

STEADMAN PHILIPPON RESEARCH INSTITUTE

2010 ANNUAL REPORT



An International Center For Research and Education — Keeping People Active SM

MISSION

The Institute is dedicated to keeping people of all ages physically active through orthopaedic research and education in the areas of arthritis, healing, rehabilitation, and injury.

HISTORY

Founded in 1988 by orthopaedic surgeon Dr. J. Richard Steadman, the Steadman Philippon Research Institute is an independent, tax-exempt (IRS code 501(c)(3)) charitable organization, employing scientists, researchers, fellows, visiting scholars, and interns. Dr. Steadman moved to Vail in 1990 with one researcher. Today, there are almost 30 employees (scientists, researchers, medical fellows, visiting scholars, administration and interns). In 2010, Dr. Marc Philippon's name was added to mark the succession of the Institute and recognize his research efforts and contributions to the field of hip arthroscopy.

Funding for research and education programs comes primarily from public donations and fundraising events (grateful patients and the physicians of the Steadman Clinic), corporations, and competitive grants.

Cover Photo: Mike Welch

J. Michael Egan
1953 – 2011
Galena, British Columbia, 2011.

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The Institute wishes to express again deep appreciation to John P. Kelly, who donated many of the stock photos in this year's Annual Report and contributed his time to photograph the many Institute and operating room subjects.

John Kelly first picked up a camera while serving as infantry lieutenant in the Air Cavalry in Vietnam. He quickly developed a love for photography that he took home with him to Colorado. By combining his new craft with his passion for sports and adventure, Kelly created a successful career.

His diverse photo assignments have taken him from Wimbledon to trekking the Himalayas, the Winter Olympics to sailing the Caribbean. He was the official photographer for the U.S. Open Golf Championships for 10 years, and the only American among the official photographers at the Lillehammer Winter Olympic Games. When Robert Redford needed the defining shot to promote his film "A River Runs Through It," he called on Kelly. Subsequently, he also provided the still photography for Redford's "The Horse Whisperer."

Although he has traveled all over the world, many of his favorite photo shoots have taken place at his beloved End of the Road Ranch in Western Colorado, where clients such as Polo/ Ralph Lauren have come to work and play with Kelly and his friends and animals.



The Institute is known throughout the world for our research into the causes, prevention, and treatment of orthopaedic disorders. We are committed to solving orthopaedic problems that limit an individual's ability to maintain an active life.

Our research perspective is based on clinical relevance, with a goal of improving the care of the patient. Recognizing that the body's innate healing powers can be harnessed and manipulated to improve the healing process has led to exciting advances in surgical techniques, developed by Dr. Richard Steadman, and validated at our Institute. Today, the Institute is recognized worldwide for Dr. Marc Philippon's pioneering research in the treatment of sports-related injuries to the hip.

Athletes are becoming bigger, faster and stronger. Unfortunately, their connective tissue does not. Therefore, injuries are becoming more complex. Our research into the anatomy and mechanisms of the complex knee, hip, and shoulder is being recognized worldwide.

We collect data and publish clinical research results on knees, hips, shoulders, spine, foot and ankle, hand and wrist and imaging, and have become one of the most published and innovative organizations in sports medicine research and education. We publish our findings in relevant peer-reviewed scientific and medical journals and present our research results at medical meetings worldwide.

Philanthropic gifts are used to advance scientific research and to support scholarly academic programs that train physicians for the future. Through our Fellowship and Visiting Scholar programs, the Institute has now built a network of more than 185 Fellows and Visiting Scholars worldwide who share the advanced ideas and communicate the concepts they learned in Vail to their patient base.

OUR PRIMARY AREAS OF RESEARCH AND EDUCATION ARE:

- **Basic Science Research** – undertakes biological studies, at the cellular level, to investigate the causes and effects of degenerative arthritis, techniques of cartilage regeneration, and basic biological healing processes.
- **Clinical Research** – conducts outcomes-based research using actual clinical data that aids both physicians and patients in making better and more-informed treatment decisions.
- **Biomechanics Research** – studies dynamic joint function using motion analysis, computer modeling and dual-plane fluoroscopy imaging in an effort to understand injury mechanisms and to enhance rehabilitation techniques and outcomes.
- **Imaging Research** – develops and evaluates noninvasive imaging techniques of the joints for the purpose of directing and monitoring clinical treatment and outcomes, and to enhance the clinical relevance of Biomechanics Research.
- **Education and Fellowship Program** – administers and coordinates the physicians-in-residence fellowship and visiting scholars programs, hosts conferences and international medical meetings, and produces and distributes publications and teaching visual media.

Dear Friends,

On behalf of all of us at the Steadman Philippon Research Institute, we wish to thank you for your continued support, which helped to make 2010 another record year. Your commitment makes it possible for us to carry out our mission of “Keeping People Active” and educating the worldwide orthopaedic community. Orthopaedic care of the patient is improving around the world directly through the advances we are making in our research.

We finished 2010 with \$6.37 million in support from our individual and corporate donors. This achievement resoundingly indicates that you believe in our mission and succession. In addition to record support, we reached another milestone by further lowering our overhead rate. In fact, our overhead rate is now just below 20 percent, which means we are directly applying more than 80 percent of your donations to our research programs. Other well-known research institutions have overhead rates many times higher than ours.

We began 2010 with our rebranding to the “Steadman Philippon Research Institute.” Our name changed to indicate that our succession is in place, and to give our individual donors and corporate supporters the confidence that our mission will continue well into the future.

In 2011, we have continued to establish new standards, with the opening of our Biomechanics Research and Surgical Skills facilities, completed in February. These facilities are among the most advanced of their kind in the world. We successfully recruited outstanding individuals to manage the new biomechanics research programs. In this Annual Report, you will read about two such people, Mary Goldsmith and Erin Lucas (page 42), who are preparing to conduct very exciting and advanced research.

Your support is responsible for our ability to carry out ambitious growth plans for the clinically relevant research we conduct. Our Clinical Research group has undergone significant advancements in how it collects data. We are now managing more than 50 million data points and have gone entirely paperless for data input. This has significantly reduced our labor and allowed our clinical researchers to devote more time to writing papers and preparing presentations regarding our advances.

Our advances in knee, hip, shoulder, foot and ankle, and spine research have dramatically increased the number of presentations made at scientific meetings and the number of articles published in peer-reviewed journals. These presentations and publications are the means by which we inform and educate the national and international orthopaedic communities. This ultimately improves the care of patients everywhere. In this Annual Report, Lauren Matheny (page 28), one of our talented clinical researchers, will discuss these new and enhanced systems for clinical research.

The Imaging Research program continues to build on the foundation it established in the past three years. New staff members were added and the clinical imaging database was expanded to include data points related to the hip, shoulder, knee, and foot and ankle.

Imaging Research continues its strong collaboration with the industry leader, Siemens Medical MR. Not only do they provide funding for our Sports Medicine Imaging Research Fellow, Siemens is also funding ongoing research related to the early detection of articular cartilage health, with the T2 mapping initiative. T2 mapping is an MRI biomarker technique that provides a more sensitive determination of the health of articular cartilage as well as potentially of other tissues about the joints

and body such as muscles, tendons, and ligaments. The department's T2 mapping research involves quantification, reproducibility, and follow-up of articular cartilage early degeneration using imaging biomarkers.

We are pleased to welcome Thomas A. Mars, who was elected to the Board of Directors at the December 2010 meeting. Tom is executive vice president and chief administrative officer for Walmart U.S. He is responsible for asset protection and financial and consumer services for the Walmart U.S. division. Tom is also responsible for the company's diversity, employment practices and policies, labor relations, and compliance departments.

Finally, we will forever be grateful to Mike Egan (page 6) and his many contributions, including his blueprint for succession and rebranding of the Institute. Mike served as President and Chief Executive Officer of the Institute for more than four and half years before a tragic cycling accident took his life this past June.

On behalf of our board members, researchers, physicians, scientists, and staff, thank you for your support. Our success, indeed all of our work, is funded by those of you who step forward to make certain that we continue our clinically relevant research. We are counting on your support of the Steadman Philippon Research Institute, and we will keep you updated on our work.

With your help, we are able to make a difference.

Respectfully yours,



J. Richard Steadman, M.D.



Marc J. Philippon, M.D.



Marc Prisant



J. Richard Steadman, M.D.



Marc J. Philippon, M.D.



Marc Prisant

BOARD OF DIRECTORS AND OFFICERS

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Vail, Colo.

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Mary K. Noyes

Freeport, Me.

Al Perkins

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Rev Gen Partners
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The Steadman Clinic
Vail, Colo.



J. Richard Steadman, M.D.



Gay L. Steadman



Marc J. Philippon, M.D.



Senenne Philippon



Howard Berkowitz



Robert A. Bourne



Julie Esrey



Stephanie Flinn



Earl G. Graves, Sr.



Ted Hartley



Frank Krauser



Greg Lewis

Senenne Philippon
Vail, Colo.

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Bellaire, Fla.

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Booth Creek Management Corporation
Vail, Colo.

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The Steadman Philippon Research Institute
Vail, Colo.

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Kemp Partners
Washington, D.C.

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Managing Member
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Jack Ferguson
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Jack Ferguson Associates
Washington, D.C.

George Gillett
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Booth Creek Management Corporation
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Alabama Sports Medicine and
Orthopaedic Center
Lafayette, La.

Arch J. McGill
President (retired)
AIS American Bell
Scottsdale, Ariz.

Betsy Nagelsen-McCormack
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The Steadman Clinic
Vail, Colo.

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Marc Prisant
Executive Vice President, Chief Financial
Officer and Secretary

John G. McMurtry
Vice President, Program Advancement



Thomas A. Mars



Peter Millett, M.D., M.Sc.



Larry Mullen, Jr.



Cynthia L. Nelson



Mary K. Noyes



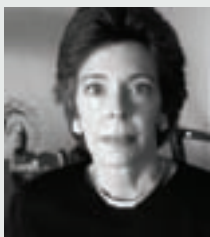
Al Perkins



Cynthia S. Piper



Steven Read



Damaris Skouras



Stewart Turley



Norm Waite



J. Michael Egan

President, Chief Executive Officer
Steadman Philippon Research Institute
2006 - 2011

A Legacy of Excellence - A Vision for the Future

“He had the highest level of integrity of anyone I’ve ever known,” says Richard Steadman, M.D., Managing Partner and Founder of the Steadman Clinic and Founder-Chairman of the Steadman Philippon Research Institute.

“Unmatched integrity and leadership,” says Marc Philippon, M.D., Managing Partner of the Steadman Clinic and a member of the Steadman Philippon board of directors.

“Excellence, honesty, integrity, and friendship,” says Marc Prisant, Executive Vice President, Chief Financial Officer, and Secretary of the Institute.

“High ethics and the ability to thoughtfully thread three needles with a frayed piece of string,” says Steven Read, a member of the Steadman Philippon board of directors and co-chairman of Read Investments.

The man these friends and colleagues are talking about is J. Michael Egan.

Mike served as President and Chief Executive Officer of the Steadman Philippon Research Institute for four and a half years before his untimely death in a tragic cycling accident in June of this year.

“I had known Mike since the early 1980s,” Dr. Steadman recalls. “I was always impressed with his knowledge and the way he was able to bring people together in the implementation of projects.

“When my wife, Gay, brought up his name as a potential CEO of the Institute (then the Foundation), I didn’t think he would come to Vail,” says Dr. Steadman.

“Why don’t you ask him?” she replied.

In fact, Mike did come to Vail to speak with Dr. Steadman about the position, and why wouldn’t he? In the 1980s, Mike’s company, Concept, was the first corporate donor to the Foundation (now the Institute).

Mike eventually agreed to join the Institute in December 2006, bringing with him 28 years of experience in medical technology, entrepreneurship, and fund raising. He had served as chairman and board member for private and public companies and had held CEO and senior management positions.

Though he had no previous experience running nonprofit organizations, he knew one important thing, it needed to be treated like any other business. Mike quickly put programs and initiatives into motion that would propel the work of the Institute to new levels. But he didn’t do this alone. He recognized and ignited the power of the team.

What the Steadman Philippon team and those who generously support the Institute have done together reflects his ability to lead. Here are a few highlights:

- A plan for succession was established and a rebranding of the Foundation implemented, both of which resulted in changing the name to the “Steadman Philippon Research Institute.”
- Revenues from all sources, including corporate and public donations, increased by more than 100 percent.
- The Imaging Research Department was established, a director was named, state-of-the-art magnetic resonance imaging was installed, and a corporate partnership was initiated.
- The Biomechanics Research and Surgical Skills facilities were re-shaped, remodeled, and expanded.
- In Clinical Research, the collection of data and entering the information into the database was digitized, reducing the amount of paper used and vastly streamlining the data collection process.
- Fellowship programs were added in imaging research and foot and ankle.
- The Visiting Scholars program was established for international participants.
- Collaborative research efforts were forged with corporations, institutions, universities, and individuals around the world.

With these and many other accomplishments, the awareness of the Institute was increased locally, nationally, and internationally.

Mike led by example and took the Institute’s mission of “Keeping People Active” to heart. As a young man he was a college and minor league ice hockey player. Throughout his adult life he was a skier, hiker, cyclist and yoga practitioner.

But those who knew him best remember his personal qualities, integrity, leadership, excellence and vision.

Integrity

Richard Steadman: “He personified integrity. I think that’s why we became such good friends over the years. He always did what he said he would do. He never tried to bend the truth to make a point.”

Marc Philippon: “Unmatched integrity and leadership. As I got to know Mike over the years, I had the utmost respect for him. He became one of my best friends.”

Marc Prisant: “Mike was a person I knew and worked with daily for 19 years. During this long history together, he never did anything that he didn’t think was the right thing to do. His integrity and values were such that he was more than willing to accept ideas from any person, if it met the desired goal. And when he did take and act on advice from someone else, he would give credit where credit was due. It was all about teamwork.”

Steven Read: “He had a very keen sense of listening as it related to the needs of the organization. He had the Richard Steadman touch, the Marc Philippon touch, the John McMurtry touch. How can I help you? How can I make your life easier and better? That’s who Mike was. It was a perfect fit.”

Leadership

Richard Steadman: “Mike had a very special way of dealing with people and creating a positive atmosphere in any conversation he was having. He was a remarkable person whose high level of enthusiasm was contagious among his colleagues.”

Marc Philippon: “Mike was able to maximize everyone’s skills to make the team work efficiently and with positive results. He knew every person at the Institute and was able to bring all of them together to work toward the common goal of excellence.”

Marc Prisant: “He wouldn’t have acknowledged achievements as his own. He would have referred to them as ‘our’ achievements. Mike was a very strong proponent of the team approach to work. No one does it alone; everyone does it together. From the moment I first began working with Mike, the common theme was ‘there’s no ‘I’ in team.’”

Steven Read: “Great leaders are people who empower you. Mike was quiet, careful, deliberate, and very disciplined, but he made people feel comfortable and allowed them to realize the potential they possessed. For the Steadman Philippon Research Institute, he was the right leader at the right time.”

Excellence

Richard Steadman: “Mike had sought excellence in all the businesses he had been involved with and he brought that same spirit to the Institute. I think it matched up with his lifelong desire for excellence.”

Marc Philippon: “Mike always had a plan and a goal. He said that our goal was to be the best in the world at what we did. He wanted to see a synergy between our evidence-based medicine and the clinical application of our research to provide better care for patients.”

Marc Prisant: “His overriding goal was excellence. He wanted everyone coming to work to strive to be number one, every day. His philosophy was, let’s be the best we can be, whether it was an intern or himself.”

Steven Read: “He wanted us to continue to build the research capacity of the Institute that drives the value and the excellence of the Clinic.”

Vision

Richard Steadman: “Mike understood, as well as or better than anyone, the goals of the Institute—whether to create operations and procedures that will improve the health and fitness of every patient—are very important.”

Marc Philippon: “Our mission now is to continue the vision he created. That will be done because he put the structure in place very successfully. Losing Mike has been difficult for all of us, but he inspired us with his charisma, and that will stay with us forever.”

Steven Read: “Mike was the igniter of potential that has been carefully built over the past 20 years. His dream and what we are left with is the opportunity to accelerate that process.”

Marc Prisant: “Only his character as a person overshadows the accomplishments achieved during his tenure at the Institute. His integrity, leadership, insistence on excellence, and vision are attributes to which the Steadman Philippon Research Institute will always aspire.”

by Jim Brown, Executive Editor, Steadman Philippon Research Institute

SCIENTIFIC ADVISORY COMMITTEE

THE SCIENTIFIC ADVISORY COMMITTEE CONSISTS OF DISTINGUISHED RESEARCH SCIENTISTS WHO REPRESENT THE INSTITUTE AND SERVE AS ADVISORS IN OUR RESEARCH AND EDUCATIONAL EFFORTS, IN OUR FELLOWSHIP PROGRAM, AND TO OUR PROFESSIONAL STAFF.

Steven P. Arnoczky, D.V.M.

Director
Laboratory for Comparative Orthopaedic
Research
Michigan State University
East Lansing, Mich.

Lars Engebretsen, M.D., Ph.D.

Professor
Orthopaedic Center
Ullevål University Hospital and Faculty
of Medicine
University of Oslo and Oslo Sports Trauma
Research Center
Oslo, Norway

John A. Feagin, M.D.

Emeritus Professor of Orthopaedics
Duke University
Durham, N.C./Vail, Colo.

Troy Flanagan, Ph.D.

High Performance Director
U.S. Ski and Snowboard Association
USSA Center of Excellence
Park City, Utah

Charles P. Ho, Ph.D., M.D.

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Imaging Research
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Mininder S. Kocher, M.D., M.P.H.

Assistant Professor of Orthopaedic Surgery
Harvard Medical School, Harvard School
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Boston, Mass.

Robert F. LaPrade, M.D., Ph.D.

Director
Biomechanics Research Laboratory
The Steadman Philippon Research Institute
The Steadman Clinic
Vail, Colo.

C. Wayne McIlwraith, D.V.M., Ph.D.

Director
Orthopaedic Research Center and
Orthopaedic Bioengineering Research
Laboratory
Colorado State University
Fort Collins, Colo.

Peter J. Millett, M.D., M.Sc.

The Steadman Clinic
Vail, Colo.

Marc J. Philippon, M.D.

The Steadman Clinic
Vail, Colo.

William G. Rodkey, D.V.M.

Chief Scientific Officer
Director of Basic Science Research
The Steadman Philippon Research Institute
Vail, Colo.

Theodore F. Schlegel, M.D.

The Steadman Hawkins Clinic
Denver, Colo.

J. Richard Steadman, M.D.

The Steadman Clinic
Vail, Colo.

**Savio Lau-Yuen Woo, Ph.D.,
D. Sc. (Hon.)**

Ferguson Professor and Director
Musculoskeletal Research Center
University of Pittsburgh
Pittsburgh, Pa.



Scientific Advisor and Former Fellow Mininder Kocher, M.D., Elected to American Academy of Orthopaedic Surgeons Board of Directors

Orthopaedic surgeon Mininder Kocher, M.D., was elected to the Board of Directors of the **American Academy of Orthopaedic Surgeons** (AAOS) at its 2011 Annual Meeting in San Diego. Dr. Kocher currently serves as an associate professor of orthopaedic surgery at Harvard Medical School in Boston and as a member of the Scientific Advisory Committee of the Steadman Philippon Research Institute.

“The healthcare landscape is changing very rapidly, and now could not be a more important time to serve in a leadership capacity with this preeminent orthopaedic organization,” said Dr. Kocher. “My background in clinical research and other public health issues will bring a unique perspective to this group, and I am honored to serve in this capacity.”

He earned his medical degree from Duke University in North Carolina, and he also completed a master’s degree in public health at Harvard. His research there focused on pediatric hip arthritis and later won him a Kappa Delta Award, one of the most prestigious musculoskeletal research awards.

After completing a combined orthopaedic surgeon residency rotating through

Massachusetts General Hospital, Brigham and Women’s Hospital, Children’s Hospital, and Beth Israel Hospital, Dr. Kocher went on to a pediatric orthopaedic fellowship at Children’s Hospital Boston and a sports medicine fellowship at the Steadman Philippon Research Institute in Vail, Colorado.

As a current board member for the American Orthopaedic Society of Sports Medicine (AOSSM) and a past board member of the Pediatric Orthopaedic Society of North America (POSNA), Dr. Kocher anticipates his new position on the AAOS Board of Directors will bring even greater collaboration among the three organizations. “This type of collaboration can only unify the orthopaedic specialties as a whole, and ultimately benefit the patients we serve. One of my goals in this position is to continue to nurture and grow the Academy’s relationship with the specialty societies.”

Throughout his medical career, Dr. Kocher has been the recipient of many honors and awards, including multiple mentions on the annual *Best Doctors in America* list. He is the author of four textbooks, 41 book chapters and more than 100 peer-reviewed journal articles. A frequent guest speaker, Dr. Kocher has lectured at 255 meetings and



Mininder Kocher, M.D.

conferences, educating his peers nationally and internationally about pediatric sports medicine.

Dr. Kocher is still active in several other professional societies, including the AOSSM, POSNA, and the sports medicine think tank, the Herodocus Society.

When not in the operating room, conducting research, or seeing patients, Dr. Kocher enjoys spending time outdoors skiing, kayaking, or hiking with his wife, Mich, and their five children, and in the barn with their horses, sheep, and barn cats.



State-of-the-Art Biomechanics Laboratory Offers New Insight into Orthopaedic Joint Repair

Institute unveils multi-million-dollar orthopaedic research facility for pioneering research in joint preservation and reconstruction techniques.

The Steadman Philippon Research Institute (SPRI) has completed construction of its highly anticipated multi-million-dollar, state-of-the-art Biomechanics and Surgical Skills facilities. The principal goal for these unique research facilities is to understand how injuries occur and what the demands on joints are for specific sports or motions. This high-tech research space has been the vision of the Institute for more than two decades. Vail Valley Medical Center, a long-term supporter of the Institute, was a significant financial partner in the endeavor.

“We are very appreciative of their support and help in building this new laboratory,” remarked Dr. Richard Steadman, Chairman and Founder of SPRI. “This new research facility will help us continue our role as a world leader in validating new surgical procedures and in understanding injury mechanisms and injury prevention.”

SPRI’s ongoing research on the hip, ankle, hand, elbow, shoulder, knee and spine has significantly impacted the treatment of joint disorders worldwide. Patients with severe or complex injuries and those with degenerative joint disease look to SPRI for the innovative treatments developed by the Institute’s world-class scientists and Steadman Clinic physicians conducting biomechanics and clinical research. Their findings have become crucial for delaying “last-step” surgeries such as joint replacement procedures.

Located at the base of Vail Mountain in the Vail Valley Medical Center, the facilities host three specific areas: a BioMotion Laboratory, a Biomechanical Testing Laboratory with robotics, and a Surgical Skills Laboratory used for surgeons to demonstrate and practice surgical techniques and anatomy.

Inside the BioMotion Laboratory, staff scientists and engineers have constructed an artificial ice-rink for studying athlete movements. Injuries to the hip, for example, are common in hockey players. Researchers



Robotics Engineer Mary Goldsmith operating the KUKA KR60 robot.

will be able to visually scrutinize body rotation and function, along with the forces generated, that contribute to injuries. The floor of the rink has been constructed so that it can be converted to turf for golf, soccer and tennis, and other sports. The motion analysis system used for this research is similar to that used for creating movies such as “The Matrix” and other video games with athletes’ signature moves.

The digital imaging section of the new facility will house some highly advanced technologies not yet used in orthopaedics, including a one-of-a-kind dual-plane fluoroscopy system that records 3-D x-ray movies, rather than 2-D still shots, at frame rates up to 1,000 per second. Researchers will use this technology, to analyze the motion of joints in three dimensions. There are only a handful of these systems in the world.

The Biomechanical Testing Laboratory utilizes a robot manufactured by KUKA Robotics, specifically developed to meet the Institute’s specifications. Using this novel technology, the department will be able to test joints in a manner that will enhance and validate joint reconstruction techniques.

The expanded Surgical Skills Laboratory will be used for teaching. It will consist of 10 fully equipped surgical operating stations for visiting clinicians, scholars, and fellows to practice what they are learning.

Under the direction of Biomechanics Research Laboratory Director and Senior Staff Scientist Coen A. Wijdicks, Ph.D.; Director of BioMotion Eric Giphart, Ph.D.; and Kelly Adair, Surgical Skills Manager, these laboratories will benefit orthopaedists and patients worldwide by facilitating the development, enhancement, and training that allow patients to keep their own joints while maintaining their desired activity levels for as long as possible.

Ephraim Gildor and Dr. Peter Millett: Working Together, Turning Challenges into Opportunities

The Gildor Foundation's \$1,000,000 grant opens new areas of shoulder and sports medicine research.

By Jim Brown, Editor, SPRI News

Take the talent, resourcefulness, and energy of a leader in the world of finance whose philanthropy supports the sciences, arts, and education. His name is Ephraim Gildor.

Combine his qualities with those of Dr. Peter Millett, an equally talented, resourceful, and energetic leader in the world of orthopaedic surgery and sports medicine research.

A shoulder injury brings Mr. Gildor and Dr. Millett together at the Steadman Clinic and later they begin exchanging ideas about the innovative research being conducted at the Steadman Philippon Research Institute. What happens next? Something big.

EPHRAIM GILDOR

Ephraim Gildor doesn't just accept difficult challenges. He turns them into opportunities. Consider some examples of his personal and professional achievements.

- Military service: fighter pilot, Israeli Air Force.
- Academic honors: B.S., magna cum laude, mathematics and computer science, Tel Aviv University; M.B.A., with honors, University of Chicago.
- Business/finance initiatives: Founder, Arbitrade Holdings and Axiom FX, an Aspen-based hedge fund.
- Philanthropic endeavors: Board of Directors, the Lincoln Center Theater in New York and the School of Art and Science of Jerusalem; Board of Governors, Tel Aviv University; Member, Israel Center for Excellence Through Education; and the Gildor Foundation.

The Gildor Foundation contributes to programs in sciences, arts, and education in the United States and Israel. Its recent recipients include the Mayo Clinic, Brown University, and now the Steadman Philippon Research Institute.

"Our foundation is focused on supporting individuals and programs that will have a positive impact on lives both here and in Israel," says Mr. Gildor.

Gildor has always been physically active. He runs, (mountain) bikes, hikes, and skis. He is also a highly skilled mountain climber who is in the process of challenging the most famous peaks in the world. They are known as the "Seven Summits," the highest mountains on each of the seven continents.

DR. PETER MILLETT

Dr. Peter J. Millett is a partner at the Steadman Clinic and an internationally recognized orthopaedic surgeon who specializes in disorders of the shoulder and all sports-related injuries. Consistently selected as one of the "Best Doctors in America," Dr. Millett serves as an international consultant and has treated elite athletes from the NFL, NBA, MLB, X-Games, and the Olympics.

Before coming to the Steadman Clinic and the Steadman Philippon Research Institute, Dr. Millett held a faculty appointment at Harvard Medical School and was Co-Director of the Harvard Shoulder Service and the Harvard Shoulder Fellowship. He also founded and directed the Musculoskeletal Proteomics Research Group at Harvard, where his team discovered and patented the protein profile for osteoarthritis.

Dr. Millett uses leading-edge open and arthroscopic surgical techniques to restore damaged joints, ligaments, and bones. A focus of his research is advanced shoulder arthroscopy and the treatment of athletes with shoulder injuries. He is often sought out nationally and internationally for his expertise in complex and revision shoulder surgery and total joint replacement. He has the advantage of using research conducted at the Institute to improve the outcomes of these procedures.

INJURY, RESEARCH INTERESTS RESULT IN MILLION-DOLLAR GRANT

Mr. Gildor leads an extremely physically active life that occasionally involves the risk of injury. In 2008, he suffered a serious shoulder injury while mountain biking. SPRI Board Member Damaris Skouras, a friend of the Gildors, introduced Ephi to Dr. Millett and the Institute. Dr. Millett performed successful shoulder separation surgery and, in the process, detected a tumor in the shoulder that was determined to be benign.

Following the shoulder injury, surgery, and recovery, Ephraim and his wife, Catherine, committed their foundation's support to the Steadman Philippon Research Institute for the work of Dr. Millett. That support came in the form of a \$1,000,000 grant for research on the shoulder and sports medicine disorders.

"I was fortunate enough to have known Dr. Millett and have him perform surgery that



Institute Benefactor Ephi Gildor at the summit of Mt. Vinson, elevation 16,050 ft., Antarctica's highest mountain.

brought my shoulder back to full health," says Gildor. "This research grant allows our foundation to continue its mission, allows me to recognize a very special doctor, and helps fund important research that will lead to critical medical advancements now and in the future."

BETTER CARE, REAL CURES

"I cannot thank Ephi Gildor enough for his more than generous research grant," says Dr. Millett. "Donations of this kind are largely responsible for the progress we make every day in treating people suffering from shoulder injuries and other sports-related disorders. Supporting our efforts leads to better treatment, better patient care, real cures, and ultimately, better health. We are very grateful."

Ephraim Gildor's personal life, professional accomplishments, and philanthropic generosity perfectly reflect the Steadman Philippon Research Institute's mission of keeping people active through orthopaedic research and education.

Dr. Peter Millett and his colleagues ensure that grants like that of Ephraim and Catherine Gildor are translated into better orthopaedic care and treatment of people around the world.

WHAT'S NEXT?

The Gildor grant will enable Dr. Millett and his colleagues to initiate or continue studies involving shoulder joint preservation, joint reconstruction, nerve damage, osteoarthritis, rotator cuff repair, management of cartilage injuries, and overall improvement of shoulder surgery outcomes.

What's next for Ephraim Gildor? In March, he left to climb Mount Everest—number six on his "Seven Summits" list. After that, Kilimanjaro.

And after that? Expect something else very big. It's what he does.

FRIENDS OF THE INSTITUTE



In 2010, we received 1,017 separate gifts and contributions from 756 individuals, foundations, and corporations. This combined support, including special events, amounted to a record \$6,373,948. The Institute is grateful for this support and to those who have entrusted us with their charitable giving. We are especially pleased to honor the following individuals, foundations, and corporations that have provided this support. Their gifts and partnership demonstrate a commitment to keep people active through innovative programs in medical research and education. Without this support, our work could not take place.

1988 Society

Lifetime Giving

On November 9, 1988, the Institute was incorporated as a not-for-profit educational and research organization dedicated to advancing modern medical science and the education of young physicians. The Institute is deeply grateful to the following members of the distinguished 1988 Society, whose cumulative giving totals \$1 million or more.

Mr. Herbert Allen

Mr. and Mrs. Ephraim Gildor

Mr. and Mrs. George N. Gillett, Jr.

Mr. Kenneth C. Griffin

Linvatec

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Dr. and Mrs. J. Richard Steadman

Vail Valley Medical Center

HALL OF FAME

The Institute is grateful to the following individuals, corporations, and foundations for their support of the Institute in 2010 at a level of \$50,000 or more. Their vision ensures the advancement of evidenced-based medical research, joint preservation research, science, and care, as well as the education of physicians for the future. We extend our gratitude to these individuals for their generous support:

Mr. Herbert Allen	Mr. Kenneth C. Griffin	Mr. and Mrs. Steven Read
Arthrex, Inc.	Mr. and Mrs. Peter R. Kellogg	Mr. and Mrs. Gary S. Rosenbach
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Mrs. Peggy Fossett	Össur Americas, Inc.	Vail Valley Medical Center
Mr. and Mrs. Ephraim Gildor	Philips Medical	Verizon Communications, Inc.

Gold Medal Contributors

We are grateful to the following individuals, foundations, and corporations that contributed \$20,000-\$49,999 to the Institute in 2010. Their continued generosity and commitment helps fund research to enhance cartilage healing. This potentially innovative treatment will help preserve the body’s own joints and tissues by leading to improved quality and quantity of “repair” cartilage produced by the microfracture technique, a procedure impacting multitudes worldwide.

Aetna Foundation	Dr. Tom Hackett	Dr. William I. Sterett
Aire and Ida Crown Memorial	Dr. and Mrs. Peter J. Millett	University of Pittsburgh
Mr. and Mrs. Howard Berkowitz	Dr. and Mrs. Marc Philippon	Dr. Randy Viola
Mr. and Mrs. Lawrence Flinn, Jr.	Dr. and Mrs. J. Richard Steadman	



Sharing our research findings throughout the world is a vital part of our educational and research mission. We wish to thank the following sponsors for their support:

European Visiting Scholar, sponsored by Arthrex, Inc.

Brazilian Visiting Scholar, sponsored by Instituto Brazil de Tecnologias da Saúde

Sports Medicine imaging research Fellowship, sponsored by Siemens Medical MR

Bioskills Research and Education grant, sponsored by Smith & Nephew



Over the years, the Institute has been privileged to receive generous and thoughtful gifts from friends and supporters who remembered the Institute in their estate plans. In fact, many of our friends — strong believers and supporters of our work today — want to continue their support after their lifetimes. Through the creation of bequests, charitable trusts, and other creative gifts that benefit both our donors and the Institute, our supporters have become visible partners with us in our mission to keep people physically active through orthopaedic research and education in arthritis, healing, rehabilitation, and injury prevention.

To honor and thank these friends, the Founders' Legacy Society was created to recognize those individuals who have invested not only in our tomorrow, but also in the health and vitality of tomorrow's generations.

Our future in accomplishing great strides, from understanding degenerative joint disease, joint biomechanics, and osteoarthritis, to providing education and training programs, is ensured by the vision and forethought of friends and supporters who include us in their estate plans. The Institute's planned giving program was established to help donors explore a variety of ways to remember the Institute. We are most grateful to these individuals for their support in becoming founding members of the Founders' Legacy Society:

Mr. and Mrs. Robert M. Fisher

Ms. Margo Garms

Mr. Albert Hartnagle

Mr. and Mrs. John McMurtry

Mr. and Mrs. Edward J. Osmers

Mr. Al Perkins

Mr. Robert E. Repp

Mr. Warren Sheridan

Silver Medal Contributors

Silver Medal donors contribute \$5,000-\$19,999 annually to the Institute. Their support makes it possible to fund research to determine the effectiveness of training programs to prevent arthritis, identify those who are most at risk for arthritis, and provide a basic foundation to improve postsurgical rehabilitation programs, thus improving the long-term success of surgical procedures. Accelerated by overuse and injuries to joints, osteoarthritis prevention is a key area of interest for the Institute. We extend our deep appreciation to the following for their generous support in 2010:

Mr. Edward C. and Mrs. Dawn Abraham	Mr. and Mrs. S. Robert Levine
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Bronze Medal Contributors

Medical research and education programs are supported by gifts to the Institute's annual fund. The Bronze Medal level was created to recognize those patients and their families, trustees, staff, and foundations who contribute \$10-\$4,999 annually to the Institute.

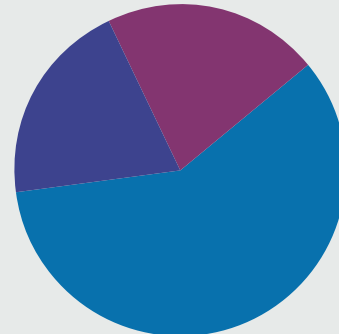
Donors at this level support many programs, including the Institute's research to validate the success of new treatments for degenerative arthritis and identify factors that influence success. For example, as youth sports injuries rise to epidemic proportions due to early specialization and extensive practicing, the Institute is researching conditions and injuries commonly associated with specific sports, such as hip impingement in young hockey players, to determine how to prevent and treat them. Injuries in growing children may cause unforeseen complications during adulthood such as an early onset of osteoarthritis. Through your support, the Institute is committed to developing early intervention techniques to reduce the predisposition to osteoarthritis and to maintain peak activity levels into adulthood.

We thank the following for their support in 2010:

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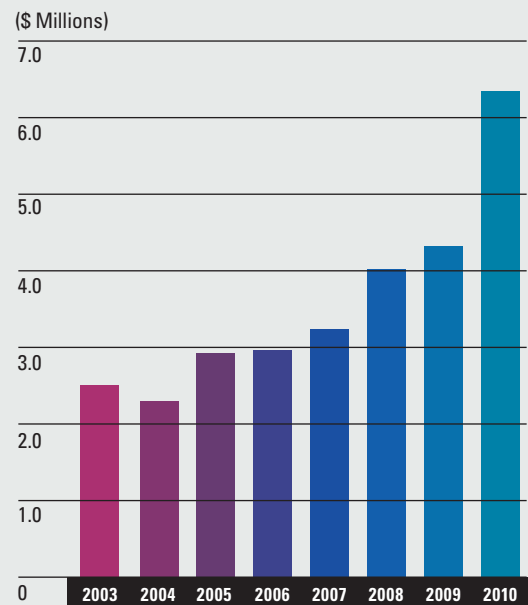


MRI and Other Revenue \$1,280,029
 Corporate Support \$1,353,598
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Increasing generosity

Support in 2010 took place in the context of a struggling world economy. Individuals, corporations and foundations contributed \$6,373,948 in 2010.

Eight Years of Support.





The education of orthopaedic surgeons is a critically important mission of the Institute. Academic Chairs provide the continuity of funding necessary to train physicians for the future, thus ensuring the continued advancement of medical research.

Currently, more than 185 Fellows practice around the world. We wish to express our gratitude and appreciation to the following individuals and foundations that have made a five-year \$125,000 commitment to the Fellowship Program to support medical research and education. In 2010, five chairs provided important funding for the Institute's research and educational mission. We are most grateful for the support from the following:

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The Institute was selected by RE/MAX International, the global real estate firm, to again hold the seventh annual Golf Classic at the Sanctuary, a premier golf resort located south of Denver.

Proceeds from the tournament support the development of new procedures and methodology to battle degenerative arthritis. The tournament was open to the public and included grateful patients and corporate supporters.

Since 2004, the Institute has raised more than \$1,000,000 from this golf tournament to support its research programs.

Renowned course architect Jim Engh, *Golf Digest's* first-ever "Architect of the Year" in 2003, designed the course that protects a private oasis of 220 acres, effectively complementing the 40,000 surrounding acres of dedicated open space.

The Institute is grateful to Dave and Gail Liniger, owners and cofounders of RE/MAX International, who developed Sanctuary and created this unique opportunity for the Institute to develop and enhance relationships with those who support our mission. In addition, we wish to express our sincere appreciation to the following sponsors and participants:

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Fellowship Benefactors fund the research of one Fellow for one year at a level of \$10,000. This is a fully tax-deductible contribution that provides an opportunity for the benefactor to participate in a philanthropic endeavor by not only making a financial contribution to the educational and research year but also to get to know the designated Fellow. Each benefactor is assigned a Fellow, who provides written reports and updates of his or her work. We extend our gratitude to the following individuals for their generous support:

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**Steadman Philippon
 Research Institute
 2010 History in the
 Making Features
 Concert by Country
 Star Darius Rucker,
 Auction and Dinner
 at Larkspur**



The summer fundraiser featured a concert by country music star Darius Rucker, July 8, 2010, at the Gerald R. Ford Amphitheater.

Because of his relationship with Dr. Steadman and his belief in the work of the Institute, Darius Rucker offered to do a concert. He won the Country Music Association New Artist of the Year award (formerly known as the Horizon Award), making him the first African American to do so since the award was introduced in 1981. He is widely considered one of the country music industry's hottest new male stars.

History In The Making included the concert, a private dinner at Larkspur restaurant and a live and silent auction. All proceeds from the event were directed to support the Institute's research and education in the areas of arthritis, healing, rehabilitation and injury.

Tommy Ford, Tim Jitloff, and Tucker Perkins: Skiing's Rising Stars Shoot for 2014 Olympics

Steadman Philippon Research Institute sponsors Alpine and Free Ride skiers.

By Jim Brown, Editor, SPRI News

Want a preview of what you might see in the 2014 Winter Olympics? Remember these names: Tommy Ford, Tim Jitloff, and Tucker Perkins. These young men have established themselves as national champions in their sports and now they are official representatives of the Steadman Philippon Research Institute.

Tommy Ford, an Alpine racer from Bend, Oregon, was a member of the 2010 U.S. Olympic team, a three-time National Champion in 2010, and a two-time National Champion in 2011.

Tim Jitloff was named to the U.S. Development Team in 2005, the same year he won a Junior World Championship. The Reno resident is now a three-time National Champion, a seven-year member of the U.S. Ski Team, and has his sights set on the next Olympic games.

New Hampshire's Tucker Perkins is a professional Free Ride skier, a Halfpipe National Champion in 2010, and in April was named to the first ever U.S. Freeskiing National Team.

TOMMY FORD: FAMILY TRADITION

For Ford, skiing is a family tradition. His father was on the U.S. team in the late 1960s and early 1970s, and later coached at Dartmouth. His mother, Mary Ellen, coached for the Mount Bachelor Ski Foundation and at the University of Vermont, and Tommy's brother, Tyson, was a college racer.

Not surprisingly, Tommy was on skis by the time he was two or three years old. Skiing came naturally. "I was almost more comfortable skiing than I was walking." Ford joined the U.S. Development Team right out of high school and has been moving up as a world-class Alpine skier ever since. His rise in the world of ski racing has been marked by winning and consistent improvement.

Ford's schedule is hectic, but very carefully planned. He gets a little down time (or at least a change of pace) each year as a student during a two-month spring semester at Dartmouth. He steps up the intensity of his training regimen beginning in July. In August, he was off to New Zealand with the U.S. Ski Team. Then it will be back to the States, down to Chile, home again, and fi-

nally in Europe to get ready for the 2011-2012 World Cup competition.

Tommy's Olympic experience in Vancouver, British Columbia, was unique, he says. He interrupted his training to attend the Opening Ceremonies, then flew back to the States to get ready for his events. "Huge. Lots of energy and definitely a different kind of energy. It was quite the experience."

As he prepares for the next Olympic Games in Russia, he is returning to the approach he had earlier in his career of enjoying the sport and trying to perform well, regardless of Olympic expectations. "My focus will be on great racing with great energy," he says, "not thinking so much about the Olympics specifically."

Tommy had known about the Steadman Clinic and the Steadman Philippon Research Institute because many of his teammates had been treated there. Then he met SPRI's Mike Egan, Marc Prissant, and Dr. Marc Philippon at a meeting in San Francisco and began to better understand the sports medicine research conducted at the Institute. He later became personally involved as a patient when he was treated for a hip injury by Dr. Philippon.

"The physicians at Steadman have worked with a lot of high-end athletes," says Ford, "and the impact of their research has benefitted ski coaches and athletes at every level. I wanted to be an ambassador for them because I realize the importance of their mission. At some point, most of us will benefit from what they do."

TIM JITLOFF: IT'S ABOUT THE TEAM

Most fans think of ski racing as a highly individual sport, but Tim Jitloff's career, on and off the slopes, has been more about the team. He was on the U.S. Development Team in 2005, is a member of the U.S. Ski Team now, and hopes to be a member of the U.S. Olympic Team (for the second time) when it competes in Sochi, Russia, in 2014. But Tim's team orientation is equally impressive apart from ski racing. "My mom is a breast cancer survivor," he explains. "After her experience, the two of us decided to get involved with Susan G. Komen for the Cure, an advocacy organization that supports breast cancer

research, education, and support programs. Our Komen Race for the Cure team raised about \$25,000 in the Reno area over a two-year period, and we will continue to support breast cancer awareness."

Tim sees his new role with the Steadman Philippon Research Institute as a continuation of a team effort. "Some of the best surgeons in the world are at the Steadman Clinic," he says. "Anyone who is a ski racer knows about this Clinic and the Research Institute. This is where we go when we have an injury. Dr. Steadman and his colleagues have been involved with the U.S. Ski Team for a long time. For the athletes, it's like we're part of the same team."

After the next Winter Olympics, Tim will decide on whether to keep on skiing competitively, to continue his studies in Germany (he is fluent in German and lives there for part of the year) or the United States, or to do both. He is interested in the business side of sports medicine. "I'm excited about the possibility of working in a field that develops tools to help people stay healthy or to heal after an injury. It would be great to do that and still be associated with Steadman Philippon."

There's that team thing again.

TUCKER PERKINS: FREESKIING PIONEER AT 20

"I grew up playing practically everything," says Perkins. "My parents gave me the opportunity to explore what I liked to do, and I played lacrosse, swam, and surfed."

Tucker, like Tommy Ford, was on skis at a very young age. Later, he got his competitive start in ski racing, then switched to moguls, tried slopestyle skiing, and by the time he was 14 began to focus on halfpipe. (The halfpipe is a long half-cylinder of packed snow where the athlete performs jumps, spins, and maneuvers while moving from the start to the finish. Although only 20 years old, his résumé reads like that of a veteran.)

Perhaps his greatest honor yet was being named as one of the four men on the first U.S. Pro Halfpipe team. "When I got the call, it was one of the most exciting days of my career," says Tucker. "Halfpipe has always been a very individual sport, but

being named to the U.S. team gives me and my teammates the opportunity to be part of something bigger than ourselves.”

Making the team also opens the possibility of representing the United States in the 2014 Winter Olympics. The team will be selected based on the results of a series of Grand Prix events leading up to the Olympic Games, and the top four Americans will make the squad. If Tucker continues to perform as he has during the past few years, he will become an Olympian.

My first encounter with the Institute and Clinic was when I was in Vail five years ago,” says Perkins. “Each of the procedures they performed on me was added to the data they have obtained from patients for the past 20 years. That information helped me get the best care and results possible. I like knowing that my data points will contribute to the evidence-based medicine that helps others.”

REPRESENTING STEADMAN PHILIPPON

Skiing stardom has given Tommy Ford, Tim Jitloff, and Tucker Perkins a platform to help educate others. As spokesmen for the Steadman Philippon Research Institute, they will wear the SPRI logo, provide feedback regarding their training and performance, contribute to research, make appearances on behalf of the Institute, and share their personal experience and knowledge of SPRI.

“We want to shine a positive light on the Institute and all the great things its doctors and scientists have done for recreational and professional athletes,” says Tucker. “I’ve personally seen positive outcomes among my friends, family members, and sports superstars.”

These three accomplished athletes are great spokespersons for the Steadman Philippon Research Institute,” says John McMurtry, Vice President for Program Advancement and former U.S. Ski Team Coach and Alpine Director. “They are living examples of what we stand for in orthopaedic research and what we want to be able to preserve in people of all ages, making dreams come true and keeping people active in all stages of life.”



Tommy Ford

Photo: Eric Schramm



Tim Jitloff

Photo: Joe Margolis



Tucker Perkins

Photo: Sam Beck

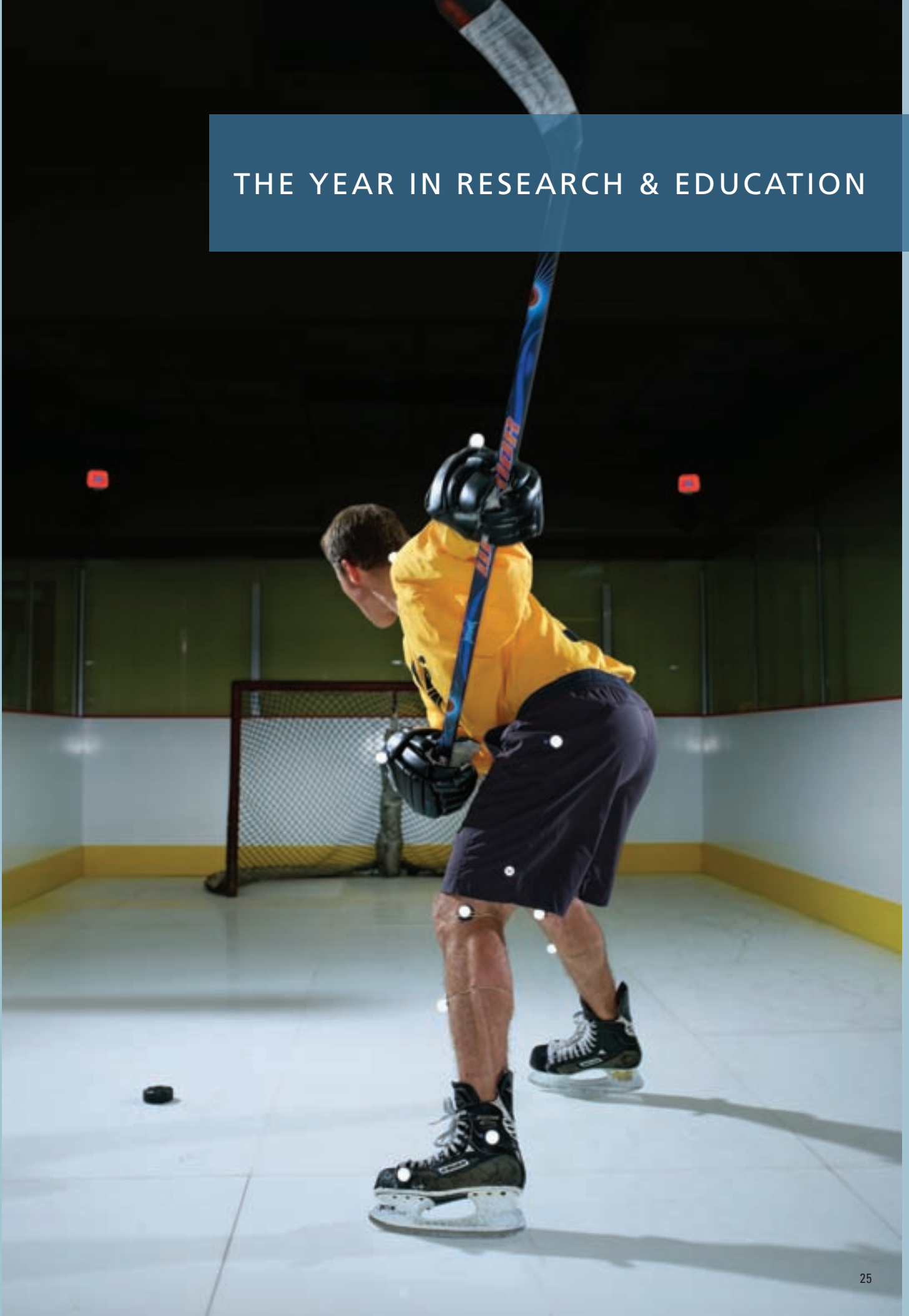


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THE YEAR IN RESEARCH & EDUCATION



William G. Rodkey, D.V.M., Diplomate, ACVS, Chief Scientific Officer and Director of Basic Science Research

THE PURPOSE OF OUR BASIC SCIENCE RESEARCH IS TO GAIN A BETTER UNDERSTANDING OF FACTORS WHICH LEAD TO: (1) DEGENERATIVE JOINT DISEASE, (2) OSTEOARTHRITIS, (3) IMPROVED HEALING OF SOFT TISSUES SUCH AS LIGAMENTS, TENDONS, ARTICULAR CARTILAGE, AND MENISCUS CARTILAGE, AND (4) NOVEL AND UNTRIED APPROACHES OF TREATMENT MODALITIES. OUR FOCUS IS TO DEVELOP NEW SURGICAL TECHNIQUES, INNOVATIVE ADJUNCT THERAPIES, REHABILITATIVE TREATMENTS, AND RELATED PROGRAMS THAT WILL HELP TO DELAY, MINIMIZE, OR PREVENT THE DEVELOPMENT OF DEGENERATIVE JOINT DISEASE. IN 2010, WE COLLABORATED WITH VARIOUS EDUCATIONAL INSTITUTIONS, PREDOMINANTLY COLORADO STATE UNIVERSITY. WE BELIEVE THAT OUR COMBINED EFFORTS WILL LEAD DIRECTLY TO SLOWING THE DEGENERATIVE PROCESSES, AS WELL AS FINDING NEW WAYS TO ENHANCE HEALING AND REGENERATION OF INJURED TISSUES.

The relatively new area of regenerative medicine is an exciting one that has gained global attention, especially in the areas of orthopaedic sports medicine and in the care of combat casualties from our military services. There are many new and innovative techniques under investigation by scientists around the world, including stem cells, blood products, and synthetic materials. One of the broad goals of this work can be stated simply as joint preservation. In 2010 we again focused our efforts on regeneration of an improved tissue for resurfacing of articular cartilage (chondral) defects that typically lead to degenerative osteoarthritis. We have been working in the promising area of adult autogenous (one's own) mesenchymal stem cell (MSCs) therapy in collaboration with Drs. Wayne McIlwraith and David Frisbie at Colorado State University (CSU). We have now completed our initial study, and the data support pursuit of regulatory approval to begin human testing. We have also studied in the laboratory with CSU the effects on cartilage healing of platelet rich plasma (PRP) derived from whole blood. We have looked specifically at how different PRP preparation techniques can influence outcomes.

The following provides some important background information and a brief summary of our most recent findings. This work is ongoing, and the encouraging results presented here will allow us to continue to focus on this work in the coming years.

Osteoarthritis (OA) is a debilitating and progressive disease characterized by the deterioration of articular cartilage, accompanied by changes in the subchondral bone and soft tissues of the joint. Traumatic injury to joints is also often associated with acute damage to the articular cartilage. Unfortunately, hyaline articular (joint) cartilage is a tissue

with very poor healing or regenerative potential on its own. Once damaged, articular cartilage typically does not heal, or it may heal with functionless fibrous scar. Such tissue does not possess the biomechanical and biochemical properties of the original hyaline cartilage; hence, the integrity of the articular surface and normal joint functions are compromised. The result is often OA, and the ultimate outcome may necessitate total joint replacement with metal and plastic.

The importance and the global impact of OA must not be underestimated. The U.S. Centers for Disease Control and Prevention estimates that in the next twenty-five years at least 75 million Americans (15 percent to 25 percent of the population) will have some form of arthritis, including degenerative arthritis secondary to injury to the articular cartilage surfaces of the joints. Osteoarthritis is the most significant cause of disability in the United States and Canada, moving ahead of low back pain and heart disease. By the year 2020, more than 60 million Americans and six million Canadians will be affected by some degree of osteoarthritis of just the knee. OA of other joints will raise this number significantly. The economic impact is enormous, and the current political discussions on health care costs certainly highlight the importance of OA. It is estimated that osteoarthritis alone will consume more than \$90 billion of direct and indirect costs to the American public in 2011. The intangibles of this terrible disease include the chronic pain, disability, and psychological distress on the individual plus the family unit. We believe that our research can have far-reaching effects by greatly enhancing the resurfacing of damaged or arthritic joints before the disease process reaches the advanced and debilitating state.

We have previously proven that arthroscopic subchondral bone plate microfracture is a successful method to promote adequate cartilage healing by enhancing both quality and quantity of the repair tissue. The technique relies on the body's own cells and healing factors present in the bone marrow to promote healing, thus avoiding concerns of immune reactions to transplanted tissues or the need for a second surgical site or second surgery to collect grafts or cells. Our clinical experience confirms that microfracture in its current form leads to demonstrable improvement in about 80 percent to 85 percent of patients over time. While such results are very positive, we are currently searching for ways to achieve even better outcomes.



William G. Rodkey, D.V.M.

Photo: Barry Eckhaus

As previously noted, we have completed the initial study involving the use of adult autogenous (one's own) mesenchymal stem cells that come from the patients themselves as an adjunct to microfracture. That is, there is no use of embryonic stem cells, nor is there a necessity to find donors. Each patient is his/her own source of the stem cells. We surmised that when injected into the joint after microfracture, these stem cells would enhance the speed and intensity of the cartilage resurfacing process. Our goals were to be able to accelerate rehabilitation, decrease postoperative pain, lessen lost time from work or sports, and hopefully decrease overall financial costs. Another goal of this treatment is to prevent, or at least minimize, degenerative osteoarthritis after chondral injury.

In an equine model of articular cartilage injury in which we used stem cells as an adjunct to microfracture, we confirmed a significant increase in repair tissue firmness and a trend for better overall repair tissue quality (cumulative score of all arthroscopic and gross grading criteria) in stem-cell-treated joints at one year. Various other analyses demonstrated significantly greater levels of aggrecan, one of the main building blocks of articular cartilage, in repair tissue associated with stem cell treatment. These important findings lead us to speculate that the new tissue that forms might be even more durable than the repair tissue that forms with the microfracture procedure alone that is now in use.

If further studies (planned) support these initial findings of repair tissue quality and durability, then we will elevate our discussions with the FDA about starting a human clinical trial using these techniques. FDA decisions are difficult to predict, but we are hopeful that initial human studies are in the not too distant future. Another approach we plan to pursue in the future is the isolation of stem cells from peripheral (circulating) blood. To date, this novel technique has not been used in the United States, but we have established a relationship with an international colleague who we believe can help us with the techniques.

Another study carried out in 2010 in collaboration with CSU involves the use of platelet-rich plasma, or PRP, that is made from the patient's own blood. PRP has been used to treat injured tendons and other soft tissues, but we believe that PRP, with or without the patient's own stem cells mentioned above, may greatly enhance the success of microfracture and other joint resurfacing procedures. The objective of the study was to evaluate the effects of platelet-rich plasma (PRP) on anabolic (building up) and catabolic (tearing down) activities of articular cartilage and meniscus tissue in a laboratory environment. We studied these effects by processing PRP using single or double spin commercial kits. We also produced a laboratory PRP preparation in which the cells were highly concentrated in order to assess the effects of having more, compared to fewer, cells. The PRP was mixed with cell culture medium and added to cartilage or meniscus cell cultures. We measured

extracellular matrix synthesis (that is, the production of new structural tissue components) with various quantitative laboratory techniques. Gene expression of catabolic (destructive) enzymes was also measured.

We found that the platelet cell density in non-concentrated laboratory PRP was about 60 percent higher than in normal blood while platelet and white blood cell densities were about the same as the single-spin kit, but the double-spin kit resulted in ~2.5-fold higher platelet and ~400-fold higher white blood cell densities. Based on the analyses, it appeared that more extracellular matrix was produced with the single-spin preparation compared to the double-spin. We also observed that the single-spin preparation resulted in lower catabolic (destructive) enzymes compared to double-spin and more concentrated preparations. Because of these findings, we speculate that single-spin PRP preparations may be the most advantageous for intra-articular applications, such as an adjunct to microfracture or meniscus repair, and double-spin systems or greater concentrations of PRP should be considered with caution.

These continue to be productive and exciting times that have yielded very useful findings, and we feel that more very important and encouraging research results lie just ahead for the Basic Science Research group and the Steadman Philippon Research Institute.



Lauren Matheny Plays Key Role in Advancement of Clinical Research

By Jim Brown, Executive Editor

Lauren Matheny has seen significant advancements in almost every phase of Clinical Research since she joined the staff six years ago. Not only has she seen them, she has played an important role in developing new systems that maintain the Institute's position on the leading edge of research.

"Lauren is a bright, young, dedicated researcher, and an excellent example of the type of committed professional we are attracting to support our mission," said Mike Egan, former Chief Executive Officer of the Research Institute. "She has been a vital part of published national and international papers that report on our clinical findings and that lead to improved orthopaedic care."

Steadman Philippon has a well-documented history of identifying and securing the services of up-and-coming scientific talent. Lauren Matheny is a good example. After graduating from Miami of Ohio with a major in zoology and a minor in neuroscience, she accepted a one-year appointment as an intern at Steadman Philippon in 2005. That didn't last long. After two months, she was hired full time as a Clinical Research Associate and is currently the Lower Extremity Research Coordinator for Clinical Research.

Over the years her responsibilities have increased as rapidly as the technology and research capability of the Clinical Research department itself.

"When I came in as an intern," says Lauren, "my main job was to collect data. Now I get to participate in the research process from conception to finalization."

Her duties include initiating the data collection process, navigating the Institute's database (which now includes 50 million pieces of patient, physician, and procedure information), assembling a study population, collecting follow-up data, making presentations, and writing and editing manuscripts and papers and submitting them to national and international journals and professional associations, as well as presenting this research.

IMPROVING PATIENT OUTCOMES AND CARE

"What we try to do is improve patient outcomes and care," she continues. "That's the big idea. It's what all of this research is

about. If a certain procedure works well, we want to talk about it. If it doesn't, we want people to know. We want our patients and our physicians to be informed, and we want to improve communication between those two groups. Many of our studies involve patient expectations. Have we accomplished what the patient actually expected? But the goal always remains one of improving patient care."

The process that makes Steadman Philippon one of the world leaders in producing scientific papers, presentations, and publications is continuously being refined and upgraded. And the pace of that process has increased significantly since Lauren arrived in Vail—probably not a coincidence.

GROWING THE DATABASE

Under the leadership of Karen Briggs, M.B.A., M.P.H., Director of Clinical Research, Matheny has helped build (and re-build) the Institute's massive database. She works to make the database information more accessible. She collaborates with more physicians and scientists than at any time in the Institute's history. She helps develop the forms that each patient and physician completes to support the Institute's evidence-based approach to surgical innovations.

GOING PAPERLESS

As of April, Briggs, Matheny, and their colleagues completed the Institute's transition to an entirely paperless method of data input.

"We've created new forms that patients complete on the web and that our attending physicians can complete on electronic tablets or other devices," says Matheny. "We've basically either developed a new system of collecting data and determining outcomes from the ground up, or we've converted it from the existing database."

"The new system will save time and provide more complete and accurate collection of data. There is not much room for error with these forms—only one answer, nothing handwritten, and less need for redundant checks."



Photo: Joe Kamia

By vastly reducing the time and energy that used to be spent on verifying data, the entire Steadman Philippon team (attending physicians, fellows, scientists, researchers, and staff members) can be more productive in other areas. The team can now conduct studies in less time, evaluate research results efficiently, write more papers, make more presentations, and let the world know what has been learned.

JUST GETTING STARTED

Based on the contributions Lauren Matheny has made during her first six years, it's safe to say she's just getting warmed up. Her expectations of what will be accomplished in clinical and biomechanical research during the next decade are high.

She continues to enhance her own professional development. In addition to her responsibilities at the SPRI, she is ready to begin work on a master's degree in statistical analysis and research design.

This should not be a surprise. Lauren already co-authored more than a dozen articles published in peer-reviewed professional journals, and she has made multiple presentations at national and international scientific meetings. She may have already written the equivalent of several master's theses.

Her next degree—and not necessarily her last one—will be one more accomplishment for one of Steadman Philippon Research Institute's brightest young researchers.

Karen K. Briggs, M.B.A., M.P.H., *Director of Clinical Research*; Marilee P. Horan, M.P.H., *Upper Extremity Research Coordinator*; Lauren M. Matheny, B.A., *Lower Extremity Research Coordinator*; Research Interns: Mackenzie Herzog, B.A.; Alexandra France, B.S., Morgan Currie, B.S., and Evan Carstensen, B.S.

IN 2010, THE CLINICAL RESEARCH DEPARTMENT BEGAN THE PROCESS OF UPDATING OUR DATABASE SOFTWARE AND DATA COLLECTION. MANY OF THE STAFF PUT IN COUNTLESS HOURS ON THIS PROJECT. IN ADDITION TO A BETTER COLLECTION AND STORAGE SYSTEM, THIS SYSTEM WILL PROVIDE BETTER QUALITY DATA AND LESS TIME SPENT ON DATA COLLECTION, LEAVING MORE TIME AVAILABLE FOR RESEARCH. IN ADDITION, IN 2010, CLINICAL RESEARCH SUBMITTED OUR FIRST ABSTRACTS FROM OUR NEW PROGRAM INVOLVING ANKLE RESEARCH AND IMAGING RESEARCH. OUR DATABASE CONTINUES TO GROW WITH MORE THAN 19,000 KNEE SURGERIES, 3,000 HIP SURGERIES, 2,300 SHOULDER SURGERIES, AND MORE THAN 400 ANKLE SURGERIES. FROM THIS DATABASE, RESEARCH PROJECTS ARE CREATED. THE FOLLOWING ARE EXAMPLES OF PROJECTS FROM THE PAST YEAR.

Ankle Research

Sport Activity Level in Patients with Foot and Ankle Injuries

Foot and ankle injuries are some of the most common injuries in sports. With so many people sustaining these injuries each year, it is important to see how patients are recovering after treatment. In order to accomplish this, a scoring system or outcome measure needs to be established. Outcome scores allow physicians to assess a patient before treatment or surgery is administered and then follow up with the patient after surgery. The outcome score must measure the change in patient outcome from preoperative to postoperative. Several scores have been used to document improvement in activity level following foot and ankle surgery. However, most of these outcome measures have not been validated for use in the foot and ankle. The Tegner Activity Scale was originally reported as a knee scale but was developed as a lower extremity score. The Tegner Activity Scale is a score that measures a patient's activity level on a scale of 0 to 10, with 0 equal to no participation in sports or activity (disabled) and 10 equal to the activity level of a professional or elite athlete. Although Tegner Activity Scale has been most commonly used in the knee, as well as validated in the knee for numerous pathologies, such as anterior cruciate ligament reconstruction (ACL) and meniscus

treatments, it was originally developed as a lower extremity score. The purpose of this paper was to determine whether the Tegner Activity Scale would correlate with a validated preoperative score in patients with foot and ankle injuries.

Between September 2009 and October 2010, all patients seeking treatment for foot and ankle injuries completed a questionnaire that included Foot & Ankle Disability Index (FADI) Sport Subscale, SF-12 (a general health survey) and current Tegner Activity Scale, prior to injury Tegner Activity Scale and Tegner goal. One hundred and sixty-three patients completed the survey. Fifty-three had previous surgery and 41 had prior ankle injections.

Median current Tegner level was 3.0, median prior to injury Tegner level was 6.0 and median goal Tegner level was 6.0. A Tegner level of 5 or greater represented a competitive athlete. Eighty-one percent of patients had a Tegner goal of more than 5. The general health survey, the SF-12, is a score that has been validated to measure general health. It is comprised of two components—physical and mental. This study showed an association between the Tegner Activity Scale and the physical component of the SF-12. Patients had a 50 percent reduction in activity. Most patients were competitive athletes and the Tegner Activity Scale was able to measure a reduction in sport level.

This study is important because it demonstrates the capability of the Tegner Activity Scale to be used as an outcome score that can measure changes in activity level of patients before and after surgery. Determining a validated way to measure activity level in patients with foot and ankle injuries



Back row, left to right: Karen K. Briggs, Alexandra France, Lauren Matheny, Evan Carstensen, John B. Hibben.
Front row Left to right: MacKenzie Herzog, Morgan Currie, Marilee P. Horan.

is key when evaluating them at follow-up. The physician is able to see how their patient is doing at different times after surgery and can rely on the outcome measure to show them where their patient is physically and sport-wise. The study is the first step in validating the Tegner Activity Scale as an acceptable outcome measure that physicians can use to monitor their patients' success with surgery. The study was accepted for presentation at the prestigious American Orthopaedic Society for Sports Medicine (AOSSM) in February of 2012.

Hip Research

Outcomes Two to Five Years Following Hip Arthroscopy for FAI in the Pediatric Patient

It is estimated that 30 to 45 million adolescents between the ages of 6 and 18 participate in sports, and many are competing at higher levels and earlier ages than ever before. The correlation between femoroacetabular impingement (FAI), which is due to a deformity on the femur, the pelvis or both, and elite athletic performance has been well documented in the adult population. Now it is increasingly being recognized in the pediatric and adolescent populations. As in adults, pediatric femoroacetabular impingement can lead to tissue injury, cartilage damage, and early arthritis.

FAI in the adult is often attributed to a randomly occurring alteration in the shape of the bones of the hip. In the younger population, problems in the hip joint can be due to several common childhood hip disorders or other deformities present since birth. However, in the absence of conditions, it is hypothesized that FAI be attributed to a developmentally

abnormal growth of the femoral head. When the open growth plate at the junction of femoral head and neck is submitted to high stresses of competitive sports, it may be prone to the development of a bony deformity which causes the tissue and cartilage damage of FAI.

FAI has been successfully treated by hip arthroscopy in the adult population and shown excellent results for return to play among high-level athletes. In the pediatric population, arthroscopic techniques have been used routinely for biopsies, infectious and inflammatory arthritis, and childhood diseases, but the open growth plate often present in the adolescent complicates the treatment plan for FAI. In the past, the recommendation was open surgery with total hip dislocation to cut out the impingement. This surgery required a large open incision, long healing time, complicated rehabilitation, and an increased risk of infection and other complications. Recent studies of pediatric hip arthroscopy have reported good early and one-year outcomes following the procedure. However, it is important to know whether the improvements following arthroscopy are maintained in the years following the repair or whether the symptoms and activity limitations recur.

The goal of this study was to report on the outcomes at two to five years following hip arthroscopy for FAI in an active pediatric population. A total of 60 patients, 16 years old or younger at the time of surgery for FAI who underwent surgery between March 2005 and May 2008 were included. Each patient was required to have a minimum of two years of follow-up results. Subjects were excluded if they had undergone prior surgery on their hip. Data collected included age, gender, body mass index,

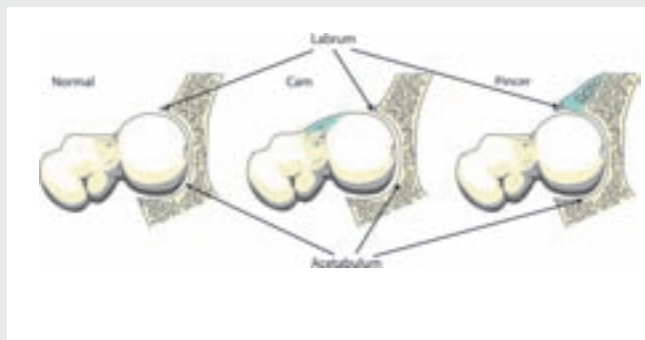
What is FAI?

Femoroacetabular impingement occurs when abnormally shaped bones of the hip repetitively hit into each other during movement. As a result, soft tissue structures of the hip, including the acetabular labrum and the articular cartilage, are often entrapped and injured. Impingement is particularly common in hip flexion and internal rotation, a position frequently encountered during activities of daily living. Difficulty with putting on shoes and socks and getting into and out of a car are common complaints in patients with extensive impingement.

There are two distinct types of femoroacetabular impingement, cam and pincer. Most commonly, patients have a combination of the two types of impingement. Cam impingement results from excess bone located on the femoral neck. Pincer impingement results from excess bone located on the acetabulum. The precise cause of the impingement is unknown; however, it likely has both developmental and activity-related (such as in contact in sports) components.

In both types of impingement, the abnormal contact between the femoral head and acetabulum during movement causes injury to the labrum and articular cartilage. Injuries to the acetabular labrum lead to increased movement of the femoral head within the acetabulum, resulting in an unstable joint. Also, tears of the acetabular

labrum result in increased contact forces between the femoral head and the acetabulum. With these increased forces, damage to the articular cartilage may result. Injuries to the articular cartilage over time may increase in size and depth, and ultimately result in bone-on-bone contact. At this point, the only current solution is a total hip replacement.



There are two distinct types of femoroacetabular impingement, cam and pincer. Cam impingement results from excess bone located on the femoral neck. Pincer impingement results from excess bone located on the acetabulum.

Illustration: Marty Bee

time of symptoms before surgery, and type of sport. In surgery, tears in the hip socket tissue due to FAI were seen in all patients, and they were either reduced or repaired. Bone trimming was performed for bony deformities, cartilage damage was addressed, and excessively loose joint capsules were tightened, if the patient's condition required. The Modified Harris Hip Score (MHHS), Hip Outcome Score sports subscale (HOS), and patient satisfaction surveys were used to measure outcomes.

At an average follow-up of three years, with 91 percent of patients following up, the mean MHHS increased from 60 to 91, mean HOS sport increased from 38 to 82, and median patient satisfaction with outcome was 10/10. There were no surgical complications such as infections or surgery-induced bone deformities. These encouraging results supported the hypothesis that hip arthroscopy in the pediatric population is safe and provides excellent outcomes with limited complications. To protect this increasingly large population at risk for developing FAI, an important area of future research should be on screening and prevention programs. However, this study indicates that when patients do develop symptoms, this adolescent age group may be ideal to safely and successfully intervene in a minimally invasive manner. By fixing the underlying deformity before further tissue or cartilage damage has occurred, we have the opportunity to prevent sport limitations, time of painful symptoms, or accelerated arthritis.

Predictors of Grade IV Cartilage Lesions in the Hip

Hip arthroscopy is becoming increasingly utilized to treat hip injuries and there are many indications to use this procedure. Now, cartilage lesions, which were previously undetectable by conventional medical imaging processes, are frequently encountered during hip arthroscopy.

Cartilage or chondral lesions may result from a variety of causes, including traumatic or idiopathic (unknown) etiologies and are classified as acute, chronic, or degenerative. The depth of chondral injuries can vary from partial to full thickness defects. As in the knee, chondral lesions of the hip are classified according to a specific classification scheme called the Outerbridge Classification.

A grade IV chondral lesion is the worst grade and represents a full thickness defect through the cartilage tissue and down to subchondral bone. One of the problems with cartilage lesions is that they are difficult to diagnose due to the fact that they typically present with minimal or no pain.

Unlike other tissues in our bodies, cartilage lacks pain receptors, making it difficult to identify new injuries and allowing old injuries to go undetected. However, chondral injuries may be detected by some recognizable physical exam findings: mechanical symptoms, like changes in joint mobility, and joint irritation are two warnings that there may be an injury.

Recognition and early treatment of hip chondral injuries is critical as cartilage lesions have severe implications for long-term health of the joint. Left untreated, many of these injuries may progress to the degenerative disease known as osteoarthritis.

Institute Hip Research to Determine Prevalence of FAI in Youth

Increased Intensity of Sports at Early Ages May be a Factor

By Karen Briggs, M.B.A., M.P.H., Director, Clinical Research

Ice hockey continues to be a popular sport in Canada and specific regions of the United States and Europe, with 577,077 registered players in Canada and 474,592 in the U.S. who participated in the 2009-2010 season. Youth programs can start as early as five years of age, and young participants can spend a significant time on the ice. In one study published in *Medicine & Science in Sports & Exercise* (January 1999), 12- to 13 year old peewees and 15-to-19-year-old elites spent an average of 18 and 45 player hours per tournament, respectively.

Many of these players develop hip problems as they continue to play and get older, and it is now recognized that hip problems are an epidemic. Often, they develop femoroacetabular impingement (FAI), which leads to labral tears, cartilage damage, and early onset osteoarthritis. It is unclear what causes the development of FAI. However, it has been hypothesized that the increased stresses of sports at an early age may contribute to the development. Though not limited to ice hockey players, the biomechanics of skating and the high-impact level put hockey players at elevated risk of suffering from FAI.

The purpose of this study, which the Institute initiated in the fall of 2010, is to determine how many young hockey players aged 10-19 have evidence of FAI. This will be determined by clinical exam and magnetic resonance imaging (MRI). In addition, we will determine the reliability of the clinical exam to diagnosing FAI prevalence in youth hockey. Test subjects will include young athletes enrolled in hockey programs.

FAI is defined by two different chondral abnormalities, cam and pincer. These bony overgrowths can occur alone or in combination, but it is an increase in the cam bone formation on the femoral head that leads to an increased alpha angle, which in turn serves as an indicator of a potential FAI. It has been suggested that cam FAI leads to decreased range of hip motion and labral tears when the abnormal femoral head traps the labrum against the acetabulum during internal rotation and flexion.

METHODS

Each individual is taken to an exam room and a standard hip screening examination is performed. This exam includes the FABER distance test, the impingement test, dial test, resisted abdominal crunch, and hip range of motion. The objective of these tests is to diagnose FAI. Following completion of the exam, the individuals undergo a short sequence MRI for the analysis of FAI.

The first step in understanding the causes of FAI is to determine how many players are suffering from this condition. Ultimately, one of our objectives will be to establish practice and playing guidelines for parents and coaches of youth hockey players, which we hope will reduce the incidence of FAI and other overuse injuries.

Following our first screening of elite youth hockey players, an abstract was submitted to International Olympic Committee World Conference on Prevention of Injury and Illness in Sport. The research was presented to the Conference, April 7-9, 2011, in Monaco.



Hockey players, beware of hip injuries

Institute studies peewees to figure out when joint problems emerge

(Reprinted with permission by *The Vail Daily*)

By Sarah Mausolf

Hip injuries are an epidemic among hockey players, surgeons at the Steadman Clinic say.

And one glance at the jerseys hanging inside the Vail clinic proves it.

Signed uniforms belonging to Mario Lemieux, Paul Kariya, and other hockey stars are proof of 100-plus National Hockey League players who have sought help from hip surgeon Marc Philippon.

But what if there was a way to avoid those hip problems?

Doctors with the Steadman Philippon Research Institute in Vail are trying to figure out when the hip injuries occur—and what young hockey players can do to prevent them.

Dr. Robert LaPrade, a Steadman surgeon leading the study along with Philippon, said researchers believe a common hip injury happens when hockey players are still growing. The condition, called femoroacetabular impingement, can lead to arthritis later in life.

“We’re worried that we’re creating a generation of kids that are going to have hip arthritis,” LaPrade said. “Ten years ago, kids played baseball and soccer and basketball and hockey. They didn’t play one sport all year round like they do now. It’s looking like the reason we’re getting this epidemic is because kids are focusing on one sport.”

So far, the researchers have found the injury is alarmingly common among 17- and 18-year-old hockey players. Over Labor Day weekend, the researchers screened 20 members of a Colorado Springs “major midget” team, which is basically a pre-college travel team, and discovered a lot of them had hip problems. Doctors aren’t disclosing exactly how many of the players exhibited hip problems until the findings appear in a medical journal.

“We found there’s an epidemic of hip problems with that age group, so it’s very concerning because we were not expecting to see that number of people with problems at that age,” LaPrade said.

To find out when the hip problems emerge, the doctors are studying a group of 20 peewee players from the Vail Eagle Hockey Association. The kids are 10 to 12 years old and unlikely to have hip problems yet.



Photo: Kristin Anderson

“It’s a good age to screen because they’re just hitting their growth spurts and it’s the first year they’re allowed checking in hockey,” LaPrade said.

Researchers will be studying their hips over the next four years to see if and when any hip problems develop.

The local hockey players had MRIs taken on Thursday. On Friday, the kids came into the clinic for a physical exam including tests of their hip strength. Researchers plan to repeat the tests in two and four years. They also plan to look into what part of the skating stride could be causing the problem.

“We want to look at the risk patterns so we can modify them and understand when the problems start,” Philippon said. He hopes the research can lead to guidelines on training, how many games kids should play without upping the injury risk and how to detect hip problems earlier.

Eagle resident Andy Clark was among the parents who brought their kids in for exams Friday. His 11-year-old son, Max, has been playing hockey since he was 4. “My concern is that my two sons enjoy the game and not have it impact them too negatively as they get older,” Clark said. He has hip problems of his own from many years of hockey, and so, he says, do most of his hockey friends.

“We just all assumed it was part of the deal,” he said.

As a longtime hockey coach in the valley, he hopes the study’s results discourage parents from pushing their kids to play hockey year-round. “I hope it sends a message to the parent who says ‘You have to play all year because we have to get a Division I scholarship,’” he said. “It’s absurd. Let them be kids.”

Hip problems are all too familiar to LaPrade, as well. One of his sons, a goalie, developed problems in both hips at 16. LaPrade also saw his share of hip injuries as the team physician for the University of Minnesota men’s ice hockey team.

The common hip injury the doctors are studying happens when the shape of the thigh bone gets too big to fit in the socket. “It’s like trying to fit a round peg in a square hole,” LaPrade said. Over time, the friction tears the socket.

Philippon has successfully treated many hockey players with surgery, but he hopes the study will outline ways to prevent the injury. The Steadman Philippon Research Institute is sponsoring the \$100,000 study. Researchers hope to submit the initial findings to a national sports medicine journal by November 1.

“This will be a landmark study,” former Research Institute president J. Michael Egan said.

tis of the hip. Prior studies have correlated cartilage defects to a variety of hip disorders but have not yet specifically reported on the important factors that predict grade IV chondral injuries. The purpose of this study was to determine predictors of grade IV cartilage defects in the hip.

To further understand what factors increase the risk of grade IV cartilage defects, data was collected from 1,097 hip arthroscopy surgeries. All patients involved in the study underwent hip arthroscopy, had no prior hip surgery, and had the presence and grade of their cartilage defects recorded. Preoperative physical exam, preoperative medical imaging, patient background information, and details from the operation were used for determination of predictors of cartilage defects.

Analysis of the data revealed that preoperative radiographic evidence of decreased joint space, less than 2mm, was the strongest predictor of the presence of grade IV injuries. Joint space refers to the space where bones (in this case the femur and the hip socket, or acetabulum) meet and move past each other. Patients with less than 2mm of joint space on preoperative x-rays were 8 times more likely to have a grade IV lesion compared to those with greater than 2mm. This is consistent with previous research findings that patients with similarly decreased joint space are much more likely to undergo hip repair surgery within a couple of years. Other independent risk factors for the presence of grade IV chondral defects include male gender, increasing age, and a large alpha angle (a measurement of the head of the femur bone). Furthermore, our data showed that grade IV lesions were also more frequently found in those who are older and those with a longer duration of symptoms prior to their surgery.

These findings suggest that longer-standing hip injuries leads to further cartilage deterioration, which will eventually lead to hip arthritis. Full thickness cartilage lesions in particular are especially worrisome for future arthritis. As joint cartilage has limited healing capacity, interventions to prevent further cartilage damage are critical to the long-term health of the hip joint.

Therefore, to avoid progression of worsening cartilage disorders, earlier surgical intervention with hip arthroscopy is indicated to attempt to stall or slow down the progression of these chondral lesions. If patients seek treatment at an earlier age and onset of symptoms, the prevalence of grade IV lesions may be reduced and slow chondral deterioration and progression to arthritis.

Return to Play Following Arthroscopic Microfracture of the Hip in Elite Athletes

Hip injuries are increasingly common among professional athletes. Surgical treatment of hip pain in the athlete remains a controversial subject. Cartilage defects, in particular, can be detrimental injuries for elite athletes. Athletes are often unable to compete and possibly forced into early retirement as a result of a focal cartilage defect or subsequent joint degeneration. Hip

arthroscopy involving the microfracture technique has been shown to be an effective treatment for full-thickness cartilage defects in the hip. Additionally, we have previously shown that professional athletes are able to return to play and have promising outcomes following microfracture surgery for full-thickness cartilage defects in the knee.

We recently performed a study to determine whether professional athletes who had an arthroscopic hip microfracture procedure could return to the same level of sport following the surgery. We studied athletes who played the following sports at the professional level: hockey, soccer, football, baseball, tennis, and golf. We found that 27 of 34 professional athletes were able to return to an elite level of competition following the procedure. On average, athletes who returned to play were able to play four seasons at the professional level following surgery. Additionally, of those athletes who returned to sport, 96 percent returned to play the same season or the season following the surgery.

This study showed that athletes, in particular those who compete professionally, who have a full-thickness cartilage defect in the hip are able to return to the same level of play following a hip arthroscopy with microfracture.

Performance Levels in Professional Hockey Players Following Arthroscopic Microfracture Surgery in the Hip

One of our recent studies showed that professional athletes who have a full-thickness cartilage defect in the hip are able to return to the same level of play following hip arthroscopy with a microfracture procedure. While this information is very valuable for athletes and athletic associations, no data exists on athletic performance following return to play after a hip surgery when microfracture is performed. Microfracture in the knee has been portrayed in the media as having a poor prognosis for NBA players. Two recent studies have shown that NBA players undergoing microfracture in the knee are at risk for not returning to the NBA, and if they do return, they exhibit a decrease in points per game when compared with controls. Cartilage defects can be detrimental injuries to athletes. We have shown that the microfracture procedure is an effective technique in the hip to allow athletes to return to sport. However, it is unclear whether athletes return with the same level of performance and technique as prior to their surgery.

We recently completed a study that evaluated the objective performance measures of a subset of patients, professional hockey players from the National Hockey League (NHL) and the American Hockey League (AHL), who had arthroscopic hip surgery with a microfracture procedure. In order to evaluate our patients' performance data prior to surgery and following surgery, we matched each of our patients to two uninjured control players who were similar in age, years in the league, games played, and all-star status. Fourteen of 17 professional hockey players who had hip surgery with a microfracture procedure returned to play at the professional level. In the season following surgery, there was no statistical difference between

the treatment and control group regarding the performance measures. The treatment group had 25 minutes on ice while the controls had 26 minutes, the treatment group had 11.8 goals compared to 12.6 goals in the control group, the treatment goalies had 89 percent saves while the controls had 90 percent, and the treatment group had 1045 shots against while the controls had 1114. Although not statistically significant, there was a trend towards a decrease in games played and points postoperatively compared with controls. The treatment group had an average decrease of 11 games played while the controls decreased by five games. The treatment group also saw a decrease in 14 points, while the controls saw a decrease of three points for the season.

This study showed that following arthroscopic microfracture surgery in the hip, professional hockey players can return to play and perform at the same high level when compared to pre-injury status and matched controls based on objective performance measures.

Knee Research

Microfracture in the Pediatric Knee

Articular cartilage defects in the knee can cause pain and disability in patients and pose a challenge to clinicians. Articular cartilage defects are known to increase the risk of developing osteoarthritis and it is therefore advisable to treat the defect in order to minimize future joint disorders.

Many years ago, Dr. Steadman created a surgical technique, known as microfracture, to treat these articular carti-

lage defects in the knee joint. Microfracture is a procedure in which an instrument that is shaped like a pick is inserted arthroscopically into the knee and then small holes are made within the area of the defect, so as to penetrate the bone marrow and release its healing properties. This in turn produces a healing response within the body and a blood clot forms over the defect. The clot then forms into a cartilaginous repair tissue, filling the defect.

The microfracture technique has been demonstrated to be an effective arthroscopic treatment for full-thickness chondral lesions and joints with degenerative lesions. This technique is cost-effective, not technically complicated, has an extremely low rate of associated patient morbidity and leaves options for further treatment. However, outcomes following microfracture in the pediatric population have not been studied extensively. Symptomatic chondral defects can be particularly troublesome in the pediatric population. Microfracture has been shown to have successful results in a younger population; however, more information is needed regarding pediatric patients. So, we conducted a study in order to see how pediatric patients with articular cartilage defects of the knee were doing following their microfracture procedure.

Between January 1992 and June 2008, all patients 18 years and younger with a diagnosis of a full-thickness knee articular cartilage defect that were treated with microfracture at our institution were identified from our database. The inclusion criteria were microfracture on one or more surfaces of the knee, no malalignment of the knee, and patients had to be at least two years out from surgery. All patients underwent knee arthroscopy and microfracture. In short, a standard knee arthroscopy was performed to confirm the presence of an articular cartilage defect.

When the full-thickness chondral defect was identified, the lesion was prepared and microfracture holes were placed 3 to 4 mm in depth, as close together as possible without breaking into adjacent holes. All patients were followed to evaluate function and pain after surgery. They were asked to complete a functional score (Lysholm score), an activity score (Tegner activity scale) and a patient satisfaction score (10=very satisfied).

A total of 26 patients (14 females, 12 males) met inclusion criteria with a mean age of 16.6 years. Minimum two-year follow-up outcome measures were obtained in 22 patients (85 percent) at an average follow-up of 69.3 months. Mean Lysholm scores were 90 (range: 50 - 100). Median Tegner scale was 6 (range: 2 - 10). Median patient satisfaction score was 10 (range: 1 - 10). Age did not correlate with the outcome scores. Lysholm was significantly correlated with Tegner activity scale and with patient satisfaction. No other patient required revision microfracture.

This study revealed that pediatric patients who underwent microfracture for an articular cartilage defect of the knee





showed improvement in function and satisfaction. In this study, age was also found to be an independent predictor of improvement. Therefore, younger patients may also have successful outcomes following microfracture surgery.

In summary, this study supports microfracture technique in the treatment of full-thickness articular cartilage defects of the knee in the pediatric population. This cohort of young patients achieved a high level of activity and function following their surgery and rehabilitation. The study is important because it offers an easy, low-risk surgery for patients who are young and suffering from articular cartilage damage. By implementing microfracture for the pediatric population, we are providing another option of treatment that has been shown to be successful in regaining function and activity level.

Early Knee Osteoarthritis

Arthritis is the leading cause of disability in the United States, affecting over 70 million people, with osteoarthritis (OA) accounting for 38.5 percent (27 million) of those affected in 2005. This is an increase of nearly six million since 1995. Specifically, knee OA affects 16 percent (18.7 percent female; 13.5 percent male) of adults older than age 45. Given the greater numbers in the 45-63 age range, along with increasing obesity in the United States, incidence and prevalence of knee OA can only increase, especially since early OA risk factors have not been clearly defined. Along with the increasing incidence

and prevalence comes increasing costs. OA is an economic burden in the United States, costing an estimated \$128 billion per year, including direct and indirect costs. The natural history of the disease varies a great deal among individuals. Since there has not been one single factor that is solely attributed to knee OA, many different factors must be assessed, which makes it difficult to intervene and prevent the progression of OA. The purpose of this study was to define common factors associated with early knee OA. We defined early knee OA as a Kellgren-Lawrence (KL) grade of 2. KL is a grading system that physicians use to determine the stage of knee osteoarthritis for an individual. This is determined by x-ray examination. KL grade 0 is no OA, KL grade 1 is mild OA, KL grade 2 is mild to moderate OA, KL grade 3 is moderate OA, and KL grade 4 is severe OA.

For this study we looked at all patients who had a Kellgren-Lawrence grade determined by x-ray and were 18 years of age or older. Demographic data including age, gender, height and weight were recorded and all patients completed a self-administered questionnaire, including WOMAC score that was used to determine current level of function, pain and stiffness. The best score for a WOMAC is 0, indicating high function, no pain and no stiffness of the knee. Long-standing x-rays were obtained from all patients to determine KL grade and knee malalignment of each patient. Malalignment of the knee was also measured radiographically as a percent deviation from normal alignment when standing.



One thousand four-hundred and forty patients were available for this study. There were 677 (47 percent) females and 763 (53 percent) males. Average age of patients was 55 years. The patients were then grouped according to their KL grade. Four-hundred and twenty-two (29 percent) patients had KL grade 1, 430 (30 percent) had KL grade 2, 334 (23 percent) had KL grade 3 and 254 (18 percent) had KL grade 4. For this study, patients with a KL grade of 1 were defined as mild OA while those with a KL grade 2 were defined as early OA. KL grades 3 and 4 were combined as one group and defined as moderate to severe OA. Malalignment, patient age, BMI, WOMAC score, and gender were then analyzed by group.

Malalignment of the knee (not normal alignment) was seen in 45.7 percent of patients with a KL grade 1, 55.6 percent of grade 2 and 77.2 percent of grade 3/4. Patients' average age in KL grade 1 group was 48 years old, KL grade 2 was 55 years old and KL grade 3/4 was 59 years old. This data suggests that malalignment of the knee plays a role in the progression of OA.

Knee malalignment, which increases the load on the knee, significantly increases the incidence of knee OA by approximately two-fold, especially in overweight and obese individuals. Patients with KL grade 2 were significantly older

than patients with KL grade 1 (55 vs. 48 years) and significantly younger than patients with KL grade 3/4 (55 vs. 59 years). This shows that age and osteoarthritis grade are related. The older the patient is, the more likely that the patient will have more severe OA. Average body mass index (BMI) for all patients was 25.9. Eleven (0.9 percent) of the patients were underweight, 542 (44.3 percent) were normal weight, 480 (39.2 percent) were overweight, and 190 (15.5 percent) were obese. Those with KL grade 2 had an average BMI of 25.6 while KL grade 3/4 was significantly greater at 26.7. This data shows that patients who are overweight are more likely to have worsened OA. Average WOMAC score for KL grade 1 group was 28.8, KL grade 2 group was 28.2 and KL grade 3/4 group was 34.4. This showed that patients with the lowest grade of OA had the best scores, while patients with the worst or most severe OA had the worst scores.

This study is important because it demonstrates some of the risk factors for patients suffering from knee OA. OA is a multi-factorial disease, with different factors affecting its progression and severity. This study showed association between Kellgren-Lawrence grade and malalignment of the knee, obesity, age and WOMAC scores. Certain modifiable risk factors such as BMI and physical activity level are essential to help prevent and treat early cases of OA. Weight loss has proven to reduce the pressure the knee experiences. The loss of every one pound reduces the amount of pressure the knee experiences four-fold. By identifying factors that put individuals at risk for more severe knee OA, physicians are able to intervene at an earlier time, to educate patients on prevention. Early treatment and prevention programs for the onset of osteoarthritis can then be created, helping to curb the growing numbers of people suffering from this debilitating disease.

Outcomes of Microfracture in Professional Skiers

The treatment of athletes with full-thickness chondral defects of the knee continues to be a challenge for orthopaedic surgeons. Defects of knee articular cartilage can cause pain, swelling, and decreased function and athletic performance on the playing field. These defects may predispose these young individuals to the development of knee osteoarthritis, and treatments should be instituted to minimize this risk. Many different surgical treatments have been popularized for this condition, including arthroscopic debridement, mosaicplasty, autologous chondrocyte implantation (ACI), and microfracture. Microfracture has been shown to be a reliable surgical outcome to treat osteochondral defects and return patients to their desired activity level.

Outcomes after microfracture in the elite athlete have been published for many sports, including NFL and NBA players. However, the function and outcome of knees after microfracture in the professional ski racer has not been previously studied. Dr. Steadman wanted to determine whether

professional skiers would benefit from microfracture to treat cartilage damage. The hypothesis was that professional skiers would have good outcomes and would return to sport following microfracture of full-thickness chondral defects of the knee.

Between 1986 and 2008, all skiers who were on their country's ski team or skiers who skied professionally were identified. Skiers were included in the study if they were currently active on the team or skied professionally. If skiers had retired prior to surgery, they were excluded. Patients with a confirmed diagnosis of a full-thickness knee chondral defect who underwent treatment with microfracture at our institution were required for inclusion into the study.

All patients underwent knee arthroscopy combined with the microfracture procedure. Each athlete underwent evaluation of the articular cartilage defect. Once the lesion was confirmed to be full-thickness in nature, its location was documented, and the defect was prepared and measured prior to placement of multiple 3 to 4 mm deep holes. These microfracture holes are carefully spaced so as to be in close proximity without breaking through to adjacent holes.

Each athlete was followed to analyze postoperative satisfaction and function. They completed a Lysholm score, Tegner scale and a patient satisfaction score. Return to sport was documented using ski race results published by the International Ski Federation. The patient was designated as having returned to competition if the patient completed a ski race recognized by the International Ski Federation. Professional races included World Cup, European Cup, Nor-Am Cup, and the Olympics.

A total of 20 patients (16 females, 4 males) met the inclusion criteria with a mean age of 23 years. Minimum two-year follow-up outcomes were completed in 18/20 skiers (90 percent) at an average follow-up of 77 months. Median Tegner activity level was 10 (range: 4 - 10). Mean Lysholm scores were 86 (range: 41-100). Mean patient satisfaction score was 10 (range: 9 - 10). Nineteen of twenty skiers (95 percent) returned to competitive skiing. The average return to competition was 13.4 months. Males returned to skiing competitively in 13 months and females returned in 14.5 months.

This study showed that high-level skiers can return to sport following microfracture treatment of full-thickness articular cartilage lesions of the knee. The results of our study are consistent with the majority of the previous literature with a very high return to ski racing (96 percent) and good medium-term follow-up (mean of 77 months). This group of athletes achieved a high level of return to sport following a careful surgery and appropriate rehabilitation. This study demonstrates that microfracture is a viable option for competitive skiers, providing skiers with an easy, low-risk procedure that can return them back to the snow with excellent function and high satisfaction. The study was presented at the American Academy of Orthopaedic Surgeons in 2011.

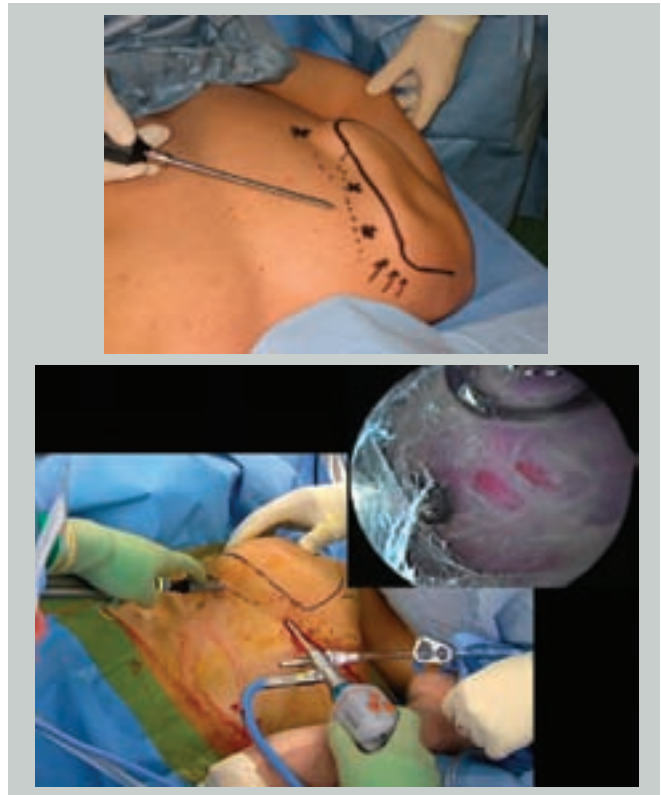
Shoulder Research

Snapping scapula syndrome

Snapping scapula syndrome is a rare condition of the shoulder that is poorly understood. Due to the lack of knowledge about this syndrome, many patients are misdiagnosed or suffer with symptoms for many years. The most common complaint is pain when the shoulder blade rubs and clicks against the ribs. There are many factors that can cause a snapping scapula, including problems between the scapula (shoulder blade) and chest wall, muscle tears, fractures in the shoulder area, a bony lump on the shoulder blade, rheumatoid diseases and shoulder injuries.

X-rays and CT scans (3-D imaging) are used to show bone spurs or abnormalities of the scapula. MRI is also used to look for related conditions, such as scapular bursitis—where the soft tissues between the scapula and the chest wall are thick, irritated, or inflamed. Treatment starts with injections of steroids to provide pain relief, along with physical therapy to improve muscle strength. Unfortunately, some bone or tissue abnormalities do not respond to these treatments—in which case surgery may be necessary.

Dr. Millett has refined a common surgical technique for this condition. This involves removing bone spurs and inflamed tissue through key-hole surgery (arthroscopically) to restore full painless motion. Recovery is typically quick, even



Dr. Millett has refined a common surgical technique for this condition. This involves removing bone spurs and inflamed tissue through key-hole surgery (arthroscopically) to restore full painless motion.



Dr. Peter Millett

within a few days of the procedure. After surgery a sling is worn for comfort only and is removed within a few days.

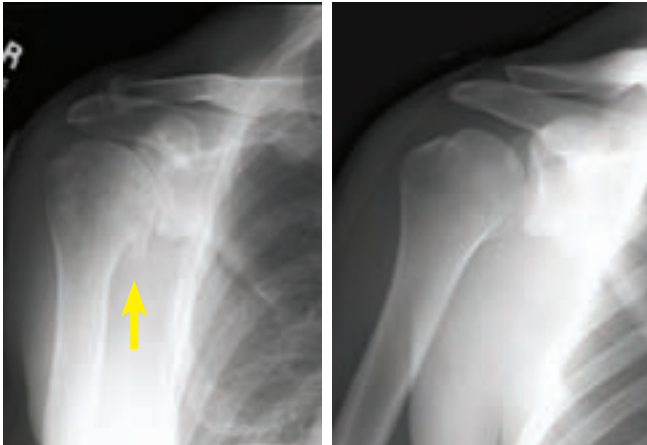
Exercises begin the first day after surgery under the supervision of an experienced therapist. This includes full range of motion of the arm. After four weeks, patients begin scapular muscle stretching and are then allowed to begin strengthening after eight weeks. Most patients are allowed to perform overhead activities and return to sports around three or four months after surgery, based on their progress with therapy.

In a study performed by Dr. Millett with the help of Dr. Gaskill and our visiting research scholar Dr. Olivier van der Meijden, patients who were treated arthroscopically for snapping scapula were followed up in order to see how they were feeling since their surgery. Eighteen patients, with 23 shoulder blades, who had undergone surgery, were included in our study. All patients described physical symptoms that did not improve with steroid injections or physical therapy. The average age of patients was 35 years. The average time patients suffered with pain and other symptoms before surgery was 3.5 years. We were able to contact 91 percent of patients two years following their operation. In 18 patients (23 shoulders) who underwent surgery, three patients needed further operations for the same problem. Also, three other patients underwent additional shoulder surgery for reasons not related to their shoulder blade, including a cartilage (labral) repair for an unstable shoulder

joint, a fracture of the shoulder joint socket (glenoid rim) and treatment for inflamed rotator cuff muscles.

Seventeen patients did not require any more operations. Fifteen of these patients completed a survey, at an average of 2.5 years after their original shoulder surgery. The survey recorded the American Shoulder and Elbow Surgeons (ASES) Score, and the Disabilities of the Arm, Shoulder, and Hand (DASH) Score, which look at factors such as current pain level and activities of daily living. We found that before surgery patients scored an average of 53/100 on the ASES score. After surgery, this significantly improved to 75/100. Similarly, with the DASH score, patients scored an average of 34/100 after surgery (0 indicates no disability and 100 indicates full disability). We found that patients who were more satisfied after surgery were those with a higher ASES score and a lower DASH score, with older age a contributing factor.

Treatment without surgery can be successful in reducing symptoms in many patients; however, surgical intervention is occasionally necessary. This study indicates that although significant improvements in overall function and the pain level were achieved, some patients still needed additional operations due to ongoing symptoms. To expand upon this study, we need to follow up with patients at longer time periods, and try to determine which factors are associated with high levels of satisfaction to see how we can improve our treatment of this rare condition.



X-rays of a shoulder: In the image on the left, we can see osteoarthritis with a bone spur (shown by the arrow) on the bottom of the “ball” of the shoulder joint (humeral head); on the right, we can compare this to a younger patient’s shoulder joint, where there is no osteoarthritis or bone spur.

Possible Cause of Teres Minor Fatty Infiltrations

Patients with wear and tear of the shoulder joint, or shoulder osteoarthritis, usually experience shoulder pain and weakness. On their x-rays, we can see evidence of this wear and tear (see images above).

The shoulder joint is a ball and socket type joint. The ball is called the humeral head, and is normally smooth and round. However, with osteoarthritis, its surface becomes pitted and it loses its normal shape, becoming flat. When this flattening occurs, a bone spur may develop at the bottom of the humeral head called an osteophyte (also referred to as a goat’s beard deformity due to its appearance). This bone spur is believed to cause irritation to the important nerves that run just below it. Each of these nerves serves an important function in helping our muscles move. If they do not work correctly, then muscles can begin to deteriorate or atrophy.

One of these muscles is called teres minor. It helps rotate the shoulder outwards (external rotation) and helps stabilize

the humeral head. The nerve involved is called the axillary nerve, which supplies the deltoid and provides sensation to the shoulder joint. The shoulder joint is enclosed in a capsule, and several anatomical studies have established that the axillary nerve runs below the humeral head through the capsule in a normal shoulder.

We find that atrophy of teres minor can occur not only by itself but also with other clinical conditions of the rotator cuff muscles. The axillary nerve can also be injured when a shoulder joint dislocates, causing this nerve to be stretched.

We wanted to determine that if a large enough bone spur existed, whether the spur would begin pressing against the axillary nerve below and therefore affect the teres minor muscle. We can measure the effect that this might have on the muscle by examining MRI scans and looking for the amount of fatty infiltration.

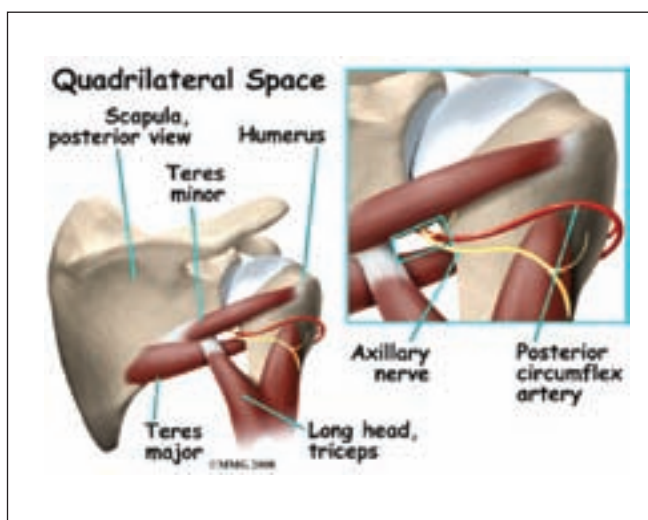
Dr. Millett, with the help of Dr. Jean-Yves Schoenahl, an Arthrex’s European Visiting Scholar, reviewed 189 MRI scans of patients’ shoulders. We identified the teres minor muscle, looking for evidence of atrophy, and measured the size of the humeral bone spur, if present. The MRI scans of 98 arthritic shoulders and 91 shoulders without arthritis were reviewed. We measured how close the axillary nerve was to either the ball or socket of the shoulder. The amount of fatty infiltration in the teres minor was measured using image analysis software. The results were compared between the two groups to determine whether there was any effect due to the bone spur.

The axillary nerve was significantly closer to the humeral head in arthritic patients compared to non-arthritic patients (25.18mm versus 20.70mm). The percentage of fatty infiltration of the teres minor muscle in the arthritic group was 10.8 percent when a bone spur was present and only 4.4 percent when no bone spur was present. So we can see that there is significantly more fatty infiltration when a bone spur is present. We also found that the larger the bone spur, there was a higher percentage of fatty infiltration that existed in the muscle.

We concluded that the axillary nerve becomes closer to the humeral head when a bone spur is present in shoulders with osteoarthritis. There is also evidence to suggest a greater amount of fatty infiltration in the teres minor muscle in the arthritic shoulder. The take-home message is that a bone spur too close to the axillary nerve may be a contributing and treatable cause of shoulder pain. The next phase of this study is to correlate the size of the humeral head spur to physical examination findings, pain and functional level at time of initial appointment. This paper was presented at the Arthroscopy Association of North America Annual Meeting in San Francisco, April 16, 2011, and the paper has been submitted to *The Journal of Bone and Joint Surgery*.

Influence of Acromion Index Size on Outcomes after Rotator Cuff Repair

The rotator cuff is formed from a group of muscles and their tendons and plays an important role in stabilizing and





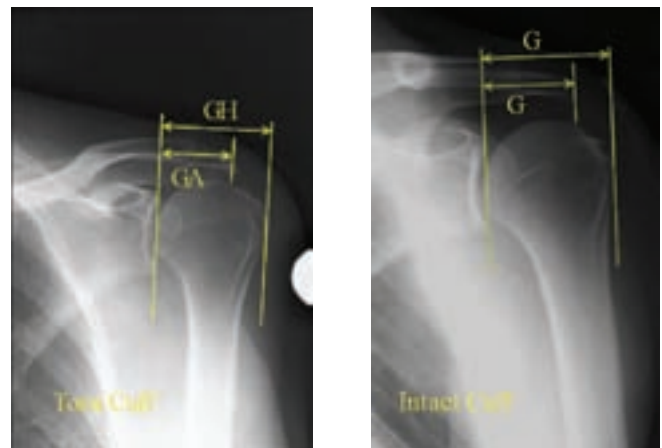
moving the shoulder. The reasoning behind how and why rotator cuff tendons tear remains controversial. Contributing factors that cause failure of a surgically repaired rotator cuff tear include: tendon quality, fixation failure (such as anchor breakage, etc.), prior injury, deterioration from overuse, or even unhealthy habits like smoking. Dr. Millett wanted to identify specific factors that may predispose rotator cuff repairs to fail after surgery.

One of the factors that may be associated with the failure of rotator cuff repairs is related to the bones that comprise the shoulder joint. A 2006 article by Dr. Nyffleer concluded that a large acromion index (AI) was associated with rotator cuff tear. The AI is measured from x-rays and takes measurements from different bones that make up the shoulder.

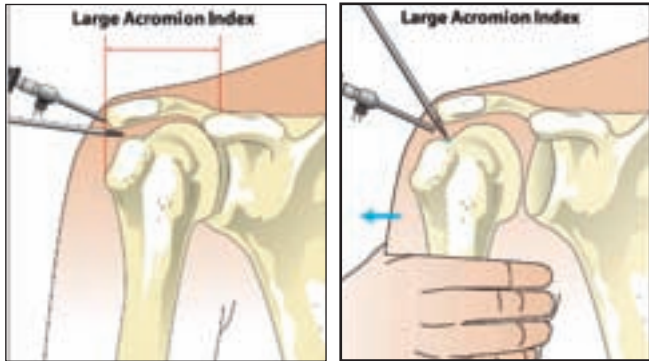
The shoulder joint is a ball and socket joint formed between the humeral head (ball) and the glenoid (socket). The acromion is a bone that is part of the shoulder blade (scapula) and sits above the rotator cuff in the shoulder. The outward projection of the acromion was measured using plain x-rays as shown in the figure to the right. Two measurements were taken to calculate the AI. The first was the length of the acromion (GA). The second was the distance from the glenoid on the inside, to the furthest portion of the humeral head on the outside (GH). The AI was calculated by dividing GA by GH. The larger the length of the acromion, the higher the AI will

be. The AI has been shown to be easily reproduced when two people are asked to calculate it, and is also very reliable when measured by different people and at different points over time.

To determine whether a large AI was indeed a major factor associated with poor surgical outcomes, Dr. Millett, along with Dr. Ames, measured the AI of 93 patients who had undergone arthroscopic surgery to repair their rotator cuff



Two measurements are taken to calculate the acromion index (AI). The first is the length of the acromion (GA). The second is the distance from the glenoid on the inside, to the furthest portion of the humeral head on the outside (GH). The AI is calculated by dividing GA by GH. The larger the length of the acromion, the higher the AI will be.



tear. We then compared these patients' scores and outcome measures after surgery to see whether this was related to the AI.

A minimum of two years' follow-up information was obtained on 79/93 (82 percent) patients. To determine how a patient was doing after surgery, we collected shoulder specific and general health questionnaires. The shoulder specific measurements were the American Shoulder and Elbow Surgeons (ASES) Score (0-100 scale, 100=best score possible), and the Disabilities of the Arm, Shoulder, and Hand (DASH) Score (0-100, 0=best score possible). The general health score (SF-12) looks at physical and patient satisfaction outcomes using a 1-10 scale (1=very unsatisfied, 10=very satisfied).

Average patient follow-up was 3.0 years after surgery. Average ASES score improved from 59 before surgery to 93 after surgery. The average DASH score after surgery was 10 (range: 0 - 54) (0=no disability) and the average SF-12 physical component score after surgery was 52.9 (range: 27.0 - 64.0). Average patient satisfaction was 9 out of 10. Patients with an AI of > 0.7 had a lower satisfaction with surgical outcomes score (9.0) compared to patients with AI < 0.7 (9.3).

This study showed that in 93 patients who had a rotator cuff tendon arthroscopically repaired, only three patients needed a revision surgery and those who did not have another surgery were significantly better at three years after the repair than before the repair. However, the differences in the outcome measures between high and low AI groups were so small that we were unable to determine a significant difference between patients with a high AI and those with low AIs. This study did show, however, that in patients with rotator cuff tears, a larger AI was associated with an increase in number of tendons torn. Patients were also slightly less satisfied with their surgical outcomes following the repair. The presence of a large acromion may also present a technical issue during surgery, making it more difficult to repair the tendon and place the anchors in the bone. Dr. Millett minimizes this problem by asking his surgical assistant to pull the arm out. This allows him to place the anchors in the correct orientation. Long-term follow-up is needed to determine the durability of our results and to identify other factors that may have more of an impact on the surgical outcomes after a cuff tendon repair.

Institute Study Shows Young Patients May Benefit from Microfracture Knee Procedures



Surgical treatment using microfracture for pediatric knee injury repair may improve activity outcomes, according to Institute research presented at the American Orthopaedic Society for Sports Medicine's Specialty Day in San Diego (February 19, 2011). The study shows patients are able to regain function and return to a normal activity level following surgery and rehabilitation.

"Our study focused on patients with articular cartilage injuries to the knee, which can be a debilitating source of pain and a strong limitation to function in pediatric patients," said lead researcher Richard Steadman, M.D., Founder, Steadman Philippon Research Institute.

"Articular cartilage defects are known to increase the risk of developing osteoarthritis and so it is advisable to treat the defect in order to minimize future joint disorders. Using microfracture might be one way to treat these issues."

Microfracture is a technique surgeons use to remove damaged cartilage and increase blood flow from the underlying bone. Holes made in the affected area allow the formation of new, healthy cartilage.

The study examined 26 patients (12 men and 14 women between the ages of 12 and 18) with articular cartilage knee defects. All patients were diagnosed with a standard knee arthroscopy procedure (small device inserted into a joint through a cut) and then treated with microfracture holes placed 3 to 4 mm in depth.

Patients were evaluated for knee function (limp, support, stair climbing, squatting, instability, swelling, pain, locking) and reported an average function score of 90 (in a range of 50-100). Patients reported a median activity level of 6 (in a range of 2-10), demonstrating ease in recreational activities following surgery.

"This is a good first step in learning about the overall outcome of this procedure on pediatric patients," said Steadman. "While we have limited data on this specific population, we have seen this procedure be effective in young athletes, who share similarly active lifestyles. This study confirms what we have already seen in this group."

The American Orthopaedic Society for Sports Medicine (AOSSM) is a world leader in sports medicine education, research, communication and fellowship and includes national and international orthopaedic sports medicine professionals. The Society works closely with many other sports medicine specialists, including athletic trainers, physical therapists, family physicians, and others to improve the identification, prevention, treatment, and rehabilitation of sports injuries.

Two World-Class Biomedical Engineers Join Biomechanics Research Department

Meet Mary Goldsmith, M.Sc., Robotics Engineer, and Erin Lucas, M.Sc., Senior Project Engineer

By Jim Brown, Editor, SPRI News

The future of biomedical engineering — applying engineering principles to the field of medicine — has arrived. It is young, talented, dedicated, and confident, and it will change the way orthopaedic surgery is practiced. It even has a name. Two names, in fact. They are Mary Goldsmith and Erin Lucas.

The standards for an appointment to any position at the Steadman Philippon Research Institute are incredibly high. In the Biomechanics Research Department's search for a Senior Project Engineer and a Robotics Engineer, Mary Goldsmith and Erin Lucas exceeded even those lofty expectations.

"We were looking for two individuals who would be able to work as team members in a very active research group, as well as work independently and with little supervision," says Coen Wijdicks, Ph.D., Director of the Biomechanics Research Department. "We also wanted them to have a strong competency in programming, to be proficient in technical writing, and to spread their research through presentations and publications."

Robert LaPrade, M.D., Ph.D., and Dr. Wijdicks are charged with fulfilling the department's mission of advancing patient care and setting global standards in orthopaedic biomechanics research. Dr. LaPrade and Dr. Wijdicks, along with Senior Staff Scientist Dr. Erik Giphart, who has a Ph.D. in biomedical engineering, know where to look for talent and what to look for.

The search for the two engineering positions was "massive," according to Dr. Wijdicks, and involved contacting professional colleagues and university biomechanical engineering departments that have a reputation for preparing great scientists.

"We were very lucky to have recruited both of these highly qualified engineers to join our team," adds Dr. Wijdicks. "Each one

of them outpaced more than 100 applicants. In both cases, the number one candidate was clearly superior."

MARY GOLDSMITH, M.SC., ROBOTICS ENGINEER

Mary Goldsmith, a magna cum laude graduate of Boston University with a bachelor of science degree in Biomedical Engineering, continued her education with a master of science in Biomedical Engineering at B.U.

She is a native of Plano, Texas, and was not exactly a late bloomer. "I won a science fair in kindergarten, using the scientific method to determine which popcorn pops best," she recalls.

She was placed in talented/gifted classes in elementary school, took an introduction-to-engineering summer course at Southern Methodist University after the 7th grade, and spent a week while in high school working with engineers at NASA in Houston. There was also the "like-father-like-daughter" factor. Her father is an engineer.

Goldsmith studied abroad in Germany, was a research assistant at Spaulding Rehabilitation Hospital's Motion Analysis Lab in Boston, worked as a teaching assistant at Boston University, and was employed as an engineering intern with MEMtronics in Texas.

Her focus on robotics began to develop at Spaulding. "I had a moment when I realized that I wanted to include a more human aspect to my engineering training, which led me to projects that involved full-body mechanics. I worked with different robotics systems, including those that taught people how to walk," she says. "I discovered that I liked programming and robotics, and that allowed me to look at other interesting applications.

"I seemed to be drawn to fields that are traditionally male-dominated," says Goldsmith. "The gender issue has been a bit of a challenge. Stereotypes come into play when you tell someone you are an engineer. They say things like, 'Good for you,' or 'Really?' or 'You don't look like an engineer.' But I enjoy that moment of opening minds up and helping them understand that engineers can come in all forms."

ERIN LUCAS, M.SC., SENIOR PROJECT ENGINEER

Erin Lucas graduated magna cum laude from Virginia Tech with a bachelor of science degree in mechanical engineering and later earned a master of applied science in biomedical engineering at the University of British Columbia.

She grew up in Richmond, Virginia, was always good in math, and enjoyed the sciences, especially biology. Her mother is a nurse and her father is in the health insurance business, and prior to going to college, Lucas thought she wanted to be an orthopaedic surgeon.

"My brother was really the one who encouraged me to get into engineering," she adds. "He is a role model for me, and I tend to follow in his footsteps." Scott Lucas has a Ph.D. in biomedical engineering and works for the ECRI Institute in Philadelphia.

Erin's first job in mechanical engineering was with Lockheed Martin. "While I was there, I did volunteer work with individuals who had disabilities," she says. "I began to realize that I enjoyed the volunteer work more than my full-time job. That's when I began looking for opportunities in the biomedical field."

Before joining the Steadman Philippon staff, she went to the Prince of Wales Medical Research Institute in Sydney, Australia, for a research position in biomedical engineering, then on to the University of British Columbia for her graduate studies.



Mary Goldsmith, M.Sc., Robotics Engineer



Erin Lucas, M.Sc., Senior Project Engineer

As with Mary Goldsmith, the gender issue has not been a problem for Lucas. “I never saw it as an obstacle,” she says. “If anything, it may have helped. Everybody wanted to see me succeed, and now I encourage girls and young women who tell me they want to become engineers to go for it.”

GETTING TO VAIL

The process of getting to Vail is similar for both young engineers. They were looking for positions that involved engineering, orthopaedic injury research, computer programming, and a chance to use their skills working with other scientists, physicians, engineers, and researchers. Both admit that the allure of Vail, Colorado, itself was very strong.

When ads appeared online for a robotics engineer and a research engineer, respectively, they immediately applied. Their impressive résumés got quick responses from the staff at Steadman Philippon.

“I went down the list of what they were looking for,” Goldsmith remembers. “I said to myself, ‘I can do that, I can do that, I can do that.’ It seemed to be a perfect fit. When I read more about the Institute and the kind of research being conducted there, I really got excited.”

Goldsmith had a series of telephone interviews, then flew to Vail to visit with Dr. Wijdicks and other Steadman Philippon staff members. Before she got back on the plane, she had been invited to become part of the team. “It was such a good opportunity, I couldn’t turn it down. It was a great way to begin the year.”

The first time Erin Lucas saw the Steadman Philippon Research Institute was January 10, 2011 — the day she reported for work. Everything prior to that date had happened online or on the telephone.

“After I got the offer,” she says, “I took a day to decide. But when I saw the offer letter, I said to myself, ‘Yep, I’m doing this.’”

SETTLING IN

Now that the two engineers have settled into their jobs at Steadman Philippon, their responsibilities are clearly defined by Dr. Wijdicks. “Using Mary Goldsmith’s expertise and experience in robotic programming and technology, the department will be on the sports medicine research industry’s leading edge of joint testing to enhance and validate joint reconstruction techniques.”

Goldsmith adds, “At Steadman Philippon we have a very talented, motivated group of people using best tools available to

better understand human biomechanics and to further the goal of improved patient care.”

Lucas is developing software to quantify cartilage health using 3T MRI techniques. Physicians and patients will be able to see the progress of their treatment by looking at a color-coded, full-picture of the hip, knee, and later, of other joints. With a dual appointment in Biomechanics and Imaging Research, Lucas works closely with her colleagues in Imaging Research and with the doctors who perform surgery.

MAKING THE CONNECTION

Erin Lucas makes the connection between the Institute’s new research capabilities work and how it will affect the average person. “The body is incredible in what it can do and how it can repair itself. But there is still a lot to be discovered and there are many new surgical techniques being developed. It’s great to have engineers, scientists, researchers, and clinicians who can work together here to evaluate these techniques and to show how this research will benefit people around the world.”



Coen Wijdicks, Ph.D., Director, *Senior Staff Scientist*; Erik Giphart, Ph.D., Director, *BioMotion Laboratory, Senior Staff Scientist*; Mary Goldsmith, M.Sc., *Robotics Engineer*; Erin Lucas, M.Sc., *Senior Project Engineer*; Kyle Jansson, B.S., *Research Engineer*; Kelly Adair, B.S., *Surgical Skills Laboratory Manager*; Olivier van der Meijden, M.D. (The Netherlands), *Visiting Research Scholar*; Bruno Nogueira, M.D. (Brazil), *Visiting Research Scholar*

BIOMECHANICS RESEARCH STUDIES DYNAMIC JOINT FUNCTION USING MOTION ANALYSIS, COMPUTER MODELING, AND DUAL-PLANE FLUOROSCOPY IMAGING IN AN EFFORT TO UNDERSTAND INJURY MECHANISMS AND TO ENHANCE REHABILITATION TECHNIQUES AND OUTCOMES.

IN 2010, THE BIOMECHANICS RESEARCH DEPARTMENT CONTINUED TO GROW IN STAFF SIZE AND EXPERTISE, IN TECHNOLOGY AND EQUIPMENT, IN THE QUALITY AND QUANTITY OF RESEARCH, AND IN COLLABORATIVE EFFORTS WITH NATIONAL AND INTERNATIONAL INSTITUTIONS.

Staff

Late in 2010 and early in 2011, Mary Goldsmith, M.Sc., and Erin Lucas, M.Sc., prepared to join the Institute in the Biomechanics Research Department.

Ms. Goldsmith is a magna cum laude graduate of Boston University with a bachelor of science in biomedical engineering and has a master of science in biomedical engineering, also earned at B.U. Her expertise in robotic programming and technology is helping the department remain on the leading edge of joint testing to enhance and validate joint reconstruction techniques.

Erin Lucas graduated magna cum laude from Virginia Tech with a bachelor of science in mechanical engineering and later earned a master of applied science in biomedical engineering at the University of British Columbia. She began the process of developing software to quantify cartilage health using 3T magnetic resonance imaging techniques. Ms. Lucas works closely with her colleagues in Imaging Research and now is a Senior Project Engineer with dual appointments in Biomechanical Research and Imaging Research.

The department continued its involvement in the Visiting Research Scholars program. Olivier van der Meijden, M.D., of The Netherlands, and Bruno Nogueira, M.D., of Brazil, worked with Steadman Philippon Research Institute physicians and scientists, and conducted research in their areas of expertise.

Biomechanics Research also continues to offer opportunities to research interns, and assigned three promising health professionals to shoulder, hip, or knee research teams during 2010. Others participated as summer research interns.

Technology and Equipment

The year was one of planning, remodeling, expanding, and refocusing the department's laboratory facilities. There are now three lab components: The BioMotion Laboratory, the Biomechanical Testing Laboratory, and the Surgical Skills Laboratory.



Left to right: Justin Stull; Kyle Jansson; Olivier van der Meijden, M.D.; Erin Lucas, M.Sc.; J. Erik Giphart, Ph.D.; Jacob Hvidsten; Robert F. LaPrade, M.D., Ph.D.; Bruno Nogueira, M.D.; David M. Civitarese; Mary Goldsmith, M.Sc.; Coen Wijdicks, Ph.D.

Left: Erin Lucas, M.Sc., striding inside the dual-plane fluoroscopy system which is used for studying in vivo kinematics of joints.

The labs include the following types of equipment:

- updated software
- moveable cameras
- motion-capture system designed to analyze a wide variety of movements and metrics
- dual-plane fluoroscopy technology (for in vivo kinematics of joints)
- imbedded plates to measure force
- KUKA Robotic System KR 60-3 (to test joints and validate joint reconstruction techniques)
- Inston ElectroPuls E10000 (an electric-powered tensile testing machine)
- Tekscan K-Scan joint pressure measurement system
- Sports Performance Area (to measure kinematics, dynamics, and muscle activation in sports such as hockey, football, tennis, and golf). The Sports Performance Area includes a seamless hockey surface with moveable force plates.

Ten fully-equipped arthroscopic stations are housed in the Surgical Skills Lab. Companies are allowed to work with Institute physicians and scientists in testing and validating new procedures and products, giving staff members, fellows, visiting scholars, and interns the benefit of observing and using cutting-edge technology.

The Surgical Skills Laboratory includes audio/visual technology capable of broadcasting surgical and testing procedures, lectures, and other presentations to television monitors within the Research Institute and via satellite to meeting rooms, research facilities, and conference centers around the world.



The renovated Laboratories also includes a conference room and a machine shop that minimizes the need to outsource certain fixtures and that can be used to develop new techniques and devices. A total 6,000 feet of space allows for modification or expansion well into the next decade.

Research Production

In 2010, studies were proposed, planned, or conducted that involved:

- a grading system for turf toe injuries
- Achilles tendon ruptures
- fixation devices for the tibia
- posterior cruciate ligament anatomy, radiography, and reconstruction
- ACL reconstruction techniques
- unloader braces and their effects on the knee joint, gait, and intra-articular spacing
- hockey padding and its effect on hip injuries
- femoroacetabular impingement (friction in the hip joint) and post-hip arthroscopy
- hip rehabilitation
- biceps repair
- shoulder functioning
- validation of the biplane fluoroscopy system in shoulder movements and injuries
- rotator cuff injuries

Biomechanics Research physicians, scientists, and fellows published more than 30 articles in peer-reviewed journals or presented their research findings at national and international conferences.

Collaborative Efforts

The department received grants, presented proposals, or conducted research in collaboration with organizations such as the Arthroscopy Association of North America, the Hockey Equipment Certification Council, Arthrex, Inc., the Southeastern Norway Regional Health Authority, Colorado State University, and the University of Oslo.

The department also hosted four groups of high school and middle school students for tours of research facilities, focus lectures on the scientific method, and for the opportunity to interact with Steadman Philippon staff members.

Projections

In 2011 and beyond, the Biomechanics Research Department will continue to work toward fulfilling its mission of (1) advancing patient care by focusing on injury mechanisms and prevention, (2) developing and validating novel surgical treatments and rehabilitation techniques, and (3) teaching advanced research protocols using state-of-the-art biomechanical research techniques and technologies.

Steadman Philippon Research Institute Develops and Scientifically Validates Medial Knee Reconstruction Technique That Restores Stability and Long-Term Ligament Viability

The Institute states that many forms of treatment are acceptable, but their technique is most effective long-term.

By Robert F. LaPrade, M.D., Ph.D., Sports Medicine and Complex Knee Surgery, Chief of Medical Research Officer, The Steadman Clinic;
Coen Wijdicks, Ph.D., Director, Senior Staff Scientist, Biomechanics Research Department, Steadman Philippon Research Institute

The Steadman Philippon Research Institute (SPRI) has developed and scientifically validated a novel reconstruction technique associated with the medial collateral ligament (MCL) of the knee. The Institute claims that while many forms of treatment for this specific injury are available today, their technique using an anatomic reconstruction is the most effective for long-term viability. An anatomic reconstruction replaces torn structures with tissue at their anatomical attachments points.

The medial collateral ligament (MCL) is located on the inner side of the knee joint and represents one of the four major ligaments within the knee. Injuries to the MCL and other associated medial knee stabilizers occur in about 24 percent of the knee injuries reported in the United States in any given year. These injuries occur predominantly in young athletic patients participating in sporting activities, with the injury involving

contact to the outside of the knee, external rotation, or combined force impacts seen in such sports as skiing, ice hockey, and soccer, where knee flexion is present.

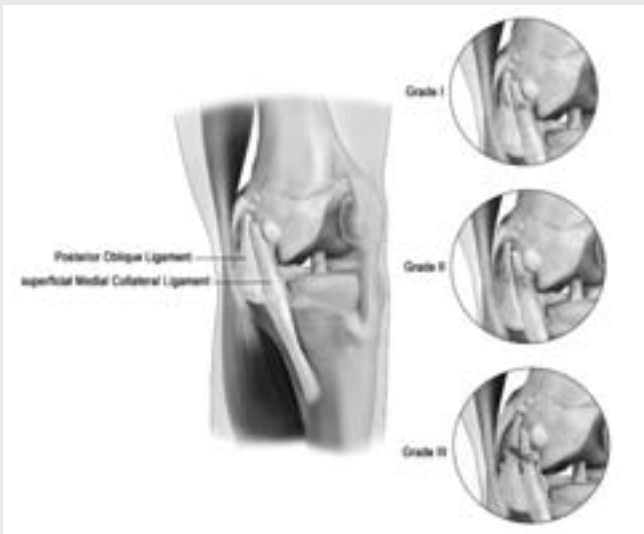
Researchers at SPRI confirmed that an anatomic medial knee reconstruction technique can restore native stability to the knee that has an acute or chronic medial knee injury. Through biomechanical testing, we evaluated the precise position and mechanics of the ligaments in healthy knees. The reconstruction technique can use a tendon from the patient (also referred to as an autograft) to reconstruct the injured ligament by placing it in the exact anatomically correct location. This aspect is important because in many countries where tissue banks do not exist, an autograft procedure provides a practical approach.

SPRI developed this reconstruction technique with the goal of making it possible

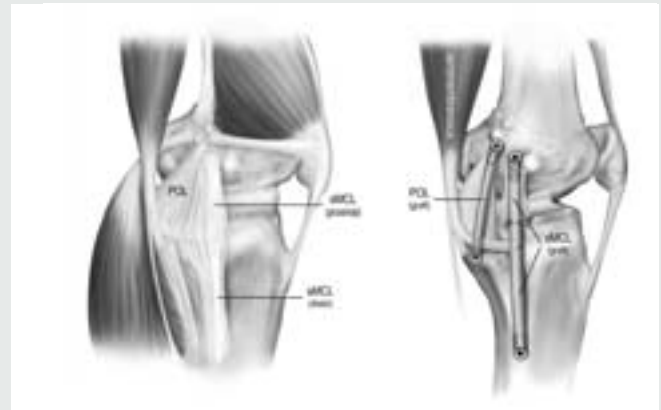
for orthopaedists around the world to perform the surgery with available resources. The procedure can also be performed with an allograft, which is tissue that has been harvested from a cadaver.

This anatomic procedure provides a viable option for patients who may require surgery, and it has been validated for superior outcome because it is stronger, conforms better with the other structures of the knee, and provides the same dynamic range of motion that the natural ligament allowed.

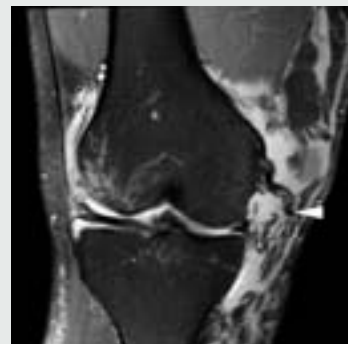
Dr. Robert LaPrade, complex knee injury surgeon and Chief Medical Research Officer at the Steadman Philippon Research Institute, along with Director Dr. Coen Wijdicks, recently published their findings in various peer-reviewed journals. They, along with their colleagues at SPRI, continue to push the envelope as leading researchers of anatomic restoration, preservation, and reconstruction techniques for joints.



(Figure 1) Left knee, showing the injury grading scale established by the American Medical Association Standard Nomenclature of Athletic Injuries. Isolated grade-I injuries present with localized tenderness and no laxity. Isolated grade-II injuries present with a broader area of tenderness and partially torn medial collateral and posterior oblique fibers. Isolated grade-III injuries present with complete disruption, and there is laxity with an applied valgus stress.



(Figure 2) An intact medial knee and an anatomical reconstruction.



(Figure 3) MRI showing an avulsion of the medial structures of the knee.

Charles Ho, M.D., Ph.D., *Director; Member, Scientific Advisory Committee*

IMAGING RESEARCH DEVELOPS AND EVALUATES NONINVASIVE IMAGING TECHNIQUES OF THE JOINTS FOR THE PURPOSE OF IMPROVING CLINICAL DIAGNOSIS, DIRECTING AND MONITORING CLINICAL TREATMENT AND OUTCOMES, AND TO ENHANCE THE CLINICAL RELEVANCE OF RESEARCH CONDUCTED IN ALL OF THE DEPARTMENTS AT THE STEADMAN PHILIPPON RESEARCH INSTITUTE.

IN 2010, THE DEPARTMENT CONTINUED TO BUILD ON THE FOUNDATION ESTABLISHED IN 2008 AND 2009. NEW STAFF MEMBERS WERE ADDED, THE CLINICAL IMAGING DATABASE WAS EXPANDED TO INCLUDE DATA POINTS INVOLVING THE HIP, SHOULDER, KNEE, FOOT AND ANKLE, AND IMAGING RESEARCH SCREENING BECAME AN INCREASINGLY IMPORTANT COMPONENT OF STUDIES BEING CONDUCTED BY PRESENT AND FORMER STEADMAN PHILIPPON PHYSICIANS AND SCIENTISTS.

Staff

In December of 2010, Erin Lucas, M.Sc., Boston University, prepared to join the Steadman Philippon staff as a research engineer in Biomechanics Research. She has since been assigned to a dual appointment as Senior Project Engineer in Imaging Research and Biomechanics Research, working on software to quantify cartilage health using 3T magnetic resonance imaging (MRI) biomarker techniques and conducting research on T2 mapping. T2 mapping is an MRI biomarker technique that provides a more sensitive determination of the health of articular cartilage as well as potentially of other tissues about the joints and body such as muscles, tendons, and ligaments.

In August 2010, the Department matriculated its first Sports Medicine Clinical Imaging Research Fellow, Anna Chacko, M.D. Dr. Chacko served more than 24 years in the United States Army, retiring as a Colonel with awards that included Legions of Merit and Meritorious Service Medals. Dr. Chacko also served as the Radiology Consultant to the Army Surgeon General and has held professorships at Texas A&M, University of Hawaii, Boston University, and the University of Pittsburgh. Her appointment as an Imaging Research Fellow ended in July 2011. Those selected as fellows assist in conducting research studies, collecting and analyzing data, and presenting and reporting the findings for orthopaedic and sports medicine conferences and peer-reviewed literature. The fellowship is sponsored by Siemens Medical Solutions, which has entered into a strategic alliance and imaging research collaboration with the Institute.

Technology and Equipment

The Clinical Imaging database continues to grow, adding data from approximately 200 MRI clinical exams per month. The data come from clinical patient evaluations that include imaging as an integral component of evidence-based medicine for patients treated at the Steadman Clinic.

Research

Among the Department's ongoing research projects are screening studies involving hip injuries in junior league hockey players and hip findings in asymptomatic adults. Dr. Marc Philippon and Dr. Robert LaPrade, and former Steadman Philippon Fellows Drs. Brad Register and Andrew Pennock are participating in the studies.

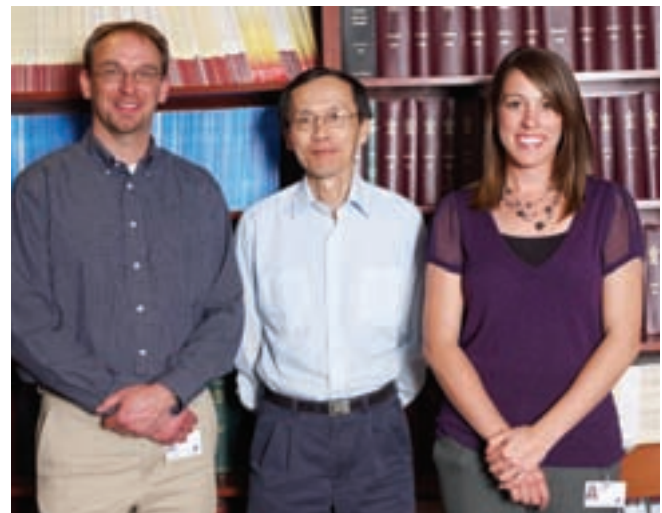
The Department's T2 mapping research involves quantification, reproducibility, and follow-up of articular cartilage early degeneration using imaging biomarkers.

Collaborative Efforts

Imaging Research continues its collaboration with Siemens, which provides funding for the Steadman Philippon Research Institute Fellowship Program (and specifically, the Imaging Research Fellow) and for ongoing research on early articular cartilage degeneration.

Projections

Imaging Research will continue to add and advance imaging data to the Steadman Philippon Research Institute database, and will provide valuable collaboration and information to be used in the treatment of Steadman Clinic patients and the advancement of orthopaedic sports medicine research in the departments of Basic Science, Biomechanics Research, and Clinical Research.



Left to right: J. Erik Giphart, Ph.D.; Charles P. Ho, Ph.D., M.D.; Erin Lucas, M.Sc.



Visiting Scholars Program Brings French and Brazilian Physicians to the Institute

Olivier A. J. van der Meijden, M.D.—2010-2011 Arthrex European Visiting Scholar Knee injuries change career goal from professional athlete to sports medicine.

By Jim Brown, Editor, SPRI News



Olivier van der Meijden, M.D., working with the Instron ElectroPuls E10000, an electric-powered tensile testing machine.

Your goal is to become a professional athlete. Your talent and drive give you a good chance of achieving that goal. Then two things happen, both before the age of 20. You tear the anterior cruciate ligament in one knee when you are 15, and you tear the ACL in the other knee at 19.

Those kinds of injuries have a way of changing your perspective in terms of a career, and that's what happened to Olivier A. J. van der Meijden, M.D., a citizen of The Netherlands and the 2010-2011 Arthrex European Visiting Scholar at the Steadman Philippon Research Institute.

"I had a dream of becoming a professional soccer player," he says, "but that dream faded pretty quickly after the second injury. Since I couldn't be a professional athlete myself, I wanted my profession to have some connection to sports," he recalls. "The second injury really increased my interest in sports medicine."

THE STEADMAN PHILIPPON REPUTATION

"The first time I heard of the Steadman Clinic and the Research Institute was in 2000 when Dr. Steadman performed surgery on one of our famous soccer players," says Dr. van der Meijden. "In due course, I heard more and more about the Clinic and the Research Institute.

"Shortly after I graduated at the University Medical Center in Utrecht, I got in touch Dr. Peter Millett through my Dutch mentor in orthopaedics. From our correspondence the idea grew that it would be a great opportuni-

ty for me to come to SPRI and do research." Previously, he had spent five weeks in Boston for an ENT-internship rotation, which intensified his interest in returning to the U.S. and conducting research.

Dr. van der Meijden would also meet Coen Wijdicks, Ph.D., Director of Biomechanics Research and Dr. Robert LaPrade, Chief Medical Research Officer at SPRI, at an international sports medicine conference in Oslo, Norway.

This meeting and eventually an offer to join the SPRI staff as a Visiting Scholar changed the normal order of orthopaedic training for Dr. van der Meijden. After completing his medical degree, he gained experience for a year as a non-training physician in general and orthopaedic surgery with the goal of advancing into the orthopaedic residency program afterwards.

Following his time in Vail, he will return to The Netherlands and begin a six-year residency in orthopaedic surgery. His goal now is to become a private practice orthopaedic surgeon specializing in the shoulder and knee.

The European Visiting Scholars program that sponsors Dr. van der Meijden and other young physicians was developed in conjunction with Arthrex, Inc., an orthopaedic medical device company. It reflects Arthrex's commitment to orthopaedic research in advancing knowledge of the global medical community and to helping surgeons treat their patients better.

WORKING, ADJUSTING

At SPRI, Dr. van der Meijden has worked closely with Dr. Millett on shoulder research, and he has been involved with a variety of research projects in the Biomechanics Research Department with Dr. Wijdicks and other scientists/physicians. Under the direction of Dr. Millett, Dr. van der Meijden is researching the enforcement of repairs of massive rotator cuff tears. The investigation is nearing completion and the findings will be submitted for publication in a professional journal.

Dr. van der Meijden is not a novice when it comes to living in other countries

and adjusting to new environments. His father worked for Shell Oil, and as a child, Olivier lived in Nigeria, England, and Australia before his family moved back to The Netherlands. He speaks Dutch, English, and "manageable" French and German.

"Vail was an all new wonder world," he says. "Different culture, different style of work, so many possibilities and options, both in research and in all the things you can do here in the mountains." His knees, he says, are fine now, and his two primary recreational sports are cycling and skiing.

SPRI OBSERVATIONS

On physician/patient relationships: "Physicians seem to have a close relationship with their patients. This is a good thing and something I will strive for when I begin my practice."

ON PATIENT CARE:

"World famous athletes and normal patients are treated the same way. If you didn't recognize the names or faces, you wouldn't know who was famous and who was not."

ON THE SPIRIT OF COLLABORATION:

"The collaboration among the Steadman Clinic, Howard Head Sports Medicine (physical therapy center), and the Steadman Philippon Research Institute is like a "golden triangle" of sports medicine treatment, rehabilitation, and research. It's great that people from all over the world come here to see how things are done, how they can collaborate with each other, and how they can contribute."

ON BEING A VISITING SCHOLAR:

"There is always a lot going on, and with both the Clinic and Institute's emphasis on training and education, it's also a great learning opportunity. We never run out of work. I'm very grateful for the opportunity Dr. Millett and the Research Institute gave me to be here."

On ever playing competitive soccer again: "I could, but I won't. I still have some years ahead of me, and I'll need my knees to do other things."

Brazilian Orthopaedic Surgeon Dr. Bruno Nogueira Joins Steadman Philippon as Visiting Scholar

By Jim Brown, Editor, SPRI News

On Tuesday, February 1, 2011, Bruno Nogueira, M.D., arrived in Vail ready to begin his work at the Steadman Philippon Research Institute. The official temperature was -4 degrees Fahrenheit.

He had come from Fortaleza, a sprawling city of 2.4 million people on the northeast coast of Brazil, where the average temperature in February is 87.7° F and where the highs can reach 100° F.

"What am I doing here?" he briefly thought to himself. What he was doing in mid-winter Colorado was beginning a one-year period of intensive training and research as a Visiting Scholar. He was chosen from among the 10,000 practicing orthopaedic surgeons in Brazil after an application and selection process that included written and oral tests, interviews, and a review of his résumé, presentations, and publications.

Before he came to Vail, Dr. Nogueira had already completed six years of medical school and four years of residency in his home country, as well as additional training at hospitals in Miami and Chicago.

ADJUSTING TO A NEW ENVIRONMENT

"That first week was really hard," says Dr. Nogueira, "but I knew that adjusting to my new environment was just a matter of time and that everything was going to be okay. I got a great welcome from the entire staff at Steadman Philippon. They treat people really well and made me feel right at home."

Dr. Nogueira is the third in a series of Visiting Scholars from Brazil, all of whom received support from a program sponsored

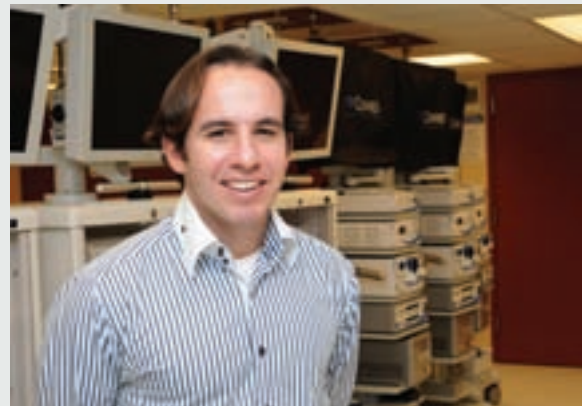
by famed Brazilian businessman Jorge Paulo Lemann. These physician/scholars (and their counterparts in the European Visiting Scholars Program) spend 12 months at Steadman Philippon learning new surgical techniques and conducting research that is submitted for publication to leading orthopaedic journals.

"Being named a Visiting Scholar at Steadman Philippon is the best award I've won in my entire life," says Dr. Nogueira. "I really wanted to come here and couldn't believe when I was told I had been accepted into the program. I knew that it would allow me to learn from the very best sports medicine surgeons and scientists.

"I work under the supervision of Dr. Marc Philippon, who I believe is the foremost hip surgeon in the world. He is an artist in the way he conducts surgical procedures. His surgical skills and his ability to perform labrum reconstruction are two of the attributes that set him apart from other great physicians. Hip arthroscopy is very, very difficult, but he makes it look easy."

Dr. Nogueira's schedule at the Institute is packed. On Mondays, Tuesdays, and Thursdays he observes and assists Dr. Philippon in surgery. During the rest of the week he is busy attending meetings, seeing patients, conducting research, and writing. Two areas of emphasis are femoroacetabular impingement (FAI) and hip arthroscopy. Hip arthroscopy in professional tennis players is a particular interest.

When he has a little free time, he enjoys playing tennis and cycling "on a very good bike."



Bruno Nogueira, M.D.

Photo: Barry Eckhaus

RETURNING TO BRAZIL

When Dr. Nogueira returns to Brazil in 2012, he will be one of only four or five orthopaedic surgeons trained in hip arthroscopy in the entire country. In addition to his surgical skills, he will also be able to use his experience gained in the SPRI Biomechanics Research Department and other areas of the Institute. "The Biomechanics Lab is one of the best facilities of its kind — anywhere," he says.

Dr. Nogueira plans to continue conducting research, sharing his research through professional journals and in presentations, and teaching other orthopaedic surgeons at the Federal University of Ceara. But his focus will be surgery, specifically hip arthroscopy.

"This year of serving as a Visiting Scholar with the best people and in the best facilities in the world will be a tremendous boost to my career. I will be able to take what I am learning here to benefit patients, students, and physicians in an area of South America where it is desperately needed."

Visiting Scholar

The European Visiting Scholar, developed and sponsored by Athrex, Inc., has become the model for our Visiting Scholars program. The Visiting Scholars programs are sponsored by corporate and individual donors. Our program was developed in conjunction with Arthrex, Inc., an orthopaedic medical device company. Arthrex's founder and president, Reinhold Schmieding, has had a long-time interest in education. Reinhold approached us with an idea for educating a European orthopaedic surgeon with interest in research, committed to funding it, and the Visiting Scholars program was created. Reinhold Schmieding commented, "Arthrex is pleased to contribute annually to the Institute. The sponsoring of a European research fellow exemplifies Arthrex's commitment to orthopaedic research to advance knowledge of the global medical community and to helping surgeons treat their patients better." Arthrex, Inc., is annually sponsoring the European Visiting Scholars program and due to its success, Jorge Paulo Lemann is supporting our Brazilian Visiting Scholar. These scholars learn new surgical techniques and conduct research, which is submitted for publication in leading orthopaedic journals.



THE INSTITUTE'S PRIMARY MISSION IS TO CONDUCT RESEARCH THAT CAN BE APPLIED DIRECTLY TO ORTHOPAEDIC MEDICINE. TO THIS END, EDUCATION IS AN IMPORTANT PART OF OUR WORK. WE OFFER TRAINING THROUGHOUT THE YEAR TO PHYSICIANS-IN-RESIDENCE, TO VISITING MEDICAL PERSONNEL, AND DURING INTERNATIONAL MEDICAL MEETINGS. MEMBERS OF THE STAFF REPORT THEIR RESEARCH THROUGH PUBLICATIONS, PRESENTATIONS, AND POSTERS. THE EDUCATION DEPARTMENT PROVIDES ADMINISTRATIVE SUPPORT FOR EDUCATIONAL PROGRAMS AND CONFERENCES, RESPONDS TO THE PRESS, AND TEACHES HIGH SCHOOL STUDENTS ABOUT HUMAN ANATOMY AND INJURY.

WELCOME 2010-2011 Fellows
Eight New Physicians Introduced

Each year, six young orthopaedic surgeons are selected from a field of more than 130 to participate in 12 months of vigorous training in the Steadman Philippon Sports Medicine Fellowship Program. Our goal is to prepare them to be leaders in the field of orthopaedic sports medicine for the remainder of their careers. Many go on to hold high-level faculty positions at top medical schools.

On July 21, 2010, we added two Fellows to our program when we welcomed the Institute's first Foot and Ankle Fellow and the world's first Sports Medicine Imaging Research Fellow. In addition, we now have three Visiting Scholars, who are in essence research fellows from overseas. All eleven (Fellows and Visiting Scholars) are being given a unique opportunity to perform research in their respective areas of interest, including Biomechanics Research, Clinical Research, Imaging Research, and Basic Science Research.

Once every 18 months after that, they will return with other past Fellows for further education and to exchange the additional knowledge they have gained since completion of Fellowship training. The Institute currently maintains a network of more than 185 Fellows in communities around the world, who serve in academic positions at leading universities and in private practices.

Thank you

A special "thank you" to our sponsors who make the Fellowship program possible. We'd like to recognize those individuals and foundations that support the entire Fellowship Class through the sponsorship of Academic Chairs.

Chair sponsors of the 2010/2011 Steadman-Philippon Fellowship Class are **Mr. and Mrs. Lawrence Flinn, the Gustafson Foundation** (Biomechanics Research Laboratory), **Mr. and Mrs. Brian P. Simmons, Mr. and Mrs. Peter Kellogg, Mr. and Mrs. Al Perkins, and Mr. and Mrs. Steven Read.**

Fellowship Benefactors fund the research of one Fellow for one year. Each benefactor is assigned a Fellow, who provides written reports and updates of his or her work. We extend our gratitude to the following individuals for their generous support: **Mr. and Mrs. Milledge Hart, the Fred and Elli Iselin Foundation, Mr. and Mrs. S. Robert Levine, Mr. Tim McAdam, Mr. and Mrs. Jay Precourt, and Mr. and Mrs. Stewart Turley.**

Left: Henry B. Ellis, Jr., M.D.

2010-2011 Steadman Philippon Fellows

James B. ("Jamie") Ames, M.D., M.S.

Dr. Ames graduated cum laude from Harvard University, where he earned a degree in American history. While at Harvard he played varsity lacrosse and was his team's Most Valuable Player during his senior year.

After college he worked as a math teacher at the Colorado Rocky Mountain School in Carbondale, Colorado, and as a business manager and backcountry guide in Edwards, Colorado.

Eventually he returned east to medical school and residency at Dartmouth. In medical school he won the "Freddy Fu Outstanding Medical Student" award. During residency he completed a master's degree at the Dartmouth Institute for Health Policy and Clinical Practice.

Henry B. Ellis, Jr., M.D.

Dr. Ellis graduated from the University of Texas with a bachelor of arts degree in biology. Following graduation, he spent a year as a research intern in the Biomechanics Research Laboratory at the Steadman Hawkins Sports Medicine Foundation (now Steadman Philippon Research Institute). This is where he developed his interest in orthopaedics.

Dr. Ellis graduated from the University of Texas Medical School in San Antonio, where he was a member of the Alpha Omega Alpha Medical Honor Society. During his orthopaedic residency at the University of Texas Southwestern, he assisted with team coverage for both high school and collegiate sports. His research mainly focused on psychological and socioeconomic factors on orthopaedic outcomes and pediatric injuries. As chief resident, he was honored with teaching and academic awards, including the W. Brandon Carrell Distinguished Physician Award.

Upon completion of his Steadman Philippon fellowship, Dr. Ellis will pursue a second fellowship in pediatric orthopaedics at Sick Kids Hospital in Toronto, Canada. He intends to pursue an orthopaedic career in sports medicine with an interest in pediatric and adolescent sports injuries.



Back row, left to right: S. Clifton Willimon, M.D.; Thomas O. Clanton, M.D.; William I. Sterett, M.D.; John E. McDonald, Jr., M.D.; James B. Ames, M.D.; Marc J. Philippon, M.D. Front row, left to right: Robert F. LaPrade, M.D., Ph.D.; Henry B. Ellis, M.D.; Matthew B. Massey, M.D.; Trevor R. Gaskill, M.D.; Anna K. Chacko, M.D.; Douglas D. Nowak, M.D.; Peter J. Millett, M.D., M.S.; J. Richard Steadman, M.D.

Trevor R. Gaskill, M.D.

Dr. Gaskill earned his bachelor of science degree from Kansas State University. He completed his medical degree at the University of Kansas School of Medicine with honors, graduating in the top five of his class, and was elected Vice President of the Alpha Omega Alpha Honor Society. During this time he was also the recipient of a Naval Health Professions Scholarship Program.

His orthopaedic residency training was completed at Duke University Hospital, providing care for local high schools, North Carolina Central University, and Duke University athletes. While in residency he was elected by Duke faculty to the American Orthopaedic Association Resident Leadership Forum and was awarded the John M. Harrelson Resident Teaching Award by vote of his peers as the Chief Resident who has contributed most to resident training and education. His interests include open and arthroscopic shoulder and hip reconstruction, and his research endeavors have received several Orthopaedic Research Educational Foundation grants and have been published and presented in journals and conferences.

John E. McDonald, Jr., M.D.

Dr. McDonald graduated cum laude from Georgetown University with a degree in biology. During his time in Washington, D.C., he played NCAA Division I tennis for the Hoyas. He received his M.D. at the University of Texas Southwestern Medical School in Dallas, where he was elected to the Alpha Omega Alpha Honor Society.

While completing his orthopaedic surgery residency at University of Texas Southwestern, Dr. McDonald provided care for high school athletes and assisted with local football team coverage. He has published on diverse topics, including pedi-

atric musculoskeletal infections, traumatic hip dislocations, and total hip arthroplasty in the obese and geriatric populations. He looks forward to taking advantage of the vast learning opportunities at Steadman Philippon.

Douglas D. Nowak, M.D.

Dr. Nowak graduated with University Honors from the University of Illinois at Chicago, where he earned a bachelor of science degree in exercise physiology. He completed medical school at the University of Illinois College of Medicine in Chicago, where he graduated with honors and was a member of the Alpha Omega Alpha Medical Honor Society. He completed residency at New York Presbyterian/Columbia University Medical Center in New York City.

His research background includes computer simulation shoulder replacement surgery. He has presented research at the American Academy of Orthopedic Surgeons National Meeting and has published articles in the *Journal of Shoulder and Elbow Surgery* and *American Journal of Orthopedics*.

S. Clifton Willimon, M.D.

Dr. Willimon graduated summa cum laude from Wofford College, where he earned a bachelor of science degree and membership in Phi Beta Kappa. He completed medical school at Emory University, where he was a member of the Alpha Omega Alpha Medical Honor Society. During his orthopaedic residency at Duke University, he provided care for high school and collegiate athletes, including both Duke and North Carolina Central University athletic teams. His research interests include pediatric tibial eminence fractures and ACL bone tunnel widening, which have resulted in multiple publications, as well as regional and national meeting presentations.

Foot and Ankle Fellow

Matthew B. Massey, M.D.

Dr. Massey graduated summa cum laude from Mississippi State University with a degree in microbiology. He was awarded a membership into the Society of Scholars and served consecutive terms as the Student Association Attorney General. He completed medical school at the University of Mississippi, and he began his orthopaedic surgery residency at Louisiana State University in New Orleans. After Hurricane Katrina, Dr. Massey and his wife transferred to the Medical University of South Carolina to complete their training. While in Charleston, he was awarded the Outstanding Clinical Research Paper for his work on the treatment of pilon fractures.

Dr. Massey, his wife Caroline, and their one-year-old son, Brooks, look forward to moving from the low country to the high country, and the opportunity to train at the Steadman Philippon Research Institute.

Sports Medicine Imaging Fellow

Anna K. Chacko, M.D.

Dr. Chacko graduated from the Indian Institute of Medical Sciences in Hyderabad, India, at the top of her class, securing the top awards in medicine, surgery, Ob/Gyn, anatomy, physiology, biochemistry, pathology, and pharmacology. She is board-certified in nuclear medicine and radiology.

She served more than 24 years in the United States Army, retiring as a Colonel with multiple awards to include Legions of Merit and Meritorious Service Medals. Dr. Chacko served as the Radiology Consultant to the Army Surgeon General in Radiology; Chair of Radiology at Brooke Army Medical Center; at the Lahey Clinic Medical Center Boston, Mass.; at the St. James Healthcare System in Butte, Mont.; at the VA Medical Center in Pittsburgh; and as Vice Chair in Radiology at Boston University Medical Center. She has served as Examiner for the American Board of Radiology and is on the reviewing staff for the Yellow Journal in Radiology.

She holds professorships at the Engineering School at Texas A&M, the John A. Burns School of Medicine at the University of Hawaii, the Boston University School of Medicine, and the University of Pittsburgh. Dr. Chacko was responsible for the introduction of PACS systems in this country and in the United States Armed Forces. In medical imaging, electronic picture archiving and communication systems (PACS) have been developed in an attempt to provide economical storage, rapid retrieval of images, access to images acquired with multiple modalities, and simultaneous access at multiple sites. Electronic images and reports are transmitted digitally via PACS. This eliminates the need to manually file, retrieve, or transport film jackets.

Dr. Chacko and her husband Bill Lollar have five sons and four grandchildren. She loves to paint, write, and cook gourmet. Her life's passion is to fight for the rights of veterans, using the slogan "Make the VA Safe for the Veterans."

Where Are They Now . . . ?

The graduating class of 2009/2010 Steadman Philippon Fellows are busy establishing new careers in orthopaedics.

John C. ("Jack") Carlisle, M.D.

Dr. Carlisle is settling in to his new practice at Kansas City Bone and Joint Clinic in Overland Park, Kansas, a suburb of Kansas City.

Chad M. Hanson, M.D.

Dr. Hanson has joined Desert Orthopaedic Center in Las Vegas, and his practice is getting busier by the week. He has been added as one of the team physicians for two local professional teams, the Las Vegas Locos (UFL football) and the Las Vegas Wranglers (hockey).

Andrew T. Pennock, M.D. (see page 56)

Dr. Pennock and his wife Paige are happy to have moved close to family in San Diego, where Andy took a position at Rady Children's Hospital and is helping to create an adolescent sports medicine program there. He is also on staff at the University of California at San Diego.

Bradley C. Register, M.D.

Dr. Register and his wife Jennifer are enjoying their new home in Athens, Georgia, where Brad is steadily building up his sports medicine practice while working with the University of Georgia athletes.

Suketu Vaishnav, M.D.

Dr. Vaishnav moved to San Francisco with his wife Aditi and is performing an additional shoulder and elbow fellowship this year.

Carl H. Wierks, M.D.

Dr. Wierks is now in Holland, Michigan, a mid-sized town on Lake Michigan, practicing sports medicine with a hip arthroscopy focus. He has been busy building relationships with the local community physicians while his clinical practice builds momentum.

Dr. Andrew Pennock: Turning a Dislocated Knee Into a Career in Orthopaedic Surgery

By Jim Brown, Editor, SPRI News

At the age of 17, Andy Pennock, a talented skier from Minnesota, suffered a train wreck of a knee injury that changed his life forever—in a good way.

A dislocated knee, three torn ligaments, and a battered meniscus sent him on his first visit to see Dr. Richard Steadman at what was then known as the Steadman-Hawkins Clinic in Vail.

“Dr. Steadman ‘fixed’ my knee,” says Andrew Pennock, M.D., now an orthopaedic surgeon who has just completed his year as a Fellow at the Steadman Philippon Research Institute. “It was a great experience—meeting Dr. Steadman, the surgery, rehab, everything. It was a pivotal moment in my life, and it is why I went into medicine. The only career goal I had from that time forward was to become an orthopaedic surgeon.”

To say that Dr. Steadman “fixed” Dr. Pennock’s knee is an understatement on at least two levels. The procedures he performed involved repairing one of the torn ligaments, employing Dr. Steadman’s famous “healing response” technique on another, allowing the third ligament to heal on its own, and “fixing” the meniscus.

TWO-TIME ALL-AMERICAN

The “fix” not only allowed Dr. Pennock to return to skiing, it allowed him to become a two-time All American and Hall of Fame member at Dartmouth. Today, some 17 years after the original injury, he skis, plays soccer, and runs half-marathons. No pain, no arthritis. “I owe a lot to Dr. Steadman,” says Dr. Pennock.

After graduating from Dartmouth with honors, he went to medical school at the University of Chicago. While others in his class stayed in Chicago to complete a

three-month research block, Dr. Pennock returned to the Institute (then called the Foundation) and “shadowed” some of the staff physicians and fellows, including Dr. Steadman and Dr. Peter Millett.

“I didn’t get off to a good start,” remembers Dr. Pennock. “The first time I observed an operating room procedure, I got overheated and passed out. I don’t think they were impressed.”

Before coming to the Institute as a Fellow in August of 2009, Dr. Pennock completed his residency training at the University of California – San Diego. He also participated in a research fellowship program there that focused on cartilage repair techniques. He has now accepted a position on the faculty at UCSD and will continue his own research, work with physicians-in-training, build a practice, and perform clinical work at Rady Children’s Hospital in San Diego, where he will also help develop a pediatric sports medicine program.

TAKE-AWAY MESSAGE

We asked Dr. Pennock what he will take from experience at the Steadman Clinic and the Steadman Philippon Research Institute. “The most important thing on the clinical side is how they treat people,” he replied. “Dr. Steadman, Dr. Philippon, and the other physicians and scientists treat everyone—patients, family members, interns, and fellows—as equals. That really means a lot to me, and is something I’ll do with the people I work with in San Diego.

“Personally, coming here and working with Dr. Philippon, who is the recognized leader in hip arthroscopy, was a huge benefit. A lot of fellowship programs don’t offer that arthroscopy experience, especially at this level. It is really unique and is something that helped me get the position at UCSD.”



Andrew Pennock, M.D.

Photo: Joe Kania

Dr. Pennock tells prospective Fellows that there are no weaknesses in the program. “There is a world leader here in every area of sports medicine. With the addition of Dr. LaPrade, the program has become even stronger. He is probably the foremost expert on complex knee injuries, and now SPRI Fellows will get to work with him.

“From the perspective of a SPRI Fellow, the Institute is a great resource. The opportunity to do research and the access we have to the huge database of previous cases are as good or better than anything out there. The Biomechanics Lab and the other departments put the Institute in a great position to produce influential research for years to come.”

His experience with the Steadman Clinic and the Steadman Philippon Research Institute wouldn’t have happened without that dislocated knee. If there is ever a top-ten list of people who turned something bad into something really good, we nominate Dr. Andrew Pennock.

PRESENTATIONS & PUBLICATIONS



A primary goal of the Institute is to distribute the results of its research. In 2010, principal investigators and Fellows published 109 papers in scientific and medical journals and delivered 288 presentations to a variety of professional and lay audiences worldwide.

PRESENTATIONS

Anavian J, Wijdicks CA, Schroder LK, Cole PA. Outcomes after Operative Management of Displaced Intra-articular Glenoid Fractures. *2010 American Academy of Orthopaedic Surgeons (AAOS) Annual Meeting, New Orleans, La.*

Anderson CJ, Westerhaus BD, Pietrini SD, Ziegler CG, Wijdicks CA, Johansen S, Engebretsen L, LaPrade RF. The Impact of Anteromedial and Posterolateral Bundle Graft Fixation Angles in Double-Bundle Anterior Cruciate Ligament Reconstructions. *Orthopaedic Research Society (ORS) Annual Meeting in New Orleans, La., March 6-9, 2010.*

Anderson CJ, Westerhaus BD, Pietrini SD, Ziegler CJ, Wijdicks CA, Johansen S, Engebretsen L, LaPrade RF. The Kinematic Impact of Anteromedial and Posterolateral Bundle Graft Fixation Angles on Double-Bundle Anterior Cruciate Ligament Reconstructions. *Minnesota Orthopaedic Society (MOS) Annual Meeting, Minneapolis, Mn., 2010.*

Anderson CJ, Westerhaus BD, Ziegler CG, Wijdicks CA, Johansen S, Engebretsen L, LaPrade RF. The Kinematic Impact of Anteromedial and Posterolateral Bundle Graft Fixation Angles on Double-Bundle ACL Reconstructions. *14th ESSKA Congress, Oslo, Norway, June 9-12, 2010.*

Anderson CJ, Westerhaus BD, Pietrini SD, Ziegler CJ, Wijdicks CA, Johansen S, Engebretsen L, LaPrade RF. The Impact of Anteromedial and Posterolateral Bundle Graft Fixation Angles in Double-Bundle Anterior Cruciate Ligament Reconstructions. *14th European Society of Sports Traumatology, Knee Surgery, and Arthroscopy (ESSKA) Annual Congress, Oslo, Norway, June 9-12, 2010.*

Anderson CJ, Westerhaus BD, Pietrini SD, Ziegler CG, Wijdicks CA, Johansen S, Engebretsen L, LaPrade RF. The Impact of Anteromedial and Posterolateral Bundle Graft Fixation Angles in Double-Bundle Anterior Cruciate Ligament Reconstructions. *Orthopaedic Research Society (ORS) Annual Meeting, New Orleans, La., 2010.*

Anker CR, Shelburne KB, Hackett TR, Duffy P, Peterson DS, Krong J, Hageman L, North A, Torry MR, Giphart JE. Method for determining scapulo thoracic motion in the lat pulldown in healthy subjects using bi-plane fluoroscopy, *56th Annual Meeting of the Orthopedic Research Society, March 6-9, 2010, New Orleans, La.*

Braman J, Hybben N, Pham T, Nystrom C, Peterson B, Camargo F, Phadke V, LaPrade RF, Ludewig P. Effects of angle and plane of motion on the subacromial space and internal impingement risk. *14th ESSKA Congress, Oslo, Norway, June 9-12, 2010.*

Brand EJ, Wijdicks CA, Nuckley DJ, Johansen S, LaPrade RF, Engebretsen L. Biomechanical Evaluation of a Medial Knee Reconstruction with Comparison of Bioabsorbable Interference Screw Constructs and Optimization with a Cortical Button. *Minnesota Orthopaedic Society (MOS) Annual Meeting, Minneapolis, Mn., 2010.*

Briggs KK. Documenting Outcome following Hip Arthroscopy. *Vail Hip Arthroscopy Symposium, Vail, Colo., March 2010.*

Briggs KK, Matheny L, Herzog M, Watts C, Steadman JR. Use of an unloader brace for medial or lateral compartment osteoarthritis of the knee. Poster, *14th ESSKA Congress, Oslo, Norway, June 2010.*

Briggs KK, Matheny LM, Steadman JR, Aultman H. Use of an Unloader Brace for Medial or Lateral Compartment OA of the Knee. *AAOS Annual Meeting, New Orleans, La., March 2010.*

Briggs KK, Philippon MJ. A New Validated Score to Document Outcomes Following Hip Arthroscopy. *International Society for Hip Arthroscopy, Cancun, Mexico, October 2010.*

Briggs KK, Philippon MJ. Analysis of Scores to Document Outcome Following Hip Arthroscopy. Star Paper. Podium, *14th ESSKA Congress, Oslo, Norway, June 2010.*

Briggs KK, Philippon MJ. Analysis of Scores to Document Outcome Following Hip Arthroscopy. Poster. *AANA Annual Meeting, Hollywood, Fla., May 2010.*

Briggs KK, Philippon MJ. Are Years of Sport Participation Associated With Femoroacetabular Impingement? *International Society for Hip Arthroscopy, Cancun, Mexico, October 2010.*

Briggs KK, Register BC, Ho CP, Koppersmith DA, Schlegel T, Philippon MJ. Abnormal Exam and Imaging Findings in Asymptomatic, Elite College Football Players. *International Society for Hip Arthroscopy, Cancun, Mexico, October 2010.*

Briggs KK, Rodkey WG, Steadman JR. A one-page form to collect knee outcomes data in a sports medicine practice. *European Federation of National Associations of Orthopaedics and Traumatology (EFORT) 11th Congress, Madrid, Spain, June 2-5, 2010.*

Briggs KK, Rodkey WG, Steadman JR. Knee Outcomes Data Collection in a sports medicine practice with a one-page form. *14th ESSKA Congress, Oslo, Norway, June 2010.*

Briggs KK, Rodkey WG, Steadman JR. Medial joint space narrowing following ACL reconstruction and partial medial meniscectomy. American Orthopaedic Society for Sports Medicine, Providence, R.I., July 15-18, 2010.

Briggs KK, Steadman JR, Matheny L, Rodkey WG. Patient expectations and clinical outcomes after viscosupplementation injections in addition to corticosteroid for knee osteoarthritis. *European Federation of National Associations of Orthopaedics and Traumatology (EFORT) 11th Congress*, Madrid, Spain, June 2-5, 2010.

Briggs KK, Steadman JR, Matheny L, Rodkey WG. Viscosupplementation injections augmented with corticosteroid for knee osteoarthritis: patient expectations and outcomes. Poster, *14th ESSKA Congress*, Oslo, Norway, June 2010.

Carlisle JC, Briggs KK, Philippon MJ. Patient Outcomes Following Bilateral Hip Arthroscopy. Poster, *International Society for Hip Arthroscopy*, Cancun, Mexico, October 2010.

Clanton TO. Ankle Arthroscopy for Impingement Syndromes. *International Society of Arthroscopy, Knee Surgery and Orthopaedic Sports Medicine*, Shanghai, China, May 2010.

Clanton TO. Athletic Foot Injuries. *American Orthopaedic Society for Sports Medicine CAQ Review Course*, Chicago, Ill., August 2010.

Clanton TO. Common Foot Pathologies and Treatments. *Arrowhead Alpine Club Community Lecture Series*, Edwards, Colo., August 2010.

Clanton TO. FDL Transfer. *Arthrex Foot and Ankle Fellows' Course*, Naples, Fla., April 2010.

Clanton TO. Fifth Metatarsal and Navicular Fractures. *The 54th Annual Edward T. Smith Orthopaedic Lectureship*, Houston, Texas, October 2010.

Clanton TO. Foot and Ankle Ligament Reconstruction: Ankle Instability Fixation. *26th Annual Summer Meeting AOFAS*, National Harbor, Md., July 2010.

Clanton TO. Foot Fractures. *Society of Military Orthopaedic Surgeons 52nd Annual Meeting*, Vail, Colo., December 2010.

Clanton TO. Lisfranc Fracture/Dislocation. *Wright Medical - Advances in Foot and Ankle Surgery*, New York, N.Y., December 2010.

Clanton TO. Posterior Tibialis Tendon Dysfunction. *Arthrex Foot and Ankle Fellows' Course*. Naples, Fla., April 2010.

Clanton TO. Stress Fractures in High Level Athletes. *International Society of Arthroscopy, Knee Surgery and Orthopaedic Sports Medicine*, Shanghai, China, May 2010.

Clanton TO. Turf Toe in High Level Injuries. *International Society of Arthroscopy, Knee Surgery and Orthopaedic Sports Medicine*, Shanghai, China, May 2010.

Clanton TO. Turf Toe. *The 54th Annual Edward T. Smith Orthopaedic Lectureship*, Houston, Texas, October 2010.

Clanton TO. We Agree to Disagree: Trauma Controversies. *Wright Medical - Advances in Foot and Ankle Surgery*, New York, N.Y., December 2010.

Clanton TO. Weil Osteotomy. *Wright Medical - Advances in Foot and Ankle Surgery*, New York, N.Y., December 2010.

Corenman DS. Arm and Stealth in Fracture Reduction and Pedicle Screw Placement. *Chile Orthopaedic and Traumatology Conference*, Chile, November 2010. (invited lecture)

Corenman DS, Strauch E, Briggs KK, Chaney-Barclay K. Diagnostic Algorithm for Lumbar Foraminal Stenosis using an Aggravating Activities Questionnaire. *North American Spine Society Annual Meeting*, Orlando, Fla., October 2010.

Corenman DS, Strauch E, Chaney-Barclay K. Sports Activity Scale for Patients with Lumbar Spine Injuries. *Lumbar Spine Research Society Annual Meeting*, Chicago, Ill., April 2010.

Decker M, Torry M, Krong J, Peterson D, Philippon MJ. Deep hip muscle activation during single and double leg squats. Poster, *2010 AAOS Annual Meeting*, New Orleans, La., March 2010.

Dewing CB, Elser F, Millett PJ, et al. Does Biceps Tenodesis Alter Glenohumeral Kinematics? A Novel In Vivo Dual-plane Fluoroscopy Study. Poster, *American Orthopaedic Society for Sports Medicine Annual Meeting*, Providence, R.I., July 2010.

Dewing CB, Philippon MJ, Hay CJ, Briggs KK. Outcome Following Arthroscopic Labral Repair in the Hip: Prospective Minimum 2-Year Follow Up. Podium, *2010 AAOS Annual Meeting*, New Orleans, La., March 2010.

Ejnisman L, Lertwanich P, Pennock AT, Herzog M, Ho CP, Briggs KK, Philippon MJ. Does femoral anteversion play a role in the pathomechanics of femoroacetabular impingement? *International Society for Hip Arthroscopy (ISHA) Annual Scientific Meeting*, Cancun, Mexico, Oct 8-9, 2010.

Ejnisman L, Philippon MJ, Briggs KK, Lertwanich P. Outcomes Following Hip Arthroscopy for FAI in the Adolescent Patient. *International Society for Hip Arthroscopy*, Cancun, Mexico, October 2010.

Ejnisman L, Philippon MJ, Herzog MM, Pennock AT, Briggs KK, Lertwanich P. Femoral Version and Intra-Articular Hip Pathology. Poster, *International Society for Hip Arthroscopy*, Cancun, Mexico, October 2010.

Engbretsen L, McCarthy M, Carmada L, Wijdicks CA, Johansen S, LaPrade RF. Anatomic Posterolateral Knee Reconstructions Require a Popliteofibular Ligament Reconstruction through a Tibial Tunnel. *AOSSM Annual Meeting*, Providence, R.I., July 15-18, 2010.

Engebretsen L, McCarthy MA, Camarda L, Wijdicks CA, Johansen S, LaPrade RF. Anatomic Posterolateral Knee Reconstructions Require a Popliteofibular Ligament Reconstruction Through a Tibial Tunnel. *14th European Society of Sports Traumatology, Knee Surgery, and Arthroscopy (ESSKA) Annual Congress*, Oslo, Norway, June 9-12, 2010.

Ewart DT, Wijdicks CA, Nuckley DJ, Johansen S, Engebretsen L, LaPrade RF. Structural Properties of the Medial Knee Ligaments. *Minnesota Orthopaedic Society (MOS) Annual Meeting*, Minneapolis, Mn., 2010.

Gauger EM, Wijdicks CA, Schroder LK, Cole PA. Improved Outcome after Reconstruction of Ipsilateral Scapula Malunion and Clavicle Nonunion Demonstrated by Functional Outcome and Novel Kinematic Technique. *Minnesota Orthopaedic Society (MOS) Annual Meeting*, Minneapolis, Mn., 2010.

Gauger EM, Anavian J, Wijdicks CA, Armitage BM, Vang S, Schroder LK, Cole PA. Defining the Anteroposterior and Transcapular-Y Radiograph for the Scapula. *Minnesota Orthopaedic Society (MOS) Annual Meeting*, Minneapolis, Mn., 2010.

Geeslin AG, LaPrade RF. Incidence and Location of Bone Bruises and other Osseous Injuries Associated with Grade III Posterolateral Corner Knee Injuries. *14th ESSKA Congress*, Oslo, Norway, June 9-12, 2010.

Giphart JE, Dewing CB, Elser F, Krong JP, Peterson DS, Torry MR, Millett PJ. Does Biceps Tenodesis Increase Glenohumeral Translations During Overhead Motion? An In Vivo Biplane Fluoroscopy Study. *8th Meeting of the International Shoulder Group*, Minneapolis, Mn., July 2010.

Giphart JE, Shelburne KB, Hackett TR, Duffy P, King J, Peterson DS, Krong J, Hageman E, North A, Torry MR (2010) Effect of clavicle shortening on in vivo acromioclavicular rotations during lat pull downs using bi-plane fluoroscopy, *56th Annual Meeting of the Orthopedic Research Society*, New Orleans, La., March 6-9, 2010

Green T, Horan M, Millett PJ. Subcoracoid Impingement: factors associated with a narrow coracohumeral interval in patients who underwent coracoidplasty. Poster, *Arthroscopy Association of North America Annual Meeting*, Hollywood, Fla., May 2010.

Green T, Horan M, Millett PJ. Subcoracoid Impingement: Factors associated with the size and location of the Coracohumeral Interval. *Arthroscopy Association of North America Annual Meeting*, Hollywood, Fla., May 2010.

Griffith CJ, LaPrade RF, Spiridonov S, Coobs BR, Ruckert P. Fibular Collateral Ligament Anatomical Reconstructions: A Prospective Outcomes Study. *14th ESSKA Congress*, Oslo, Norway, June 9-12, 2010.

Griffith CJ, LaPrade RF, Pepin S, Wijdicks CA, Goerke U, Michaeli S, Ellermann J. Untreated Posterolateral Knee Injuries Biomechanical and MRI Evaluation of an In Vivo Canine Model. *14th ESSKA Congress*, Oslo, Norway, June 9-12, 2010.

Hackett TR. ACL revision solutions with the use of bio-composite screws and the flip cutter. *Arthrex Faculty Symposium*, Naples, Fla., June 2010.

Hackett TR. Clavicle fracture technique and outcomes. *Live Surgical demonstration shoulder, Hospital for Special Surgery*, New York, N.Y., September 2010.

Hackett TR. Clavicle Fracture Solutions and Future Directions. *Sonoma Clavicle Symposium*, Providence, R.I., July 2010.

Hackett TR. Clavicle Fracture Solutions and Future Directions. *Sonoma Clavicle Symposium*, Boulder, Colo., June 2010.

Hackett TR. Current and Future Research in Clavicle Fracture Management. *Sonoma Clavicle Symposium*, New Orleans, La., February 2010.

Hackett TR. Management of glenohumeral instability in the face of glenoid bone loss. *Arthrex Faculty Symposium*, Naples, Fla., June 2010.

Hackett TR. Motion analysis and its role in Clavicle Malunion Evaluation. *Sonoma Clavicle Symposium*, New Orleans, La., February 2010.

Hackett TR. SLAP repair technique. *Arthrex Faculty Symposium*, Naples, Fla., June 2010.

Heuer HJD, Boykin RE, Hardt J, Petit CJ, Millett PJ. Decision-making in Treating Diaphyseal Clavicle Fractures: Is there Agreement among Surgeons? *Doctoral Candidate Seminar "Jour Fixe" - of the Institute for Social Medicine and the Institute for Cancer Epidemiology*, University Hospital Schleswig-Holstein Campus, Luebeck, Germany, May 2010.

Heuer HJD, Boykin RE, Hardt J, Petit CJ, Millett PJ. Decision-making in treating diaphyseal clavicle fractures: is there agreement among surgeons? *5th International Congress on Science and Skiing*, St. Christoph am Arlberg, Austria, December 2010.

Heuer HJD, Boykin RE, Hardt J, Petit CJ, Millett PJ. Decision-Making in Treating Diaphyseal Clavicle Fractures: Is there Agreement among Surgeons? Poster, *American Academy of Orthopaedic Surgeons*, New Orleans, La., March 2010.

Hurst J, Horan MP, Chris E, Millett PJ. Comparison of non-op, IM pinning and plate fixations for mid shaft clavicle fractures. Poster, *American Academy of Orthopaedic Surgeons*, New Orleans, La., March 2010.

Johansen S, Pietrini SD, Ziegler CJ, Westerhaus BD, Wijdicks CA, Anderson CJ, Engebretsen L, LaPrade RF. Radiographic Landmarks for Tunnel Positioning in Double-Bundle ACL Reconstructions. *14th European Society of Sports Traumatology, Knee Surgery, and Arthroscopy (ESSKA) Annual Congress*, Oslo, Norway, June 9-12, 2010.

Johansen S, Westerhaus BD, Wijdicks CA, Anderson CJ, Engebretsen L, LaPrade RF. Biomechanical correlation between common clinical examinations to determine ACL integrity. *14th European Society of Sports Traumatology, Knee Surgery, and Arthroscopy (ESSKA) Annual Congress*, Oslo, Norway, June 9-12, 2010.

LaPrade RF. Anatomy and Diagnosis of Posterolateral Knee Injuries, *13th Brazilian Congress of Knee Surgery Meeting*, Porto de Galinhas-PE, Brazil, March 25-29, 2010.

LaPrade RF. Surgical Treatment of Acute Posterolateral Knee Injuries, *13th Brazilian Congress of Knee Surgery Meeting*, Porto de Galinhas-PE, Brazil, March 25-29, 2010.

LaPrade RF. Surgical Treatment of Chronic Posterolateral Knee Injuries, *13th Brazilian Congress of Knee Surgery Meeting*, Porto de Galinhas-PE, Brazil, March 25-29, 2010.

LaPrade RF. Posterolateral Corner: Treatment of Acute and Chronic Injuries. *The Steadman Clinic 2010 AANA Traveling Fellows Academic Session*, Vail, Colo., May 3, 2010.

LaPrade RF. Elucidation of the Dark Side of the Knee - A Decade of Focused Research on Posterolateral Knee Injuries. *United States Navy Southwest Resident Research Symposium*, San Diego, Calif., May 11-12, 2010.

LaPrade RF. Posterolateral Corner: Treatment of Acute and Chronic Injuries. *United States Navy Southwest Resident Research Symposium*, San Diego, Calif., May 11-12, 2010.

LaPrade RF. Superficial MCL and Posteromedial Knee Injury: Don't Confuse With a Posterolateral Knee Injury. *United States Navy Southwest Resident Research Symposium*, San Diego, Calif., May 11-12, 2010.

LaPrade RF. Anatomy of the Medial Knee and Reconstruction of the sMCL and POL, *Pre-ESSKA Cadaver Knee Course*, Oslo, Norway, June 8, 2010.

LaPrade RF. Anatomy and Diagnosis of Posterolateral Knee Injuries, *14th ESSKA Congress*, Oslo, Norway, June 9-12, 2010.

LaPrade RF. Posterolateral Corner: Outcomes of Acute and Chronic Injuries, *14th ESSKA Congress*, Oslo, Norway, June 9-12, 2010.

LaPrade RF. Introduction, Anatomy, and Diagnosis of Medial Knee Injuries, *14th ESSKA Congress*, Oslo, Norway, June 9-12, 2010.

LaPrade RF. Elucidation of the Dark Side of the Knee – A Decade of Focused Research on Posterolateral Knee Injuries. *The Steadman Clinic Academic Session*, Vail, Colo., July 26, 2010.

LaPrade RF. Examination of the Athletic Knee. *Clinical Orthopaedic Society*, Denver, Colo., September 23, 2010.

LaPrade RF. Posterolateral Knee Injuries: Diagnosis and Management. *Clinical Orthopaedic Society*, Denver, Colo., September 23, 2010.

LaPrade RF. Moderator for “The Science of Evaluating/Quantifying Concussions – The Physical Evaluation of Concussions.” *Mayo Clinic Hockey Meeting*, Rochester, Mn., October 19, 2010.

LaPrade RF. Breakout Session Leader for “Recognizing, Diagnosing, Caring and RTP Players to Hockey Break Out Session.” *Mayo Clinic Hockey Meeting*, Rochester, Mn., October 20, 2010.

LaPrade RF. *Yale Grand Rounds.* Elucidation of the Dark Side of the Knee. New Haven, Conn., October 22, 2010.

LaPrade RF. *Yale Grand Rounds.* Examination of the Athletic Knee. New Haven, Conn., October 22, 2010.

LaPrade RF. Evaluation and Determination of Severity and Treatment of the Posterior Lateral Patholaxity of the Knee with or without Associated Cruciate Injury. *Andrews Paulos Research and Education Institute*, Gulf Breeze, Fla., November 4, 2010.

LaPrade RF. Managing Knee Dislocations. *Arthrex Surgical Skills Treatment of the Multi-ligamentous Injured Knee Workshop*. Los Angeles, Calif., November 6, 2010.

LaPrade RF. Examination of the Athletic Knee. *Steadman Philippon Research Institute 2010-2011 Orthopaedics & Spine Lecture Series*. November 16, 2010.

LaPrade RF. Panelist for “Acute Multi Ligament Injuries.” *AANA Fall Course*. Phoenix, Ariz., November 18, 2010.

LaPrade RF. A Simple Reproducible Technique for Posterolateral Corner Reconstruction. *AANA Fall Course*. Phoenix, Ariz., November 18, 2010.

LaPrade RF. “A Decade of Focused Research on Posterolateral Knee Injuries.” *Society of Military Orthopaedic Surgeons 52nd Annual Meeting*, Vail, Colo., December 15, 2010.

LaPrade RF. Understanding and Managing Posterolateral Knee Injury, *Metcalf 2010 Annual Meeting, Arthroscopic Surgery 2010*, Sun Valley, Idaho., January 30-February 2, 2010.

LaPrade RF. Posterolateral Knee Acute Treatment - Edited Case, *Metcalf 2010 Annual Meeting, Arthroscopic Surgery 2010*, Sun Valley, Idaho., January 30-February 2, 2010.

LaPrade RF. Chronic Posterolateral Reconstruction - Cadaveric Demo, *Metcalf 2010 Annual Meeting, Arthroscopic Surgery 2010*, Sun Valley, Idaho., January 30-February 2, 2010.

LaPrade RF, Wozniczka JK, Stellmaker M, Wijdicks CA. The “Fifth Ligament” of the Knee: Analysis of the Static Function of the Popliteus Tendon and Evaluation of an Anatomic Reconstruction. *Orthopaedic Research Society (ORS) Annual Meeting*, New Orleans, La., March 6-9, 2010.

LaPrade RF. Clinically Relevant Anatomy of the Medial Knee. *14th ESSKA Congress*, Oslo, Norway, June 9-12, 2010.

LaPrade RF, Ziegler C, Pietrini S, Westerhaus B, Anderson C, Johansen S, Engebretsen L. Landmarks for Tunnel Positioning in Single and Double Bundle ACL Reconstructions. *14th ESSKA Congress*, Oslo, Norway, June 9-12, 2010.

LaPrade RF. Take Home Messages. *14th ESSKA Congress*, Oslo, Norway, June 9-12, 2010.

LaPrade RF, Spiridonov S, Coobs BR, Ruckert P, Griffith CJ. Fibular Collateral Ligament Anatomic Reconstructions: A Prospective Outcomes Study. *AOSSM Annual Meeting*, Providence, R.I., July 15-18, 2010.

LaPrade RF, Wozniczka JK, Stellmaker M, Wijdicks CA. The "Fifth Ligament" of the Knee: Analysis of the Static Function of the Popliteus Tendon and Evaluation of an Anatomic Reconstruction. *Orthopaedic Research Society (ORS) Annual Meeting*, New Orleans, La., March 6-9, 2010.

Lertwanich P, Ejnisman L, Briggs KK, Philippon MJ. Relationship Between the Presence of a Rim Fragment and Intra-Articular Pathology of Patients With Femoroacetabular Impingement. Poster, *International Society for Hip Arthroscopy*, Cancun, Mexico, October 2010.

McCarthy MA, Camarda L, Wijdicks CA, Johansen S, Engebretsen L, LaPrade RF. Anatomic Posterolateral Knee Reconstructions Require a Popliteofibular Ligament Reconstruction Through a Tibial Tunnel. *Orthopaedic Research Society (ORS) Annual Meeting*, New Orleans, La., March 6-9, 2010.

Millett PJ. Advancements in Rotator Cuff Repair, *Arthrex Sports Medicine Course*, Vail, Colo., February 2010.

Millett PJ. Bony Bankart with PushLock Technique. *Arthrex @ Esch Meeting*. San Diego, Calif., June 2010.

Millett PJ. Grand Rounds. *Boland Symposium Mercy Hospital*, Scranton, Pa., May 2010.

Millett PJ. Knee OATS Auto/Allograft. *Arthrex Sports Medicine Course*, Vail, Colo., February 26-27, 2010.

Millett PJ. Latarjet Reconstruction for Anterior Shoulder Instability: Pitfalls & Pearls. *54th Annual Edward T. Smith Orthopaedic Lectureship American Shoulder and Elbow Surgeons 2010 Closed Meeting*, Scottsdale, Ariz., October 2010.

Millett PJ. Live Demo: Knee OATS Auto/Allograft. *Arthrex Sports Medicine Course*, Vail, Colo., February 2010.

Millett PJ. Live Demo: Rotator cuff repair. *Arthrex Sports Medicine Course*, Vail, Colo., February 2010.

Millett PJ. Management of the Acute Anterior Shoulder Dislocation: On and Off the Field. *Rocky Mountain Athletic Training Association Symposium*, Denver, Colo., April 2010.

Millett PJ. Pitfalls and Pearls plus commentary during the live surgical demonstration on Latarjet Reconstruction. *American Orthopaedic Society for Sports Medicine /International Society of Arthroscopy, Knee Surgery and Orthopedic Sports Medicine, Pre-Conference Program*, Providence, R.I., July 2010.

Millett PJ. Proximal Humerus Fractures – Diagnosis, Classification and Treatment. *Arthrex @ Esch Meeting*, San Diego, Calif., June 2010.

Millett PJ. Rotator Cuff Mastery. *American Academy of Orthopaedic Surgeons*, New Orleans, La., March 2010.

Millett PJ. Single vs Double Row Repair for Rotator Cuff Tears: Indications and Surgical Techniques. *54th Annual Edward T. Smith Orthopaedic Lectureship ASES 2010 Closed Meeting*, Scottsdale, Ariz., October 2010.

Millett PJ. Shoulder: AC/SC/Nerves/Fractures. *American Orthopaedic Society for Sports Medicine & American Academy of Orthopaedic Surgeons, Review Course for Subspecialty Certification in Ortho Sports Medicine*, Chicago, Ill., August 2010.

Millett PJ. Subscapularis Repair, Coracoplasty and Biceps Tenodesis. *54th Annual Edward T. Smith Orthopaedic Lectureship ASES 2010 Closed Meeting*, Scottsdale, Ariz., October 2010.

Millett PJ. SpeedBridge Rotator Cuff Repair Technique/Outcomes. *Arthrex @ Esch Meeting*, San Diego, Calif., June 2010.

Millett PJ. Subcoracoid Impingement and Coracoplasty. *Arthroscopy Association of North America Annual Meeting*, Hollywood, Fla., May 2010.

Millett PJ. Surgical Anatomy of 10 Common Upper Extremity Conditions: A Refresher for the General Orthopaedic Surgeon. *American Academy of Orthopaedic Surgeons*, New Orleans, La., March 2010.

Millett PJ. Surgical Repair of the Cuff: When to Open the Shoulder. *Alumni Association 92nd Annual Meeting, Hospital for Special Surgery*, New York, N.Y., November 2010.

Millett PJ. Visiting Professor for the John A. Feagin Sports Medicine Fellowship. West Point, N.Y., November 2010.

Millett PJ, Horan MP, Elser F. Comprehensive Arthroscopic Management (CAM) of Shoulder Osteoarthritis in Young Active Patients. Poster, *Arthroscopy Association of North America Annual Meeting*, Hollywood, Fla., May 2010.

Miyamoto RG, Duffy P, Ho C, Hackett T. Optimization of magnetic resonance imaging of the anterior bundle of the ulnar collateral ligament: A randomized controlled trial of 3 patient positions. Paper SS-26. *2010 Annual Meeting of the Arthroscopy Association of North America*, Hollywood, Fla., May 20-23, 2010.

Pennock AT, Philippon MJ. Arthroscopic ligamentum teres reconstruction: Technique and Early Outcomes. *International Society for Hip Arthroscopy (ISHA) Annual Scientific Meeting*. Cancun, Mexico, Oct 8-9, 2010.

Philippon MJ. The Treatment of Intra-articular Hip Pathology in Pro-Athletes, *2010 Baseball Team Medicine Conference*. San Francisco, Calif., January 2010.

Philippon MJ. The Athletes Hip and Groin: Evaluation and Diagnosis, *11th AAOS/AOSSM Annual Sports Medicine Course #3802*. Bonita Springs, Fla., February 2010. (

Philippon MJ. Role of Hip Arthroscopy in Athletes: Tips and Techniques, *11th AAOS/AOSSM Annual Sports Medicine Course #3802*. Bonita Springs, Fla., February 2010.

Philippon MJ, Souza B, Briggs KK. Arthroscopic Reconstruction of the Hip Labrum, Video. *2010 AAOS Annual Meeting*. New Orleans, La., March 2010.

Philippon MJ. Hip Arthroscopy Pearls: State of the Art Instructional Course #171, *2010 AAOS Annual Meeting*. New Orleans, La., March 2010.

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IN THE MEDIA

A close-up look at medical research in Vail

Students from local middle and high schools see what the scientific method can do

Scott N. Miller, Vail Daily

Like many high school students, Jamie Barnett has often wondered if the scientific method is good for anything besides homework and test questions. Recently, she got an up-close look at the scientific method in action.

Barnett, a 15-year-old Battle Mountain High School student, was part of a group of local middle and high-school students who got an up-close look at some of the research going on at the Steadman Philippon Research Institute at Vail Valley Medical Center. The students got a good look at some of the work local cardiologist Larry Gaul is doing, too.

But in the far corners of the hospital building, the people at Steadman Philippon gave these students—all part of the Eagle County School District's "Eagle Program" for gifted and talented kids—a look at what leading-edge researchers do. And it all starts with the scientific method.

Robotics engineer Mary Goldsmith put the students through a quick exercise about how the Institute's robots—one of which worked in the auto industry in a former life—can help test a hypothesis.

Goldsmith laid out a fairly simple exercise—how a research intern might determine the effectiveness of ligaments of various sizes in knee surgery—then asked the students how



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Steadman Philippon Research Institute Director of Biomechanics Coen Wijdicks, Ph.D., left, shows local students a model of a knee that the research department's robot can mimic for knee surgery research. The students, part of the Eagle County School District's "Eagle Program," toured the institute and other parts of Vail Valley Medical Center during a tour.



Dominique Taylor / dtaylor@vaildaily.com

Battle Mountain student Trexler Hirn, 15, left, tries out an EMG system that senses muscle activity as Erik Giphart, right, director of the Steadman Philippon Research Institute's BioMotion Laboratory, explains how it can be used to help with injury rehabilitation during a student tour of the lab.

they might arrange their work in terms of sample size, number of categories, and other factors.

Dr. Coen Wijdicks, the Institute's Director of Biomechanics, then showed the students a model of a knee and explained how the model, along with the Institute's robots, can help researchers answer questions about what surgical methods might produce the best results for patients.

After talking with Goldsmith in the robotics lab, the students met Erik Giphart, who talked about how the Institute uses imaging that also helps create video games to examine athletes' motion and how it might lead to injury.

"This is incredibly useful," teacher Deb Harrison said. "These kids are getting exposure to cutting-edge research in their own back yard."

The students on this trip had all listed an interest in robotics, engineering, or medicine on the individual learning plans all "Eagle Program" students complete.

For Barnett, the demonstrations helped reinforce her goal of becoming a physical therapist.

"It was really cool," she said. "I really liked the X-ray motion capture."

Fellow Battle Mountain student Trixler Hirn was also impressed.

"I know what I'd be getting into," he said.

Barnett said going through the morning exercise with Goldsmith gave her a look at what the proofs, math, and other work in school might lead to.

"You go through school and think, 'How are we going to use this?'" she said. "It really will come in handy."

Jaime Trudeau is still in seventh grade at Gypsum Creek Middle School, so she hasn't had the kind of work in math and



Fifth-graders from the Vail Mountain School sent "thank you" notes following their tour of the new biomechanics laboratory this past May.

science the high schoolers have. At least not yet. But she saw some of the work she'll need to do if she wants to achieve her goal of working in sports medicine in Vail.

"I need to work more on the scientific method," Trudeau said.

RECOGNITION

German-Speaking Association of Arthroscopy Endorses Visiting Scholar Program Directed by Dr. Peter J. Millett and Sponsored by Arthrex

The German-speaking Association of Arthroscopy (AGA) is endorsing and supporting a one-year Research and Clinical Visiting Scholar Program with Dr. Peter J. Millett at the Steadman Philippon Research Institute. The selected Fellow must be an "up and coming" orthopaedic surgeon with an interest in shoulder surgery and arthroscopy and must have presented or authored at least three lectures or publications on shoulder arthroscopy. He or she will be mentored by Dr. Peter Millett, chief of shoulder service for the Steadman Clinic, and will conduct research in the Biomechanics Research Laboratory and assist in the clinical practice.

AGA is Europe's largest professional society for arthroscopy with 2,800 members. It was founded in 1983 in Zurich, Switzerland, in collaboration with German, Austrian, and



Peter Millett, M.D.

Swiss doctors. AGA organizes an annual conference, provides grants and scholarships, and publishes the journal *Arthroscopy*. "The endorsement of our program by an international educational body with the prestige of AGA really sets this program apart and brings it to a new level of academic credibility," said Dr. Millett.

The Shoulder Visiting Scholars Program was developed in 2006 by Dr. Millett and has been generously supported by Arthrex, Inc., an orthopaedic medical device company. Arthrex's founder and president, Reinhold Schmieding, who has had a long-time commitment to surgeon education, commented, "Arthrex is pleased to support the visiting scholars' program and to contribute annually to the Institute."

The sponsorship of a research scholar endorsed by AGA exemplifies Arthrex's commitment to orthopaedic research to advance knowledge for the global medical community and to help surgeons treat their patients better.

Arthroscopy Association of North America Awards Grant to Institute

Dr. Peter Millett from the Steadman Clinic and Senior Scientist Erik Giphart, Ph.D. from the Biomechanics Research Department of the Steadman Philippon Research Institute, were awarded a prestigious \$25,000 Research Grant by the Arthroscopy Association of North America for 2011. After a careful peer review of 38 different proposals by scientists and clinicians, their grant proposal investigating rotator cuff tears and repair was one of three that were awarded.

Rotator cuff tears are very common shoulder injuries, and not all rotator cuff repairs lead to fully healed tendons and excellent function. The purpose of this one-year study is to accurately measure the motion inside the shoulder joint using our biplane fluoroscopy system in patients with full-thickness rotator cuff tears both before and after surgical repair. The biplane fluoroscopy system is a unique stereoscopic x-ray system capable of measuring very small (sub-millimeter) motions inside the shoulder.

We believe that improvements in shoulder motion will be highly associated with improvements in functional and patient outcomes. This study will help improve patient care by helping determine whether treatment needs to be more focused on treating pain or on restoring proper motion inside the shoulder joint. Moreover, improved care of rotator cuff patients will lead to improved activity and quality of life for these patients. This research grant further validates the Steadman Philippon Research Institute as an international leader in developing new means to make people healthy.

The Arthroscopy Association of North America is an Accredited Council for Continuing Medical Education-approved organization. The Association exists to promote, encourage, support, and foster, through continuing medical

education functions, the development and dissemination of knowledge in the discipline of arthroscopic surgery. This is done to improve upon the diagnosis and treatment of diseases and injuries of the musculoskeletal system.

Institute Research Leads the World Research Project Recognized at International Conference

ISAKOS Ranks Institute Research Paper in the Top 10

Outcomes of Treatment of Acute Grade III Isolated and Combined Posterolateral Knee Injuries: A Prospective Case Series, was awarded as a top 10 e-poster out of more than 1,000 submitted at the eighth biennial meeting of The International Society of Arthroscopy, Knee Surgery, and Orthopaedic Sports Medicine (ISAKOS) held in Rio de Janeiro, Brazil, May 15-19. The authors, Robert LaPrade, M.D., Ph.D., Chief Medical Research Officer for the Steadman Philippon Research Institute, and Andrew G. Geeslin, M.D., University of Minnesota Medical School (who helped write up the study while on a medical student research rotation at the Institute) investigated whether acute grade III posterolateral knee injuries are best treated with repairs, reconstruction, or a hybrid of both.



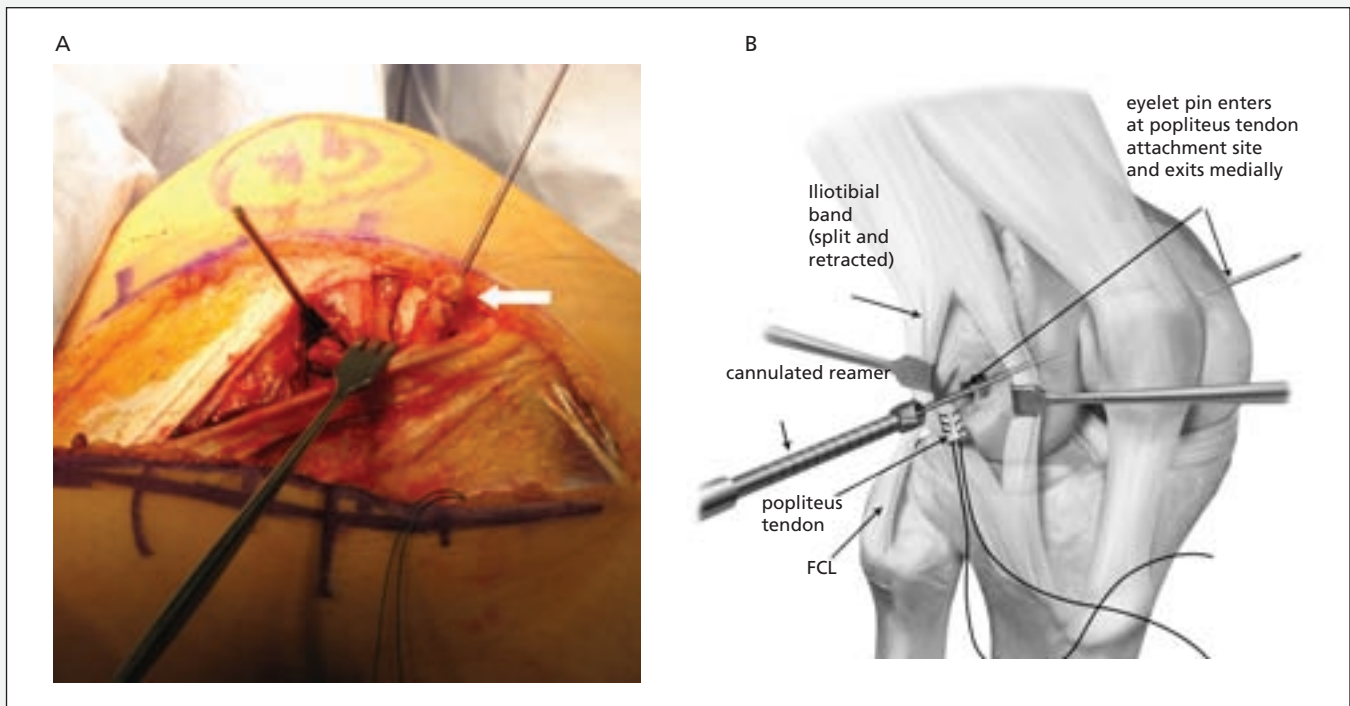
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Anteroposterior varus stress radiographs (at 20° of knee flexion) of a patient with an injury to the posterolateral corner of the left knee.

A and B: Preoperative radiographs of the right and left knees showing a side-to-side difference of 7 mm.

C: Radiograph of the left knee at the final follow-up evaluation. Following reconstruction of the posterolateral corner and the anterior cruciate ligament and repair of the lateral meniscus and the lateral capsular ligament, the side-to-side difference was -1 mm.

The purpose of the research was to report on the subjective and objective outcomes of acute treatment with a combined anatomic repair and/or reconstruction of these injuries, often referred to as “the dark side” of the knee because it is recognized as the most complex and difficult to treat when injured. In effect, this research represents the culmination of



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A: Photograph of a right knee showing sutures placed in the femoral attachment of the avulsed popliteus tendon (arrow) in preparation for a recess procedure.

B: Illustration depicting the popliteus recess procedure. The cannulated reamer is shown producing a recess for femoral fixation of the popliteus tendon. FCL = fibular collateral ligament.

over a decade of work and more than 50 peer-reviewed publications by Dr. LaPrade.

The paper was also published in *The Journal of Bone and Joint Surgery*, the premier peer-reviewed orthopaedic journal, on September 21, 2011 | Vol. 93, Issue 18.

The study elicited the following discussion points:

- Acute repairs of avulsed structures and reconstructions of non-repairable acute grade III PLC injuries showed significantly improved objective and subjective patient outcomes.
- Concurrent reconstructions of concomitant cruciate ligament tear(s) are both possible and also are recommended without any risk of increase in patient complications or postoperative stiffness.

- Early postoperative motion and functional activities within the limits of “safe zone” motion determined by the surgeon not only results in improved patient outcomes but also does not result in the surgical treatment stretching out over time. This is a major advancement in the treatment of this particular injury because many centers cast or immobilize patients for 3-6 weeks after surgical treatment due to concerns that early motion may result in failure of the repair.

ISAKOS was established to develop, support and promote charitable, scientific and literary works that disseminate and further the increased knowledge of arthroscopy, knee surgery and orthopaedic sports medicine. ISAKOS works with regional and local societies that share similar goals, providing a larger arena where these national societies and continental organizations can combine their strengths in an international forum.



Robert F. LaPrade, M.D., Ph.D., and Henry B. Ellis, Jr., M.D.

ASSOCIATES



THE INSTITUTE IS PROUD TO RECOGNIZE ITS TEAM OF ASSOCIATES WHO CARRY OUT THE RESEARCH AND EDUCATIONAL MISSION IN VAIL. THE STAFF HAS BEEN SELECTED FOR ITS DIVERSE TRAINING AND BACKGROUND IN BIOMECHANICS, ENGINEERING, CLINICAL RESEARCH, IMAGING RESEARCH, VETERINARY SCIENCE, AND COMPUTER SCIENCE. TOGETHER, THE STAFF MEMBERS TAKE A MULTIDISCIPLINARY APPROACH TO THEIR WORK IN SOLVING ORTHOPAEDIC SPORTS MEDICINE PROBLEMS.

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John Hibben

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Coordinator

Independent Auditors' Report

To the Board of Directors
Steadman Philippon Research Institute
Vail, Colorado

We have audited the accompanying consolidated statements of financial position of Steadman Philippon Research Institute and Affiliate (collectively, the "Institute") as of December 31, 2010 and 2009, and the related consolidated statements of activities, functional expenses, and cash flows for the years then ended. These consolidated financial statements are the responsibility of the Institute's management. Our responsibility is to express an opinion on these consolidated financial statements based on our audits.

We conducted our audits in accordance with auditing standards generally accepted in the United States of America. Those standards require that we plan and perform the audit to obtain reasonable assurance about whether the consolidated financial statements are free of material misstatement. An audit includes consideration of internal control over financial reporting as a basis for designing audit procedures that are appropriate in the circumstances, but not for the purpose of expressing an opinion on the effectiveness of the Institute's internal control over financial reporting. Accordingly, we express no such opinion. An audit also includes examining, on a test basis, evidence supporting the amounts and disclosures in the consolidated financial statements, assessing the accounting principles used and significant estimates made by management, as well as evaluating the overall financial statement presentation. We believe that our audits provide a reasonable basis for our opinion.

In our opinion, the consolidated financial statements referred to above present fairly, in all material respects, the financial position of Steadman Philippon Research Institute and Affiliate as of December 31, 2010 and 2009, and the results of their activities and their cash flows for the years then ended in conformity with accounting principles generally accepted in the United States of America.

As discussed in Note 12 to the consolidated financial statements, an error related to the exclusion of tax expense and liabilities as of and for the years ended December 31, 2009 and 2008, was discovered during the current year. Accordingly, the 2009 consolidated financial statements have been restated and an adjustment has been made to net assets as of January 1, 2009 to correct the error.

Ehrhardt Keefe Steiner & Hottman PC

August 26, 2011
Denver, Colorado

Statements of Financial Position

ASSETS

	December 31	
	2010	2009 (Restated)
Current assets		
Cash and cash equivalents	\$ 1,613,039	\$ 1,755,593
Accounts receivable	342,000	-
Accounts receivable, related parties	2,349	1,673
Contributions receivable, current portion (Note 3)	338,200	131,400
Contributions receivable, related parties	750	750
Prepaid expenses and other assets	2,014	2,014
Investments (Note 2)	4,801,823	4,292,010
Total current assets	7,100,175	6,183,440
Contributions receivable, less current portion (Note 3)	839,327	115,026
Property and equipment, net (Note 4)	2,300,316	2,591,539
Investments - other	227,050	227,050
Total assets	\$ 10,466,868	\$ 9,117,055

LIABILITIES AND NET ASSETS

Current liabilities		
Accounts payable	58,344	39,312
Accrued expenses	253,105	448,336
Line-of-credit (Note 5)	340,019	15,146
Current portion of long-term debt (Note 6)	10,841	10,339
Current portion of capital leases (Note 7)	434,150	417,007
Current portion of deferred rent	153,622	153,622
Total current liabilities	1,250,081	1,083,762
Long-term liabilities		
Long-term debt, net of current portion (Note 6)	7,520	18,358
Capital leases, net of current portion (Note 7)	988,354	1,422,529
Deferred tax liability	101,000	51,000
Deferred rent, net of current portion	307,242	460,866
Total liabilities	2,654,197	3,036,515
Commitments (Note 12)		
Net assets		
Unrestricted	6,227,713	5,232,046
Temporarily restricted (Note 9)	1,584,958	848,494
Total net assets	7,812,671	6,080,540
Total liabilities and net assets	\$ 10,466,868	\$ 9,117,055

See Notes to Financial Statements

Statements of Activities

	For the Years Ended					
	December 31, 2010			December 31, 2009		
	Unrestricted	Temporarily Restricted	Total	Unrestricted	Temporarily Restricted (Restated)	Total
REVENUES, GAINS, AND OTHER SUPPORT						
Contributions	\$ 1,777,762	\$ 1,444,760	\$ 3,222,522	\$ 1,385,633	\$ 392,676	\$ 1,778,309
Grants	-	218,578	218,578	-	34,871	34,871
Corporate sponsors	853,566	500,032	1,353,598	519,140	538,666	1,057,806
Fundraising events	299,221	-	299,221	285,171	-	285,171
Bioskills lab	15,000	-	15,000	40,541	-	40,541
Video income	2,190	-	2,190	3,759	-	3,759
MRI and other income	1,262,839	-	1,262,839	1,133,092	-	1,133,092
	4,210,578	2,163,370	6,373,948	3,367,336	966,213	4,333,549
Net assets released from restrictions	1,426,906	(1,426,906)	-	1,324,591	(1,324,591)	-
Total revenues, gains, and other support	5,637,484	736,464	6,373,948	4,691,927	(358,378)	4,333,549
Expenses and losses						
Biomechanics research	1,138,534	-	1,138,534	925,896	-	925,896
Basic science	232,257	-	232,257	246,266	-	246,266
Bioskills and education	434,481	-	434,481	432,392	-	432,392
Clinical research	817,412	-	817,412	661,966	-	661,966
Information services	201,525	-	201,525	197,175	-	197,175
Imaging research	693,488	-	693,488	608,567	-	608,567
Management and general	580,718	-	580,718	487,933	-	487,933
Fundraising	659,574	-	659,574	593,073	-	593,073
Total expenses and losses	4,757,989	-	4,757,989	4,153,268	-	4,153,268
Other income (expense)						
Investment return	527,423	-	527,423	755,103	-	755,103
Interest expense	(69,251)	-	(69,251)	(56,920)	-	(56,920)
Total other income	458,172	-	458,172	698,183	-	698,183
Provision for income tax	(342,000)	-	(342,000)	(222,000)	-	(222,000)
Change in net assets	995,667	736,464	1,732,131	1,014,842	(358,378)	656,464
Net assets at beginning of year	5,232,046	848,494	6,080,540	4,217,204	1,206,872	5,424,076
Net assets at end of year	\$ 6,227,713	\$ 1,584,958	\$ 7,812,671	\$ 5,232,046	\$ 848,494	\$ 6,080,540

See Notes to Financial Statements

Statements of Cash Flows

	For the Year Ended December 31	
	2010	2009 (Restated)
Cash flows from operating activities		
Change in net assets	\$ 1,732,131	\$ 656,464
Adjustments to reconcile change in net assets to net cash provided by operating activities		
Depreciation and amortization expense	615,692	601,970
Net gain on investments	(510,425)	(743,500)
Donated real estate	-	(227,050)
Donated stock	(22,346)	(15,000)
Amortization of deferred rent	(153,624)	(153,622)
Deferred taxes	50,000	7,000
Changes in assets and liabilities		
Accounts receivable	(342,676)	(761)
Contributions receivable	(931,101)	69,326
Prepaid expenses and other assets	-	267
Accounts payable	19,032	25,309
Accrued expenses	(195,231)	321,849
	(1,470,679)	(114,212)
Net cash provided by operating activities	261,452	542,252
Cash flows from investing activities		
Purchase of investments	-	(919,016)
Proceeds from sale of investments	22,958	589,959
Additions to buildings and equipment	(324,469)	(45,271)
Net cash used in investing activities	(301,511)	(374,328)
Cash flows from financing activities		
Payments on capital leases	(417,032)	(238,083)
Payments on long-term debt	(10,336)	(3,339)
Net borrowings on line-of-credit	324,873	15,146
Net cash used in financing activities	(102,495)	(226,276)
Net decrease in cash and cash equivalents	(142,554)	(58,352)
Cash and cash equivalents at beginning of year	1,755,593	1,813,945
Cash and cash equivalents at end of year	\$ 1,613,039	\$ 1,755,593

Supplemental disclosure of cash flow information:

Cash paid for interest was \$69,251 and \$56,920 for the years ended December 31, 2010 and 2009, respectively.

Supplemental disclosure of non-cash activity:

During the year ended December 31, 2009, the Institute recorded \$768,110 of additions to leasehold improvements that were recorded as deferred rent concessions paid by the landlord.

During the year ended December 31, 2009, \$32,036 of the outstanding balance on the line-of-credit was converted to a note payable.

See Notes to Financial Statements

Statement of Functional Expenses

For the Year Ended December 31, 2010

	Program Services						Support Services			
	Biomechanics Research	Basic Science	Bioskills and Education	Clinical Research	Information Services	Imaging Research	Total	Management and General	Fundraising	Total
Salaries and benefits	\$ 751,238	\$ 56,312	\$ 183,551	\$ 598,311	\$ 129,579	\$ 152,324	\$ 1,871,315	\$ 337,661	\$ 161,472	\$ 2,370,448
Consulting and contract labor	37,805	99,571	1,117	69,744	11,528	51,878	271,643	6,485	83,745	361,873
Supplies (office, computer, lab)	33,464	362	45,534	13,300	2,501	3,003	98,164	5,415	2,092	105,671
Events and fundraising	-	-	-	-	-	-	-	10,000	173,898	183,898
Printing	14,346	429	629	12,429	678	326	28,837	3,459	66,309	98,605
Maintenance and supplies	29,206	1	2,496	11,664	1,146	1,048	45,561	6,235	3,977	55,773
Rent and leases	25,247	10,034	17,392	11,298	21,125	38,684	123,780	7,583	2,998	134,361
Telephone and utilities	34,707	3,404	22,918	16,394	8,468	15,784	101,675	11,876	3,593	117,144
Travel	44,247	39,847	-	19,037	89	18,393	121,613	36,800	14,309	172,722
Legal and accounting	37,060	-	8,893	5,781	3,666	6,523	71,923	13,899	4,294	90,116
Fellows	-	-	36,608	-	-	4,567	41,175	-	-	41,175
Education meetings/lectures	-	-	22,673	-	-	-	22,673	-	-	22,673
Direct mail/planned giving	-	-	-	-	-	-	-	-	96,647	96,647
Meals and entertainment	4,800	2,830	(5,340)	3,425	291	1,248	7,254	13,040	11,102	31,396
Gifts	1,752	2,169	195	1,809	389	389	6,703	24,668	1,428	32,799
Postage	2,067	35	8,146	23,023	1,356	132	34,759	3,065	18,456	56,280
Insurance	1,115	-	90	1,252	-	-	2,457	72,960	159	75,576
Meeting fees/registrations and dues and subscriptions	12,731	3,820	22,819	5,706	500	-	45,576	2,295	763	48,634
Bank/credit card fees	-	-	-	-	-	-	-	11,707	-	11,707
Meetings (Board and SAC)	-	13,424	-	-	-	-	13,424	1,032	-	14,456
Grant writing/medical editing	450	-	-	450	-	-	900	-	8,050	8,950
Advertising	2,000	-	90	-	-	-	2,090	5,062	4,241	11,393
	1,032,235	232,238	367,811	803,623	181,316	294,299	2,911,522	573,242	657,533	4,142,297
Depreciation and amortization	106,299	19	66,670	13,789	20,209	399,189	606,175	7,476	2,041	615,692
Total	\$ 1,138,534	\$ 232,257	\$ 434,481	\$ 817,412	\$ 201,525	\$ 693,488	\$ 3,517,697	\$ 580,718	\$ 659,574	\$ 4,757,989

See Notes to Financial Statements

Statement of Functional Expenses

For the Year Ended December 31, 2009

	Program Services						Support Services		
	Biomechanics Research	Basic Science	Bioskills and Education	Clinical Research	Information Services	Imaging Research	Management and General	Fundraising	Total
Salaries and benefits	\$ 641,203	\$ 6,548	\$ 132,380	\$ 513,788	\$ 117,766	\$ 96,516	\$ 345,074	\$ 141,410	\$ 1,994,685
Consulting and contract labor	19,820	96,000	440	21,103	2,070	50,884	4,307	95,803	290,427
Supplies (office, computer, lab)	36,891	- 102,06	1	15,233	10,117	696	3,940	6,819	175,757
Events and fundraising	17	-	7	20	7	-	14	115,671	115,736
Printing	3,668	-	54	6,827	97	207	394	112,016	123,263
Maintenance and supplies	20,268	-	2,690	7,134	11,601	1,058	5,056	3,890	51,697
Rent and leases	19,668	7,264	17,750	10,439	18,927	38,423	2,629	3,334	118,434
Telephone and utilities	34,526	-	25,254	9,504	13,674	17,217	12,216	4,707	127,098
Travel	10,877	2,199	-	16,136	467	1,692	17,187	10,824	59,382
Legal and accounting	25,234	-	8,404	14,582	3,507	924	9,419	5,392	67,462
Fellows	-	-	39,363	-	-	-	-	-	39,363
Education meetings/lectures	-	-	8,403	-	-	-	-	-	8,403
Direct mail/planned giving	-	-	-	-	-	-	-	68,576	68,576
Meals and entertainment	2,869	397	8,435	3,651	380	1,900	(1,094)	1,131	17,669
Gifts	2,953	1,639	328	3,570	656	328	2,405	2,018	13,897
Postage	512	91	12,618	11,614	722	-	1,625	9,345	36,527
Insurance	710	-	48	799	-	67	58,577	92	60,293
Meeting fees/registrations and dues and subscriptions	5,714	100	10,375	4,329	149	-	1,700	1,122	23,489
Bank/credit card fees	-	-	-	-	-	-	14,539	-	14,539
Meetings (Board and SAC)	-	2,108	-	-	-	-	274	-	2,382
Grant writing/medical editing	-	-	-	-	-	-	-	9,000	9,000
Research grant	-	129,920	-	-	-	-	-	-	129,920
Advertising	-	-	90	464	-	-	2,745	-	3,299
	824,930	246,266	368,700	649,193	180,140	209,912	481,007	591,150	3,551,298
Depreciation and amortization	100,966	-	63,692	12,773	17,035	398,655	6,926	1,923	601,970
Total	\$ 925,896	\$ 246,266	\$ 432,392	\$ 661,966	\$ 197,175	\$ 608,567	\$ 487,933	\$ 593,073	\$ 4,153,268

Notes to Financial Statements

NOTE 1 - ORGANIZATION AND SUMMARY OF SIGNIFICANT ACCOUNTING POLICIES

Organization

The Steadman Philippon Research Institute (“SPRI”), a non-profit organization, was incorporated in the state of Colorado on February 22, 1999 and is a tax-exempt organization under Section 501(c)(3) of the Internal Revenue Code (“IRC”). SPRI is located in Vail, Colorado, and is dedicated to keeping people of all ages physically active through orthopedic sports medicine research and education in the areas of arthritis, healing, rehabilitation, and injury. SPRI’s primary sources of support are public donations, grants, special events, and corporate partners. Prior to January 1, 2010, SPRI was known as the Steadman Hawkins Research Foundation.

SPRI has agreements with several corporations who sponsor SPRI’s research. This research is for the general use of and publication by SPRI. These agreements are recorded as income in the year the research is performed and payment is received.

In 2010, SPRI created the SPRI Leasing Corporation, a wholly-owned subsidiary corporation, in order to hold the assets, liabilities, and revenues derived from the SPRI’s MRI scanner. During 2009, the balances and activities related to the MRI scanner were included in SPRI’s amounts.

Principles of Consolidation

The reporting entity referred to as Steadman Philippon Research Institute and Affiliate (collectively, the “Institute”) includes the accounts of SPRI and SPRI Leasing Corporation. All intercompany accounts and transactions have been eliminated in consolidation.

Basis of Presentation

The Institute reports information regarding its financial position and activities according to three classes of net assets: unrestricted net assets, temporarily restricted net assets, and permanently restricted net assets.

Unrestricted amounts are those currently available at the discretion of the Board of Directors for use in the Institute’s operations, fundraising, and certain programs.

Temporarily restricted amounts are monies restricted by donors specifically for certain purposes or programs; these monies are available for use by the Institute for the restricted purpose.

Permanently restricted amounts are assets that must be maintained permanently by the Institute as required by the donor; but the Institute is permitted to use or expend part or all of any income derived from those assets. As of December 31, 2010 and 2009, the Institute did not have any permanently restricted amounts.

Cash and Cash Equivalents

The Institute considers all highly liquid investments with a maturity of three months or less when purchased to be cash equivalents, unless held for reinvestment as part of the investment portfolio or otherwise encumbered. The Institute utilizes a sweep account that is not federally insured.

Accounts and Contributions Receivable

Accounts and contributions receivable represent amounts due from individuals and organizations in support of the Institute’s programs. Management considers all amounts collectible; therefore, no allowance has been recorded as of December 31, 2010 and 2009.

Unconditional gifts expected to be collected within one year are reported at their net realizable value. Unconditional gifts expected to be collected in future years are reported at the present value of estimated future cash flows. The resulting discount is amortized using the level-yield method and is reported as contribution revenue.

Investments

The Institute reports investments in equity securities with readily determinable fair values and all investments in debt securities at their fair values with unrealized gains and losses included in the consolidated statements of activities.

The Institute holds alternative investments, which are not readily marketable and are carried at fair value as provided by the investment managers. The Institute reviews and evaluates the value provided by the investment managers and agrees with the valuation methods and assumptions used in determining the fair value of the alternative investments. Those estimated fair values may differ significantly from the values that would have been used had a ready market for these securities existed.

Investment return includes dividend, interest, and other investment income; realized and unrealized gains and losses on investments carried at fair value; and realized gains and losses on other investments. Investment return is reflected in the consolidated statements of activities as unrestricted, temporarily restricted, or permanently restricted based upon the existence and nature of any donor or legally imposed restrictions.

Property and Equipment

Land, buildings and improvements, and equipment purchased by the Institute are recorded at cost. Donated fixed assets are capitalized at fair value at the date of donation. Depreciation is provided on the straight-line method based upon the estimated useful lives of the assets, which range from five to forty years. Leasehold improvements are amortized over the shorter of the lease term plus renewal options or the estimated useful lives of the improvements.

Other Investments

During 2009, the Institute received a contribution of real estate, which is recorded at estimated fair value. The investment is assessed for impairment if events and circumstances warrant such a review.

Deferred Rent

Tenant improvement allowances paid by the landlord are recorded as deferred rent and are recognized as a reduction of rent expense over the term of the related lease.

Contributions

Gifts of cash and other assets received without donor stipulations are reported as unrestricted support. Gifts received with a donor stipulation that limits their use are reported as temporarily or permanently restricted support. When a donor-stipulated time restriction ends or purpose restriction is accomplished, temporarily restricted net assets are reclassified to unrestricted net assets and reported in the consolidated statements of activities as net assets released from restrictions.

Gifts of land, buildings, equipment, and other long-lived assets are reported as unrestricted support unless explicit donor stipulations specify how such assets must be used, in which case the gifts are reported as temporarily or permanently restricted support. Absent explicit donor stipulations for the time long-lived assets must be held, expirations of restrictions resulting in reclassification of temporarily restricted net assets as unrestricted net assets are reported when the long-lived assets are placed in service.

Revenue Recognition

MRI and other income are recognized at the time the services are provided.

Functional Expenses

Expenses incurred directly for a program service are charged to such program. Allocations of certain overhead costs are also allocated to programs on a pro-rata basis of total space occupied by each service or by headcount.

Income Taxes

SPRI is exempt from federal income taxes under Section 501(c)(3) of the IRC. SPRI is not a private foundation within the meaning of Section 509(a) of the IRC.

SPRI Leasing Corporation is a for-profit corporation that is required to file a corporate income tax return for its operations and recognizes deferred tax assets and liabilities based upon differences between its basis of assets for tax and financial reporting purposes.

The Institute applies a more-likely-than-not measurement methodology to reflect the financial statement impact of uncertain tax positions taken or expected to be taken in a tax return. After evaluating the tax positions taken, none are considered to be uncertain; therefore, no amounts have been recognized as of December 31, 2010. If incurred, interest and penalties associated with tax positions are recorded in the period assessed as general and administrative expense. No interest or penalties have been assessed as of December 31, 2010. Tax years that remain subject to examination include 2007 through the current year for the federal returns and 2006 through the current year for the state returns.

Use of Estimates

The preparation of financial statements in conformity with generally accepted accounting principles requires management to make estimates and assumptions that affect the reported amounts of assets and liabilities, disclosure of contingent assets and liabilities at the date of the financial statements, and the reported amounts of revenue, expenses, gains, losses, and other changes in net assets during the reporting period. Actual results could differ from those estimates.

Subsequent Events

The Institute has evaluated subsequent events through August 26, 2011, the date the consolidated financial statements were available to be issued, and has identified no subsequent events that require disclosure.

NOTE 2 - FAIR VALUE MEASUREMENTS AND INVESTMENTS

The Institute values its financial assets and liabilities based on the price that would be received to sell an asset or paid to transfer a liability in an orderly transaction between market participants at the measurement date. In order to increase consistency and comparability in fair value measurements, the following fair value hierarchy prioritizes observable inputs used to measure fair value into three broad levels, which are described below:

Level 1: Quoted prices in active markets for identical assets or liabilities that are accessible at the measurement date. The fair value hierarchy gives the highest priority to Level 1 inputs.

Level 2: Other than quoted prices that are observable for the asset or liability either directly or indirectly.

Level 3: Unobservable inputs where little or no market data is available, which requires the reporting entity to develop its own assumptions.

In determining fair value, the Institute utilizes valuation techniques that maximize the use of observable inputs and minimize the use of unobservable inputs to the extent possible as well as considers counterparty credit risk in its assessment of fair value. These classifications (Levels 1, 2, and 3) are intended to reflect the observability of inputs used in the valuation of investments and are not necessarily an indication of risk or liquidity.

Following is a description of the valuation methodologies used for assets measured at fair value:

Common Stock, Mutual, and Money Market Funds: Valued at the closing price reported on the active market on which the individual securities are traded.

Limited Partnerships: Valued based on the net asset value per share of the fund.

Financial assets carried at fair value as of December 31, 2010 are classified in the table below in one of the three categories described above.

Description	Level 1	Level 2	Level 3	Total
Common stock	\$ 8,198	\$ -	\$ -	\$ 8,198
Mutual funds				
Global equity	362,635	-	-	362,635
International value	252,796	-	-	252,796
Money market funds	1,052,599	-	-	1,052,599
Limited partnerships	-	3,125,595	-	3,125,595
Total	\$ 1,676,228	\$ 3,125,595	\$ -	\$ 4,801,823

Financial assets carried at fair value as of December 31, 2009 are classified in the table below in one of the three categories described above.

Description	Level 1	Level 2	Level 3	Total
Mutual funds	\$ 559,999	\$ -	\$ -	\$ 559,999
Money market funds	1,046,409	-	-	1,046,409
Limited partnerships	-	2,685,602	-	2,685,602
Total	\$ 1,606,408	\$ 2,685,602	\$ -	\$ 4,292,010

Investments in certain entities that calculate net asset value per share are as follows:

Fund Description	December 31, 2010 Fair Value	December 31, 2009 Fair Value	Unfunded Commitments	Redemption Frequency	Redemption Notice Period
Absolute Return Funds	\$3,125,595	\$2,685,602	None	Quarterly to annually	30 to 90 Days

The Absolute Return Funds employ a strategy to achieve consistent positive, absolute returns with low volatility primarily by seeking to exploit pricing inefficiencies in equity and debt securities and by using a traditional hedge fund approach. The fair value of the investments has been calculated using the net asset value per share of the investments.

Investment return consists of the following:

	December 31,	
	2010	2009
Dividends and interest – reinvested	\$ 16,998	\$ 11,603
Net realized and unrealized gains	510,425	743,500
Total return on investments	\$ 527,423	\$ 755,103

NOTE 3 - CONTRIBUTIONS

Contributions receivable consist of the following:

	December 31,	
	2010	2009
Due in less than one year	\$ 338,200	\$ 131,400
Due in one to five years	910,400	126,400
	1,248,600	257,800
Less unamortized discount	(71,073)	(11,374)
	\$ 1,177,527	\$ 246,426

The discount rate used was 3.25% and 5.00% for 2010 and 2009, respectively.

NOTE 4 - PROPERTY AND EQUIPMENT

The Institute's property and equipment are comprised of the following:

	As of December 31,	
	2010	2009
Equipment	\$ 410,372	\$ 233,363
Furniture and fixtures	97,477	97,477
Leasehold improvements	857,977	851,742
Machines and video equipment	1,202,747	1,061,520
Medical equipment	1,974,704	1,974,704
	4,543,277	4,218,806
Less accumulated depreciation and amortization	(2,242,961)	(1,627,267)
	\$ 2,300,316	\$ 2,591,539

NOTE 5 - LINE-OF-CREDIT

The Institute has a \$500,000 line-of-credit with a bank, which bears interest at the prime rate per annum (3.25% at December 31, 2010) and matures February 2011. The outstanding balance was \$340,019 and \$15,146 at December 31, 2010 and 2009, respectively. Subsequent to year-end, the Institute's line-of-credit was reduced to \$250,000 and maturity date was extended to May 2012.

NOTE 6 - LONG-TERM DEBT

Long-term debt consists of the following:

	December 31,	
	2010	2009
Note payable to a bank, interest accruing at 4.75%, payable in monthly installments of principal and interest of \$958, due August 2012.	\$ 18,361	\$ 28,697
Less current portion	(10,841)	(10,339)
Long-term portion of debt	\$ 7,520	\$ 18,358

Maturities of the note payable are as follows:

For the Year Ending December 31,	
2011	\$10,841
2012	7,520
	\$ 18,361

NOTE 7 - CAPITAL LEASES

The Institute has acquired assets under the provisions of capital leases. For financial reporting purposes, minimum lease payments relating to the assets have been capitalized. The leases expire between June 2012 and March 2014. Amortization of the leased property is included in depreciation expense. The assets under capital leases have cost and accumulated amortization as follows:

	December 31,	
	2010	2009
Equipment	\$ 2,188,507	\$ 2,188,507
Less accumulated amortization	(888,824)	(545,975)
	\$ 1,299,683	\$ 1,642,532

Maturities of capital lease obligations are as follows:

For the Year Ending December 31,	
2011	\$ 482,470
2012	539,327
2013	387,536
2014	101,387
Total minimum lease payments	1,510,720
Amount representing interest	(88,216)
Present value of net minimum lease payments	1,422,504
Less current portion	(434,150)
Long-term capital lease obligation	\$ 988,354

NOTE 8 - RETIREMENT PLAN

The Institute has a defined contribution retirement plan (the "Plan") under IRC Section 401(k). Employees are eligible to participate in the Plan after one year of service. The Institute's contributions to the Plan are determined annually. The Institute contributed \$15,388 and \$14,856 to the Plan in fiscal years 2010 and 2009, respectively.

NOTE 9 - TEMPORARILY RESTRICTED NET ASSETS

The temporarily restricted net assets have been restricted by the donors to be used only for specified purposes, and/or are time restricted until payments on contributions receivable are received as follows:

	December 31,	
	2010	2009
Assets available for		
Education	\$ 407,431	\$ 602,068
Assets available in future periods		
Education	192,996	140,530
Biomechanical and clinical research	872,58	3105,896
Time restricted only	111,948	-
Total contributions receivable	1,177,527	246,426
	\$ 1,584,958	\$ 848,494

NOTE 10 - RELATED PARTY TRANSACTIONS

During 2010 and 2009, the Institute received approximately \$697,439 and \$381,000, respectively, in contributions from related parties including various Board members, as well as the Steadman Clinic (the "Clinic").

In addition, the Institute received \$1,259,815 and \$1,132,990 from the Clinic during 2010 and 2009, respectively, for the use of certain equipment.

NOTE 11 - INCOME TAXES

Income tax expense has been computed at the statutory rates applicable during the period. The components of taxes on income are as follows:

	For the Years Ended December 31,	
	2010	2009
Current		
Federal	\$ 256,000	\$ 189,000
State	36,000	26,000
	<u>292,000</u>	<u>215,000</u>
Deferred		
Federal	44,000	6,000
State	6,000	1,000
	<u>50,000</u>	<u>7,000</u>
	<u>\$ 342,000</u>	<u>\$ 222,000</u>

The Institute's deferred tax liabilities are a result of the difference in the tax and book basis of depreciable leasehold improvements.

NOTE 12 - COMMITMENTS**Operating Leases**

The Institute leases facilities under non-cancelable operating leases expiring between January 2012 and December 2013, which call for both base rent payments and operating expenses. Rent under these leases for the years ended 2010 and 2009 was \$134,631 and \$118,434, respectively.

Future minimum lease payments under these leases, which include the repayments for tenant improvement allowances, are as follows:

Year Ending December 31,	
2011	\$293,131
2012	292,512
2013	182,508
	<u>\$768,151</u>

NOTE 13 - RESTATEMENT

The Institute's December 31, 2009 financial statements have been restated to reflect the deferred tax liability and tax expense that was previously excluded from the Institute's financial statements. The following financial statement line items as of and for the year ended December 31, 2009 were affected by the restatement:

	As Previously		Effect of
	Reported	As Restated	
Consolidated statement of financial position			
Accrued expenses	\$ 233,336	\$ 448,336	\$ 215,000
Deferred tax liability	\$ -	\$51,000	\$51,000
Unrestricted net assets	\$ 5,498,046	\$ 5,232,046	\$ (266,000)
Unrestricted net assets			
Provision for income taxes	\$ -	\$222,000	\$ 222,000
Change in net assets	\$878,464	\$656,464	\$ (222,000)
Net assets at beginning of year (January 1, 2009)	\$ 5,468,076	\$ 5,424,076	\$ (44,000)



A 501(c)(3) nonprofit organization

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