAPTER 8

**Assessing Outcomes After Hip Surgery** 74  
*Nick G. Mohtadi, M. Elizabeth Pedersen, and Denise Chan*

## SECTION 2

## Arthroscopic Management 87

### CHAPTER 9

**Supine Approach to Hip Arthroscopy** 88  
*Zackary D. Vaughn and Marc R. Safran*

### CHAPTER 10

**Lateral Approach to Hip Arthroscopy** 95  
*Thomas G. Sampson*

### CHAPTER 11

**Peripheral Compartment Approach to Hip Arthroscopy** 105  
*Michael Dienst*

### CHAPTER 12

**Complex Therapeutic Hip Arthroscopy With the Use of a Femoral Distractor** 113  
*Hassan Sadri*

### CHAPTER 13

**Arthroscopic Labral Debridement** 121  
*Joseph C. McCarthy and Jo-Ann Lee*

### CHAPTER 14

**Arthroscopic Labral Repair** 124  
*Carlos A. Guanche*

### CHAPTER 15

**Arthroscopic Capsular Plication and Thermal Capsulorrhaphy** 131  
*Anil S. Ranawat and Jon K. Sekiya*

### CHAPTER 16

**Arthroscopic Iliotibial Band Lengthening and Bursectomy for Recalcitrant Trochanteric Bursitis and Coxa Saltans Externa** 139  
*Champ L. Baker III and Champ L. Baker, Jr.*



## CHAPTER 17

**Arthroscopic Hip “Rotator Cuff Repair” of Gluteus Medius Tendon Avulsions** 144*James E. Voos, Travis Maak, and Bryan T. Kelly*

## CHAPTER 18

**Arthroscopic Iliopsoas Release and Lengthening** 152*Victor M. Ilizaliturri, Jr.*

## CHAPTER 19

**Arthroscopic Femoral Osteoplasty** 159*Marc R. Safran*

## CHAPTER 20

**Arthroscopic Rim Resection and Labral Repair** 173*Marc J. Philippon, Chad T. Zehms, Karen K. Briggs, and David A. Koppersmith*

## CHAPTER 21

**Arthroscopic Synovectomy and Treatment of Synovial Disorders** 181*Christopher M. Larson and Mebul M. Taylor*

## CHAPTER 22

**Arthroscopic Microfracture and Chondroplasty** 188*Jason Kob*

## CHAPTER 23

**Arthroscopy for Symptomatic Hip Arthroplasty** 195*Vikas Khanduja and Richard N. Villar*

## CHAPTER 24

**Arthroscopic Management of the Trauma Patient** 199*Aaron Perdue and James A. Goulet*

## CHAPTER 25

**Arthroscopic Management of Pediatric Hip Disease** 206*Yi-Meng Yen and Mininder S. Kocher*

## SECTION 3

**Open Management** 213

## CHAPTER 26

**The Bernese Periacetabular Osteotomy for Hip Dysplasia and Acetabular Retroversion** 214*Martin Beck and Reinhold Ganz*

## CHAPTER 27

**Trochanteric Distalization (Relative Femoral Neck Lengthening) for Legg-Calvé-Perthes Disease and Coxa Vara** 225*Karl F. Schultz*

## CHAPTER 28

**Surgical Hip Dislocation for Femoroacetabular Impingement** 228*Michael Leunig, Anil S. Ranawat, and Reinhold Ganz*

## CHAPTER 29

**Limited Open Osteochondroplasty for the Treatment of Anterior Femoroacetabular Impingement** 240*Murat Pekmezci and John C. Clobis*

## CHAPTER 30

**Nonvascularized Bone Grafting for the Treatment of Osteonecrosis of the Femoral Head** 246*Ronald E. Delanois, Mike S. McGrath, Lorenzo Childress, Mario Quesada, David R. Marker, and Michael A. Mont*

## CHAPTER 31

**Vascularized Fibular Grafting for Osteonecrosis of the Femoral Head** 251*J. Mack Aldridge, III and James R. Urbaniak*

## CHAPTER 32

**Proximal Femoral Osteotomies in Adults for Secondary Osteoarthritis: Femoral Osteotomies for Adult Deformity** 259*Daniël Haverkamp, Michel P. J. v/d Bekerom, and René K. Marti*

## CHAPTER 33

**Open Treatment for Hip Cartilage Injuries** 269*Michael K. Shindle, Dean G. Lorch, Robert L. Buly, and Bryan T. Kelly*

## CHAPTER 34

**Anterior Hueter Approach for Hip Resurfacing in the Arthritic Patient** 274*Benoit Benoit and Paul E. Beaulé*

## CHAPTER 35

**Total Hip Arthroplasty in the Young Active Patient with Arthritis** 280*Aditya V. Maheshwari, Amar S. Ranawat, and Chitranjan S. Ranawat*