20th Anniversary

AN INTERNATIONAL CENTER FOR RESEARCH AND EDUCATION — KEEPING PEOPLE ACTIVE

MISSION

The Foundation 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 Foundation is an independent, tax-exempt (IRS code 501(c)(3)) charitable organization. Known throughout the world for its research into the causes, prevention and treatment of orthopaedic disorders, the Foundation is committed to solving orthopaedic problems that limit an individual's ability to maintain an active life.

The Foundation wishes to express 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 Foundation 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 US Open Golf Championships for 10 years, and the only American amongst 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.

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The Foundation has influenced the practice of orthopaedics — from diagnosis to rehabilitation. Recognizing that the body's innate healing powers can be harnessed and manipulated to improve the natural healing process has led to exciting advances in surgical techniques that are used today by orthopaedists in many practices. The microfracture technique, for example, is now accepted as a treatment to enhance articular cartilage healing that may make it possible to postpone or even eliminate the need for joint replacement surgery. It has been independently estimated that more than one million patients have now been treated with microfracture to repair chondral defects. Today, the Foundation is recognized worldwide for pioneering research of new arthroscopic procedures to treat femoral impingement in the hip and rotator cuff injuries in the shoulder.

The Foundation collects data and publishes clinical research results on knees, hips, shoulders, and spine, and it has become the most published and one of the most innovative organizations in sports medicine research and education. The Foundation publishes its findings in relevant scientific and medical journals and presents its 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. As a result of its Fellowship Program, the Foundation now has a global network of more than 173 Fellows and associates who have put the advanced concepts they learned in their fellowships to good use in their orthopaedic practices.

Our focus is on improvement of function and quality of life. Future research will target predictors of disability caused by arthritis, predictors of successful surgery, predictors of patient satisfaction, patient expectation of treatment, and patient outcomes following surgery.

THE FOUNDATION'S PRIMARY AREAS OF RESEARCH AND EDUCATION ARE:

- **BASIC SCIENCE RESEARCH** – undertakes biological studies to investigate the causes and effects of degenerative arthritis, techniques of cartilage regeneration, and basic biological healing processes.
- **CLINICAL RESEARCH** – conducts evidence-based medicine "outcomes" research based on actual clinical data that aids both physicians and patients in making better-informed treatment decisions.
- **BIOMECHANICS RESEARCH LABORATORY** – 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 training program, hosts conferences and international medical meetings, and produces and distributes publications and teaching visual media.

SINCE ITS INCEPTION, THE FOUNDATION HAS HELPED PEOPLE OF ALL AGES REMAIN PHYSICALLY ACTIVE THROUGH ORTHOPAEDIC RESEARCH AND EDUCATION. THE FOUNDATION CONTINUES TO PURSUE ITS GOALS OF:

- Understanding, enlisting, and enhancing the body's innate ability to heal.
- Designing and validating surgical and rehabilitation techniques, as well as nonoperative management for osteoarthritis.
- Producing and publishing scientifically validated research in leading medical and scientific journals.

DEAR FRIENDS,

We want to thank you all personally for your tremendous, record-setting support in 2008. We've been overwhelmed by the generosity of our donors, especially in light of difficult economic times. We finished 18 percent higher in contributions from all sources in 2008 than in 2007 and 36 percent ahead of contributions in 2006. Between 2006 and 2008, we have leveraged this strong support with sound management practices and greater efficiencies to reduce the Foundation's overhead rate by 11 percent.

Your contributions have allowed us to continue our mission, grow our science and education programs by recruiting internationally recognized researchers, scientists, physicians, and business people; add a fourth area of science; and increase the number of visiting scholars. The bottom line is that we are positioned for our very bright future and we're being more efficient in the management of the Foundation than ever before.

What does that mean to you? It means that for every dollar received from donors, 68 cents goes directly to research. Other medical research programs have significantly higher overhead costs. In fact, in most competitive research programs less than 50 cents of every dollar goes directly to research — the majority goes to overhead. Our goal for the Foundation is to have the highest percentage of money spent directly on research of any orthopaedic program, whether independent or university-based.

Through your continued support, we have made several organizational improvements during the past 24 months. We are very pleased with the financial management and controls that Marc Prisant, our Executive Vice President and Chief Financial Officer, has implemented in the Foundation (see page 84). We have made structural changes and employed new policies and procedures in all departments. We have also established the position of Chief Scientific Officer. All of this has been implemented to prepare us for continued excellence as we carry out our mission.

We are pleased that the Clinic has addressed its succession by naming Dr. Marc Philippon as managing partner with Dr. Steadman. We are fortunate that Dr. Philippon has chosen to practice and conduct his research here. Our international reputation has grown since his arrival. Additionally, the Clinic successfully recruited Dr. Thomas Clanton (see page 3), a world-renowned foot and ankle surgeon, to Vail. Dr. Clanton is known for his academic research and speaks all over the world about his findings in foot and ankle. We will soon begin collecting clinical data on all of Dr. Clanton's patients.

In 2008, the Foundation set records for publications and presentations, but we are not just about grading ourselves with numbers. The reason for the increase was that, in addition to collecting and reporting on data for knees and shoulders, your contributions have allowed us to develop databases to collect data on every hip the last four years and every spine the last two years. We are now in a position to look retrospectively at our data and report our observations to our peers worldwide. For example, Dr. Marc Philippon published a landmark study on two-year hip arthroscopy outcomes in the prestigious British edition of the *Journal of Bone and Joint Surgery* (see page 37). Dr. Philippon and our clinical research group, led by Karen Briggs, M.B.A., M.P.H., are literally teaching the world about advancements and outcomes in hip surgery and rehabilitation.

The Foundation has also initiated an important study in Basic Science to determine whether adding an adult's own bone marrow stem cells to the microfracture procedure can improve cartilage regeneration (see page 30). Additionally, Dr. William Rodkey, Dr. Richard Steadman, and Karen Briggs, were among the authors of the lead article in the July 2008 issue of the *Journal of Bone and Joint Surgery*. Based on research conducted both at the Foundation and at other sites around the country, this article describes long-term results on a collagen implant for meniscus regeneration.

In the Biomechanics Laboratory, our dual-plane fluoroscopy research, led by Peter Millett, M.D., M.Sc., and Erik Giphart, Ph.D., received recognition from the American Orthopaedic Society for Sports Medicine for groundbreaking work in further understanding the bones in the shoulder, their movement, and their relationship to each other. Dr. Steadman, Mike Torry, Ph.D., and the researchers of the Biomechanics Laboratory, in collaboration with Dr. Savio L.Y. Woo and researchers at the University of Pittsburgh, were awarded more than $200,000 from the National Institutes of Health to investigate ACL injuries in female athletes. This represents the first government peer review grant procured by the Foundation since its inception and was a testament to the quality of work and recognition this group is receiving from its fellow scientists. The Biomechanics group has also received sponsorship to (1) conduct foot and ankle research as it pertains to walking and running injuries; and (2) investigate new medical and retail devices that aid in shoulder function by controlling posture, that unload the knee, and that increase performance at the hip during sporting activities.

Our Imaging Research department, under the direction of Dr. Charles Ho, which began in late 2008, will be first in the world solely dedicated to improving imaging diagnosis in sports medicine. Siemens Medical Solutions USA and the Foundation formed a strategic alliance that added 3.0 Tesla (T) magnetic resonance imaging (MRI) technology to the Foundation. This technology will allow researchers better access to advanced medical imaging for experimental studies and assessment of clinical outcomes.

In Education and Fellowship, we added Visiting Scholars from Europe and Brazil to our program. We also laid the groundwork for the first Sports Medicine Imaging Radiology Fellowship. Dr. Philippon and Karen Briggs continued to teach the world about advancements in hip surgery with more than 90 presentations and publications in 2008, and Dr. Richard Steadman and Dr. John Feagin published a book titled *The Crucial Principles in Care of the Knee*.

J. Richard Steadman, M.D.

Marc J. Philippon, M.D.

J. Michael Egan

In communications, we have emphasized the technical nature of our research and explained why the work of the Foundation is unique, specifically what it means to you. Our message to supporters, potential contributors, and the scientific community focuses on: (1) evidence-based medicine, (2) the Foundation as an international center for research and education, (3) our goal of keeping people active, and most importantly, (4) our incredible professionals. This emphasis has allowed us to achieve significant increases in corporate and donor relationships. All four messages have been well received and continue to illustrate the Foundation's uniqueness.

Our Foundation was started 20 years ago because of the dedication of one individual and today has become an internationally recognized institute known for the quality and validity of its work. Now we are poised for an incredible future because many other talented people have chosen to come here and take us well into the 21st century. We are grateful to these dedicated professionals with such varied backgrounds and talents who share our vision. We hope you will take the time to learn more about these individuals, their backgrounds, and their areas of focus. We are confident you will agree that our people will make our vision a reality.

On behalf of our dedicated board members, physicians, researchers, and staff, we again wish to express our gratitude. We look forward to your continued support and to updating you on exciting advances being made by the Foundation.

Respectfully yours,

J. Richard Steadman, M.D.

Marc J. Philippon, M.D.

J. Michael Egan

THOMAS O. CLANTON, M.D., AN INTERNATIONALLY RENOWNED SURGEON, TO INITIATE FOOT AND ANKLE RESEARCH

Dr. Thomas Clanton joined the Clinic and Foundation last August as an orthopaedic surgeon and Director of Foot and Ankle Sports Medicine. He is known around the world for his foot and ankle research and as a physician. He has had many years of accomplishments as a physician, researcher, and leader in the world community of orthopaedic surgeons.

He received his M.D. degree from Baylor College of Medicine, followed by a five-year orthopaedic residency program at The University of Texas Health Science Center - San Antonio. After completing this work in 1981, he did additional training in foot and ankle with Roger A. Mann, M.D., in Oakland, California. Further training in knee and sports medicine was undertaken in Jackson, Wyoming, under the tutelage of John Feagin, M.D.; Ken Lambert, M.D.; and Bill Mott, M.D., before beginning his own orthopaedic practice in Houston in 1982.

He will treat lower extremity injuries, with special emphasis on disorders of the foot and ankle. Dr. Clanton comes to us from Houston, Texas, where he served as team physician for the Houston Rockets, Houston Texans, and at Rice University.

Dr. Clanton's accomplishments include serving as past President of the American Foot and Ankle Society, Professor of Orthopaedic Surgery at the University of Texas Medical School at Houston, Chief of Orthopaedic Surgery at Memorial Hermann Hospital in Houston, and Co-Medical Director of the Sports Medical Institute at Memorial Hospital. He also served as President of the Texas Society for Sports Medicine.

Dr. Clanton brings strong academic and leadership skills to the Clinic and Foundation. We are very excited to have Tom begin his research on one of the most important joints in the body.

Dr. Clanton lives with his wife, Kay, in Edwards, Colorado. Their two daughters, Kelly and Laura, live in Eagle County with their families. He enjoys spending time with his grandchildren and fly fishing.

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LARRY MULLEN, U2 FOUNDER, PARTNER, LEAD DRUMMER, RENOWNED MUSICIAN AND BUSINESS LEADER MOVES BEYOND THE MUSIC TO BRING AN INTERNATIONAL PERSPECTIVE TO THE FOUNDATION'S BOARD OF DIRECTORS

By Jim Brown, Executive Editor, *The Foundation News*

Although Larry Mullen describes himself as just a "street drummer," he is, by the highest of standards, considerably more. As founder, partner, and lead drummer for one of the world's most famous rock bands, U2, he has moved beyond entertainment to make a difference in the lives of people around the world.

This should not be a surprise to those who have followed the careers of Larry and his fellow U2 band members. This legendary group has a well-deserved record of using its high-profile platform to promote philanthropy, service, and social responsibility to a worldwide audience. Now he has added his voice to the mission of the Foundation as a member of its Board of Directors, the governing group he joined in 2007.

Three Reasons

Why? "Three reasons," explains Mullen. "Firstly, I have benefitted so much from the incredible, cutting-edge resources, expertise, and practices available here in Vail and I thought it important to share the news. Secondly, I feel strongly that this level of care should be available to everybody — celebrity and non-celebrity, sportsman and non-sportsman — all over the world. Lastly, the Foundation's willingness to invest money and resources back into the community was probably the single, biggest part of my signing on with the Board.

Like other board members, athletes, and exercisers, Larry first became aware of the Clinic through injury. "I was having trouble playing due to a knee problem. I saw Dr. Muller-Wohlfahrt in Germany. He recommended surgery, and suggested that I have it done by surgeon Richard Steadman in Vail at the Clinic. I had been told that Dr. Steadman was a pioneer in his field and I was desperate and intrigued."

The rest is history, but it is history still in the making. "I have already seen Dr. Steadman, Dr. Philippon, and Dr. Millett, among other physicians, as well as receptionists, lab technicians, imaging specialists, scientists, administrators — practically everyone in the building, and the way things are going with my body, I'll probably meet the rest of them by the end of the year."

Occupational Hazards

"I'm a street drummer and I've physically abused—neglected may be a better word— my body for a long time, through bad posture, questionable technique, throwing myself around a stage, not eating or hydrating as I should have, and sitting too much. Almost all the things I do as part of my job are bad for my body. It's not just the physical act of hitting things. Rock and roll is about freedom and escapism, it's like running away to the circus. That's okay for about 10 years, then bits start to fall off. I was not trained as an athlete, but I have to perform like one."

His travel schedule is frenetic, exciting, and adds to the problem. The day before he made a stop in Vail to have a hamstring injury checked (and to give us this interview), he performed before 70,000 people at the new Dallas Cowboys football stadium. He left Vail and flew to Houston for another concert the next day. During the two weeks that followed, his schedule included dates in Phoenix, Los Angeles, Norman, Oklahoma, Las Vegas, Vancouver and New York, before performing in Berlin to finish the tour. Larry Mullen is not a member of a flier program; he IS a frequent flier program.

AP Photo/Julie Jacobson

Larry Mullen, Jr.

Confidence Based on Evidence

"That's why Vail has become so important to me," he says. "It's a 'one stop shop' for anybody with sports related injuries. I consider it an integral part of my maintenance and recovery. The doctors are willing to listen and are anxious to develop new ways to treat you and heal you quickly, based on their expertise and supported by the Foundation's research. This is very important for me. What sets the Clinic and Foundation apart is the confidence the doctors, scientists, and staff members have in their own ability."

Mullen now sees an opportunity to get this message out to the rest of the world. "Larry's international viewpoint and expertise at branding and message delivery is invaluable to our Foundation," says Mike Egan. "Larry agrees with our mission of taking our expertise and ability to educate around the world so that we can have a positive impact on the next generation."

Mullen's Message:

"We have an incredible resource here," concludes Mullen. "I want to re-emphasize that this facility, its resources, the data it has amassed, and its educational programs are not exclusively for the privileged. It is available to all — and we should figure out ways to share this treasure with people in the rest of the world, so that their quality of life can be improved."

SCIENTIFIC ADVISORY COMMITTEE

The Scientific Advisory Committee consists of distinguished research scientists who represent the Foundation and serve as advisors in our research and educational efforts, in our Fellowship Program, and to our professional staff.

DR. LARS ENGEBRETSEN TO JOIN SCIENTIFIC ADVISORY COMMITTEE

Dr. Engebretsen's list of achievements, appointments, publications, and leadership is long, impressive, and is reflected in the medical societies he has led. He was recently appointed Head of Science and Research for the International Olympic Committee, and he currently serves as President of the European Society of Sports Traumatology, Knee Surgery, and Arthroscopy (ESSKA). He previously served as President of the International Society of Arthroscopy, Knee Surgery and Orthopaedic Sports Medicine, which is the world's largest society for sports medicine and arthroscopy.

He is a Professor and Director of Research at Orthopaedic Center, Ullevål University Hospital and University of Oslo Medical School, as well as Professor and Co-Chair of the Oslo Sports Trauma Research Center. He is also Chief Doctor for the Norwegian Federation of Sports, he heads the medical service at the Norwegian Olympic Center, and he serves as chief team physician for the Norwegian Olympic teams.

He is the Associate Editor and Editor-in-Chief of a new professional publication titled *Injury Prevention and Health Protection* and serves on the editorial boards of several major sports journals. His publications number more than 200 papers and book chapters.

Lars Engebretsen (center) celebrates his 60th birthday this past August by climbing Norway's highest mountain, Galdhøpiggen, with Foundation CEO Mike Egan (left) and brother Tim.

Dr. Engebretsen has a previous connection with the Foundation. He and his colleagues scientifically demonstrated that microfracture to treat isolated articular chondral defects, a procedure developed and refined by Dr. Richard Steadman in the late 1980s, was as effective as a more expensive two-surgery procedure that was more commonly used at the time. His verification of microfracture was pivotal in the procedure being accepted on a worldwide basis.

The main area of Dr. Engebretsen's research is resurfacing techniques of cartilage injuries, combined and complex knee ligament injuries, and prevention techniques of sports injuries.

Lars and his wife, Brit, and their two sons, Jonas and Truls, are very active people who personify the Foundation's mission of keeping active people active throughout their lives. Lars will begin to spend significant time in Vail during the summer months helping the Foundation conduct its research.

THE 20TH ANNIVERSARY OF A VISION THAT BECAME A REALITY

By J. Michael Egan, Chief Executive Officer

In 1988, Dr. Richard Steadman had a vision of documenting the results of every patient treated at the Clinic, but he didn't have a vehicle to make his vision a reality. As a result, he founded our Foundation, which became the perfect platform to house a base of scientific evidence that would track his outcomes.

Tremendous growth and progress has occurred since inception. Last year we celebrated the 20th anniversary of the Foundation. We have become an internationally recognized research institute that is leading the world in sports medicine clinical research. The Foundation makes it possible to collect, organize, and analyze hundreds of data points on every patient and, overall, there are more than 20 million data points in our rich database. This vast collection of information positioned the Foundation as a leader in evidence-based medicine long before the term became popular in sports medicine. Through our publications and presentations, we are in essence making this data available to the world's medical, scientific, and research communities.

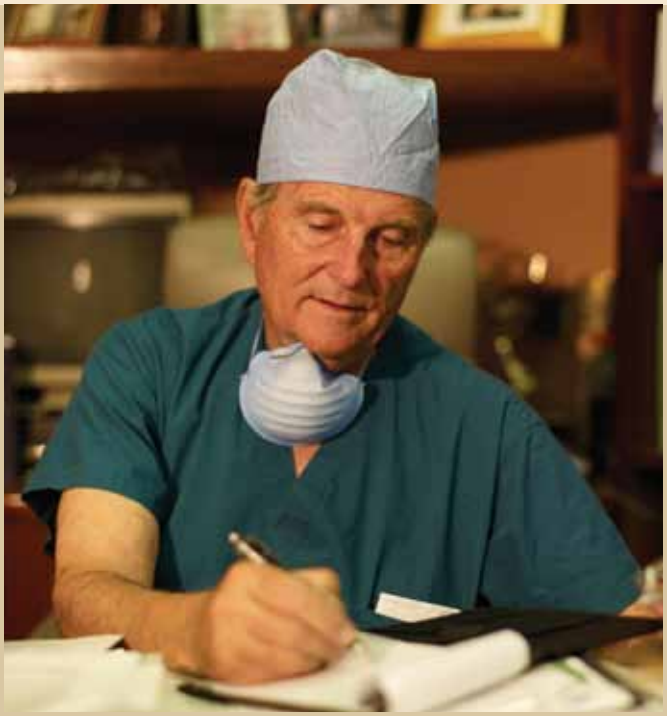
Selective Support

Our Foundation is a research institute that allows individual and corporate donors to be selective in their support of research programs. If they feel strongly about anterior cruciate ligament (ACL) surgery, hip arthroscopy, shoulder conditions, high-tech diagnostic tools, or any number of other ongoing research initiatives, the Foundation can provide an avenue to channel their contributions in the right direction and to match those interests.

Of course, our work and results would be impossible to realize without the tremendous support of our donors. We are most grateful to our individual donors over the first 20 years, who cumulatively have contributed more than $33 million! Our donor support has allowed us to carry out our vision and recruit very talented people. Our corporate support has grown dramatically, because the importance of our findings and financial efficiency of our research have been recognized.

Anyone who supports a research study, whether it's at Stanford, the Mayo Clinic, the Hospital for Special Surgery in New York, or here in Vail, wants to know how efficient the organization is going to be with its money. At the Foundation, the answer to that question is that we're more than twice as efficient as other research institutions because our overhead is less than half as much.

We are fortunate because our model is a 21st century model, meaning that compared to other programs, we are not supporting a university-based 19th or 20th century model of bureaucracy, departments spread out across campuses, and bricks and mortar. Rather, we are all in close proximity, have daily direct contact between the Clinic, Foundation, Howard Head rehabilitation, and most importantly, our patients. We are forming alliances where we feel necessary, whether national or international, in order to ensure we have the opportunity to be the best in a particular area of interest. Overall, we are more efficient because we require less bureaucracy, work in close proximity, and make decisions more quickly, which allows us to be more nimble.



J. Richard Steadman, M.D.

Team Effort

The most important element in the realization of Dr. Steadman's original vision are the extraordinary people who share that vision and its pursuit. Many of the key staff members, doctors, Howard Head rehabilitation personnel, board members, and scientists have known him since the inception of the Foundation. Others who have chosen to come here were already internationally recognized in their specialties, whether in medicine, science or business. Today, everyone shares our vision of building the premier sports medicine institute.

An excellent example of an extraordinary individual with a similar vision is Dr. Marc Philippon. I was enthused when I learned that Dr. Philippon decided to leave the University of Pittsburgh to come to Vail. At a relatively young age, he already had a worldwide reputation in hip arthroscopy. Dr. Philippon is in very high demand clinically because his outcomes, recorded by the Foundation on more than 2,000 hip surgeries here in Vail, are clearly showing that early intervention can have dramatic positive effects on people with hip problems. However, he still devotes important time for research and education. In fact, in 2008 Dr. Philippon, in conjunction with the Foundation, produced and presented more than 90 publications and presentations worldwide. We have established a succession process for the Foundation. Dr. Philippon is leading our succession. Dr. Philippon and Dr. Steadman are now the managing partners of the Clinic. They recently convinced Dr. Thomas Clanton, an internationally renowned foot and ankle surgeon and researcher, to join us in Vail. Dr. Clanton is another example of a very talented individual who shares our vision. Our succession is well underway.

The successful attainment of our vision is predicated on our ability to continue to attract and retain extraordinary individuals in

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(continued from page 7)

The successful attainment of our vision is predicated on our ability to continue to attract and retain extraordinary individuals in all areas: researchers, physicians, scientists, and business people. The combination of a worthy vision, pursuit of an active lifestyle, a unique location, and the opportunity to work with other talented people will ensure our ultimate attainment of our vision.

all areas: researchers, physicians, scientists, and business people. The combination of a worthy vision, pursuit of an active lifestyle, a unique location, and the opportunity to work with other talented people will ensure our ultimate attainment of our vision.

We are fortunate that Lars Engebretsen, M.D., Ph.D. has agreed to join our Scientific Advisory Committee, and his international reputation speaks for itself. Karen Briggs, Bill Rodkey, Mike Torry, Eric Giphart, and Charles Ho are all internationally known for their research, as well. Marc Prisant has extensive financial experience that he's applied to our Foundation. Our extraordinary young people, whether fellows, interns, visiting scholars, or staff, are keeping us enthused and challenged. We are providing an environment for all our people to have the opportunity to become future leaders, and we are paying for many of their post-graduate educations to ensure their and our success.

Planning for the Future

We are in the planning stages of developing a world-class facility to house our sports medicine institute by working with various constituencies in Vail to make that happen. We will be announcing international alliances to strengthen our sciences and continue to allow us to reach for the highest level in all areas. On our 25th anniversary we plan for the institute to be a fully operational orthopaedic clinic, research, imaging, and rehabilitation center.

Dr. Steadman's vision of creating an internationally known research institute has become a reality over these first 20 years. Our collective vision for our future, which is to become the premier sports medicine institute worldwide, is underway, and the many talented people who today make up the Foundation and Clinic are committed to making our vision a reality.

Finally, we want to thank the researchers, scientists, doctors, patients, sponsors, staffers, board members, supporters, and especially our donors, for helping us carry out our vision. Your support is vital to our future!

J. Michael Egan

DR. MARC PHILIPPON AND THE FOUNDATION: A PERFECT FIT— THE LEADER OF OUR SUCCESSION

By Jim Brown, Executive Editor, *The Foundation News*

"It was a perfect fit," answers Dr. Philippon. "I had known Dr. Steadman for some time, and they had been referring patients to me. I knew that Dr. Steadman was a great surgeon and innovator, and I was honored to become a part of the Clinic and Foundation. Dr. Steadman asked me to continue what I had been doing at the University of Pittsburgh and to keep developing the fellowship program I had in Pittsburgh with the same type of program here in Vail."

Consider this scenario. You have successful practices in two states. You serve as a consultant to professional teams and leagues, and you treat high-profile athletes in multiple sports. You are on the faculty at a large, well-respected research university and you direct the sports medicine/hip disorders programs. You've already been recognized as one of the leading orthopaedic surgeons and hip specialists in the world, and you can live and work anywhere you like. You're set for life, right?

Not if you are Marc Philippon, M.D., who left what many would consider a dream situation to move his family to Vail and to become a managing partner in the Clinic and researcher in the Foundation. Why?

"It was a perfect fit," answers Dr. Philippon. "I had known Dr. Steadman for some time, and they had been referring patients to me. I knew that Dr. Steadman was a great surgeon and innovator, and I was honored to become a part of the Clinic and Foundation. Dr. Steadman asked me to continue what I had been doing at the University of Pittsburgh and to keep developing the fellowship program I had in Pittsburgh with the same type of program here in Vail.

"But probably the most important factor was the Foundation," says Dr. Philippon. "It was well established and well known in the orthopaedic medical community and around the world. I thought this position would allow me to do with hip disorders what Dr. Steadman had done with the knee." Dr. Philippon is committed to research and education. This year alone, he was involved in more than 90 presentations and publications worldwide.

And then there are those Colorado mountains. "There were also the mountains, the skiing (Dr. Philippon and his wife, Senenne, and their children all like to ski), the town of Vail, and the positive energy at the Clinic and Foundation," he adds. "Everybody I've met is happy and enthusiastic. They are willing to help, and everybody from the person at the front desk on seems to be happy to be here. It's like a big family."

Marc J. Philippon, M.D.

Dr. Philippon is now a managing partner of the Clinic, a member of the Foundation's Board of Directors, and a member of the Scientific Advisory Committee. "The decision to come to Vail," says Dr. Philippon, "turned out to be a perfect fit for my family and me."

International Recognition

Dr. Philippon treats a variety of hip disorders, but much of the international recognition he has received comes from his innovative, arthroscopic treatment of a condition called femoro-acetabular impingement. (Luckily for us, we'll call it FAI from here on.) FAI, which affects 10-20 percent of the general population, is a developmental condition (not something that exists at birth) in which abnormally shaped bones of the hip joint rub against each other during movement. This repetitive action eventually damages the soft tissue in the area, particularly the articular cartilage, and damaged cartilage is hard to treat. Any sport that involves forceful rotation — golf, hockey, baseball, football, and soccer, for example — can compound the FAI problem.

"FAI is a disease of active people," says Dr. Philippon. "It has been seeing us for many years, but we were not recognizing it. And until recently, we didn't have a predictable treatment. Now we have a better understanding of the problem and better surgical techniques. Many people who might not have sought treatment earlier follow the example of professional athletes who have the procedure to correct FAI and return to their sports relatively quickly."

(continued on page 10)

(continued from page 9)

Treating High-Profile Athletes

Although Dr. Philippon and the other surgeons at the Clinic don't deliberately seek professional athletes as patients, the athletes find them. Dr. Philippon had already treated golfer Greg Norman and hockey great Mario Lemieux before coming to Vail, and more recent patients have included Arizona Cardinals quarterback Kurt Warner, New York Yankees slugger Alex Rodriguez and New York Ranger Marion Gabrak.

"These people make a living with their bodies," explains Dr. Philippon. "They want to go to a place where they are safe and where they think they will have a good outcome. The word gets around to other elite athletes and then to the general public."

Does he feel any added pressure treating high-profile athletes? "Not really," answers Dr. Philippon. "I treat everyone like I would treat my parents and my family. The key is preparation. The work of the Foundation prepares us for any kind of surgery. If we are well prepared, it is easy to execute well. The goal of the Clinic, the Foundation, and the physician to is provide every patient with the best possible care." The Foundation has collected hundreds of data points on every patient of Dr. Philippon's since his arrival. Our hip database now represents over 2,000 of Dr. Philippon's patients. Our ability to look at the data retrospectively and report our findings has educated the orthopaedic community worldwide.

The Next Big Thing

Dr. Philippon's vision for the injuries he treats and for the research of the Foundation extends beyond FAI. "I'm interested in the prevention and treatment of hip injuries but also in figuring out a way to actually modify the course of cartilage damage. We need to make cartilage more durable. It will be difficult because every joint has specific cartilage, several layers of tissue, and a lack of blood supply. It's very complex." Our newest area of science, Imaging Research, will be extremely important in further understanding cartilage, its role, interventions, and its health.

There are other items on his already full agenda. "Repairing the labrum (the ring of cartilage around the joint), reconstructing the labrum, treating cartilage injuries, and early detection are all in the future of hip injuries," he says.

The Foundation and its surgical outcomes database are making Dr. Philippon's work possible. "When I came in 2005, we didn't have much of a database for hip injuries. Now we have 2,000 cases in our database and in five years we'll probably have close to 4,000. Most importantly, we'll have more answers in terms of the prevention of hip injuries and in the health of cartilage after FAI treatment." Early surgical intervention in the hip has become the fastest growing surgical area in sports medicine. Our hip database is the largest of its kind in the world and our mission requires us to make our findings available to the greater orthopaedic community. Our Foundation's infrastructure provides the means for Dr. Philippon to present his findings.

"If the Foundation's research allows us to discover better prevention and better techniques to repair cartilage, it will have a huge impact. We'll be able to help more people remain active as long as they want without having hip joints replaced."

When — not if — that happens, it will truly have been a perfect fit for Dr. Philippon and the Foundation.

MIKE JONES: MORE THAN JUST YOUR AVERAGE JOE

By Jim Brown, Executive Editor, *The Foundation News*

Mike Jones says he's just a regular Joe, but he's not. He has a wife, Susan, two successful children, Matt and Becky, and grandchildren, but that's about where he stops being average. He gets up early every morning, drives his pickup into the mountains of northeast Nevada, and spends the day hunting for gold. "I do for a living what some people do on vacation," he explains.

Mike is a self-employed exploration geologist with three degrees who uses a hammer to collect rock samples from outcroppings. "If this part of Nevada were a country, it would be the third largest producer of gold in the world," says Mike. At the end of the day, he has loaded as much as 50 pounds of rocks into his backpack and has headed to his home in Elko. "If we find something that looks promising, the companies I work for drill anywhere from a few hundred to 2,000 feet. If successful, the drilling results in a gold mine."

In His Spare Time

In his spare time, Mike climbs mountains (including Mt. Rainier), fishes, hunts, takes week-long canoe and kayak trips, snowshoes, and skis cross-country. During the past 20 years, Mike, now 63, has participated in racquetball, volleyball, soccer, hang-gliding, and long-distance running (nine miles in one race, 44 miles in another). For fun, he also teaches a course in canoeing at a local college.

When asked what Susan Jones thinks about her husband's unusual occupational and recreational pursuits, she jokingly (we think) replies, "Well, at least he died doing what he liked to do."

In addition to an unusual job description and his passion for risky, physically demanding recreational activities, there is another reason why Mike is no average Joe. He does all of these things on a surgically repaired right knee.

20 Years Ago

"I injured my knee 20 years ago and couldn't get from one room to another in my house without pain," he remembers. "I was totally impaired for doing field work. I knew I was going to need surgery and asked people around town (Elko, Nevada) who I should see. Three different people told me I should contact a doctor up in South Lake Tahoe named Richard Steadman. I called his receptionist, told her what had happened, and asked about an appointment. She said Dr. Steadman was very busy and that it would be two or three months before he had an opening for surgery, but that she would check with him. A half-hour later, she called back and asked if I could be there on Thursday.

"Instead of proceeding with surgery, Dr. Steadman first asked me what kind of lifestyle I wanted. I remember thinking 'Who is this guy?' and 'Why is he asking me these kinds of questions?' I told him I wanted the lifestyle that got me here in the first place. He said, 'Okay, this is what we're going to do.' He replaced a torn anterior cruciate ligament (ACL) and repaired some damaged cartilage, and it's been pretty much clear sailing ever since.

Mike Jones (right) with son-in-law John Gallagher at the summit of Colorado's 14,000-ft. Mount of the Holy Cross.

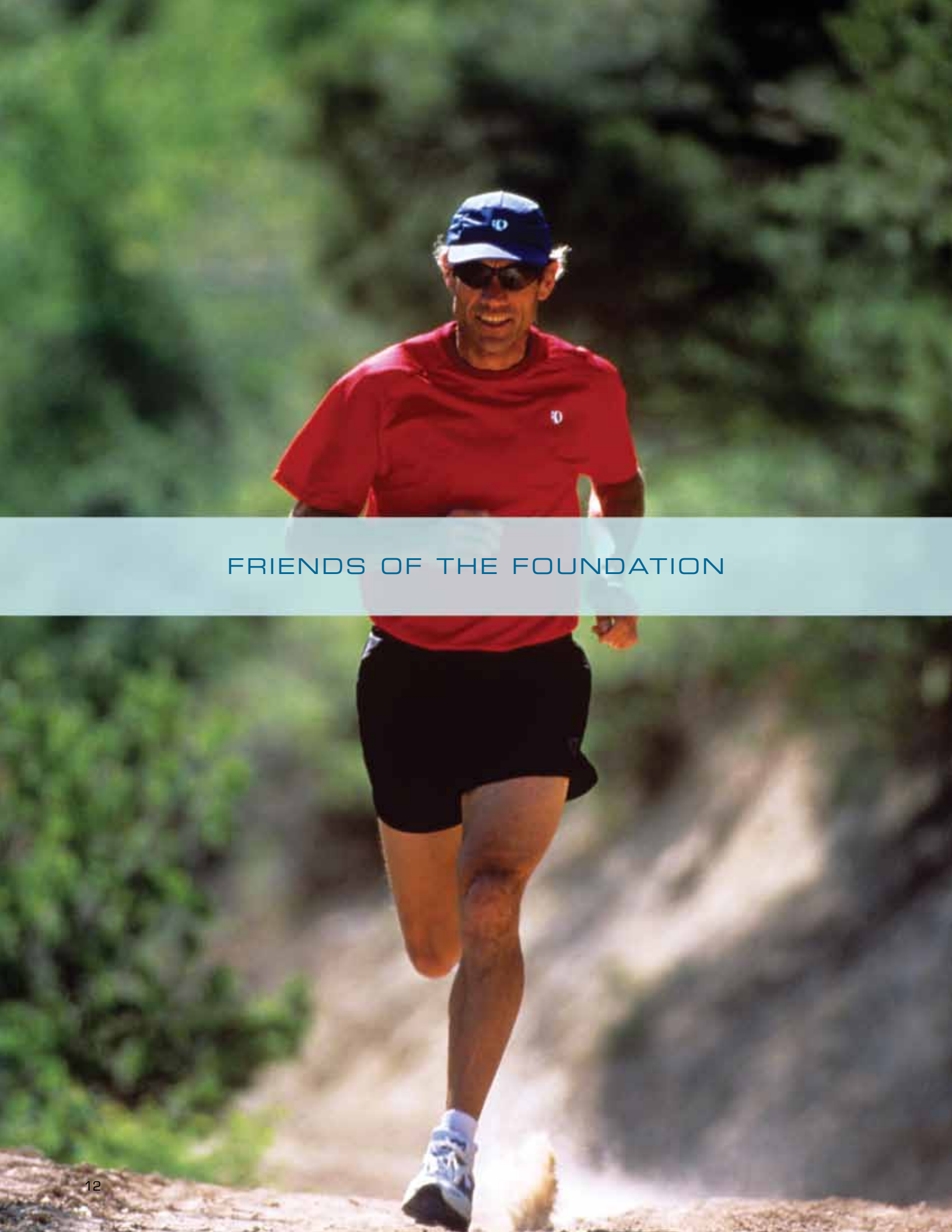
"My life today is every bit as vigorous as I have time for," says Mike. "I do, or attempt to do, anything I want. My knee does not limit my choice of activities, and my job places significant stress on my knee."

15-, 20-Year Studies

Mike Jones is now part of a study being conducted by the Foundation to determine the long-term outcomes of patients who have had ACL surgery. After 15 years, only five out of 60 patients who had the procedure have required total knee replacement. Among those in the 20-year follow-up group, the average patient satisfaction so far is 9.5 on a scale of 1-10. None of Dr. Steadman's patients who underwent surgery 20 or more years ago is experiencing disability because of knee function.

Perhaps Mike sums up these remarkable results best. "The Clinic makes people like me vertical again. When I found out that people like Dan Marino, Martina Navratilova, and Picabo Street share the same knee doctor, I couldn't believe it. I'm just an average Joe — there he goes again — and Dr. Steadman could stay perfectly busy treating high-profile patients only.

"When people ask me about Richard Steadman, I am totally enthused about him and the research conducted at the Foundation," concludes Mike. "Dr. Steadman kept my lifestyle intact. Every day is a gift he has given me."



FRIENDS OF THE FOUNDATION

In 2008, we received 1,192 separate gifts and corporate support from 895 individuals, foundations, and corporations. This combined support, including special events, amounted to $4,016,169.

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

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

Mr. Kenneth C. Griffin

Össur Americas, Inc.

Smith & Nephew Endoscopy

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Vail Valley Medical Center

EDUCATION AND RESEARCH GRANTS

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 Jorge Paulo Lemann

Sports Medicine Imaging Research Fellowship, sponsored by Siemens

Bioskills Research and Education Grant, sponsored by Smith & Nephew

HALL OF FAME

The Foundation is grateful to the following individuals, corporations, and foundations for their support of the Foundation in 2008 at a level of $50,000 or more. Their vision ensures the advancement of evidenced-based medical 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:

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GOLD MEDAL CONTRIBUTORS

We are grateful to the following individuals, foundations, and corporations who contributed $20,000-$49,999 to the Foundation in 2008. 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.

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SILVER MEDAL CONTRIBUTORS

Silver Medal donors contribute $5,000-$19,999 annually to the Foundation. 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. We extend our deep appreciation to following individuals for their generous support in 2008:

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Dr. Tom Hackett

Mr. Milledge A. Hart III and Ms. Linda W. Hart

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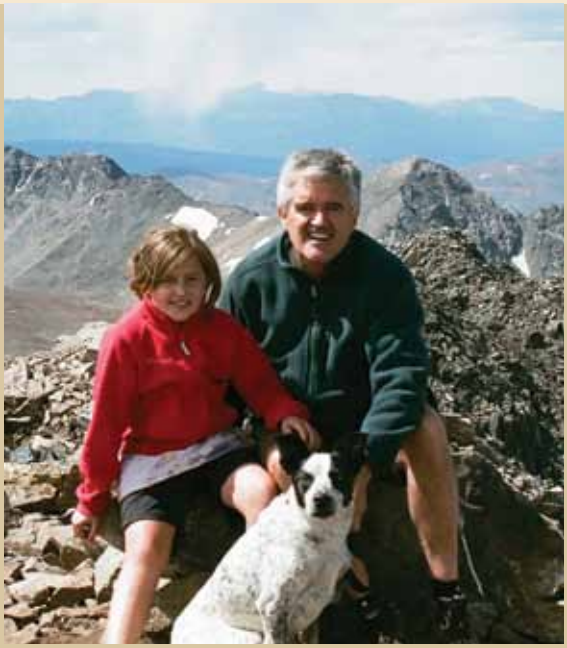
FROM MENTORING OLYMPIANS TO ADVANCING ORTHOPAEDIC RESEARCH, JOHN MCMURTRY SHARES A UNIQUE PERSPECTIVE



John McMurtry, daughter Jessica and Pepper Jack, at the summit of 14,265-ft. Quandary Peak, Colorado's 12th highest mountain.

John McMurtry has come full circle, from coaching this country's national ski team to raising important funding for orthopaedic research. From 1984 – 1987, following the Winter Olympics in Sarajevo, John and two colleagues, Topper Hagerman and John Atkins, who were trainers for the U.S. Ski Team, joined Dr. Steadman in South Lake Tahoe, California, to help develop his fitness and rehabilitation concepts into programs for his patients. These concepts had proven to be highly effective for injured Ski Team athletes following treatment and surgery by Dr. Steadman. In 1994, after a successful career of coaching and organizing the United States efforts in international ski competition, John again joined Dr. Steadman in Vail, Colorado, to establish the development and fundraising arm of the Foundation. As Vice President for Program Advancement, John manages the annual fundraising plan, which includes major gifts, special events, and publications.

At the University of Denver, he was a member of the perennial NCAA championship ski team and coached the first intercollegiate women's ski team in the university's history.

From 1976-84, one of the most successful periods in U.S. skiing history, John was development and head technical coach for the women's Olympic and World Cup alpine ski teams. His athletes won every major international title, including the first World Cup Title (1983), World Cup Giant Slalom (1981, 1983) and Slalom (1984) titles, the first and only Nation's Cup (1982), and Olympic Gold and Silver at Sarajevo (1984). Dr. Steadman said at the time, referring to the 'total team effort,' "For America, this was an achievement comparable to Switzerland winning the Super Bowl, Sweden winning the World Series, or Liechtenstein winning the NBA play-offs." Then Colorado Governor Richard D. Lamm and then Denver Mayor W.H. McNichols, Jr., honored John on November 13, 1982, as "John McMurtry Day" for his contributions to the state, city, and skiing. In 1995, he was inducted into the Colorado Ski Hall of Fame.

From 1987 to 1990, McMurtry was director of athlete development and director of the entire U. S. Alpine Ski Team program. He drafted the first comprehensive national athlete development plan. Between 1987 and 1990, the U.S. teams dominated the World Junior Championships, winning 14 medals. In 1986, he was invited to present a proposal for a national ski program to government leaders of the People's Republic of China.

Active in the community, John's volunteer work includes membership in the Vail-Eagle Valley Rotary Club, where he served as a board member and president. He also served as chairman of the Charitable Foundation of the Rotary Club. In 2002, Rotary International President Richard D. King presented him with the *Distinguished President* citation. John was appointed Lieutenant Governor for Vocational Service by Rotary International District 5470, where he served three terms. Other community service includes the Eagle County School to Career Council, Ski Club Vail, and the Colorado Ski and Snowboard Museum and Hall of Fame.

He and his wife, Jeanette, have three daughters, Jessica Rose, Jenevieve Virginia, and Jordan June. John is active in his children's sports programs, coaching soccer and skiing.

THE FOUNDERS' LEGACY SOCIETY

Over the years, the Foundation has been privileged to receive generous and thoughtful gifts from friends and supporters who remembered the Foundation 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 Foundation, 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 Foundation's planned giving program was established to help donors explore a variety of ways to remember the Foundation. 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

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(continued from page 15)

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Medical research and education programs are supported by gifts to the Foundation'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 Foundation.

Donors at this level support many programs, including the Foundation's research to validate the success of new treatments for degenerative arthritis and identify factors that influence success. We thank the following for their support in 2008:

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Ms. Elizabeth Buntrock

CHAIRS SUPPORT FOUNDATION WORK

The education of orthopaedic surgeons is a critically important mission of the Foundation. 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 170 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 2008, eight chairs provided important funding for the Foundation's research and educational mission. We are most grateful for the support from the following:

Mr. and Mrs. Lawrence Flinn
The Gustafson Family Foundation
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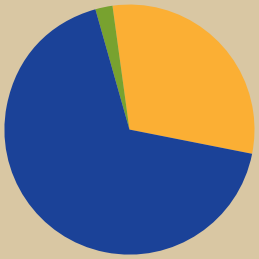
Mr. and Mrs. Steven Read
Mr. and Mrs. Brian P. Simmons

THE FACE OF PHILANTHROPY HIGHLIGHTS IN 2008

2008 Revenues

The Foundation supporters — individuals, corporations and foundations— increased their philanthropy in 2008.

Total: $ 4,016,169.



Contributions and Special Events $2,704,851

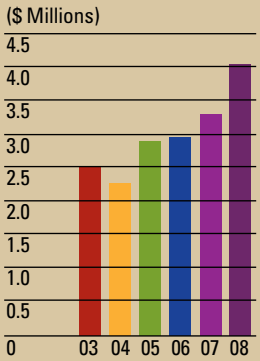
Corporations $1,226,079

Other $85,239

Increasing Generosity

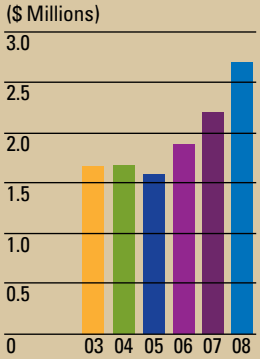
Individuals, corporations and foundations contributed $ 4,016,169 in 2008, breaking the record for total revenue.

Six years of support.



Annual Giving

The generosity of our friends making annual gifts to the Foundation between 2003 and 2008 has shown a positive trend. In 2008, contributions and special events totaled $2,704,851.



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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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The Foundation was selected by RE/MAX International, a global real estate firm, to hold the fifth 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.

The Foundation is grateful to Dave and Gail Liniger, owners and cofounders of RE/MAX International, who created this unique opportunity for the Foundation 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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FOUNDATION CELEBRATES 20TH ANNIVERSARY

2008 marked the 20th Anniversary of the Foundation and two celebrations were held.

On March 5, 300 donors, friends, and former Fellows gathered at the de Young Museum in Golden Gate Park, San Francisco, to celebrate the 20th Anniversary of the founding of the Foundation. The reception coincided with the annual meeting of the American Academy of Orthopaedic Surgeons (AAOS), which was taking place that week in San Francisco. The evening was filled with warm collegiality, a fabulous art venue, great food and music, featured vintner Silver Oak Cellars, and a tribute to Dr. Steadman and the many supporters of the Foundation for its success as a world leader in sports medicine research and education. The Foundation wishes to thank Steven and Mary Read, honorary co-chairs of the event, as well as Ted Hartley and George Gillett for their special participation in the evening's activities.

July 19

On July 19 our Founders and Board Members celebrated the Foundation's 20th Anniversary at the Larkspur Restaurant, Vail, Colorado. Festivities includes a performance by the New York Philharmonic at Ford Amphitheatre and dinner followed by a live and silent auction.

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Corporate support helps fund our Foundation's Research and Education Programs in Vail, Colorado, and at six university sites. Corporate funding has increased as we have continued to deliver efficiencies in overhead, allowing us to direct more dollars into research. This year, 68 cents of every dollar raised goes into research. The Foundation is grateful for the generous support of our corporate donors. In 2008, we received $1,226,079 in corporate support. This work will benefit patients and physicians for generations to come.

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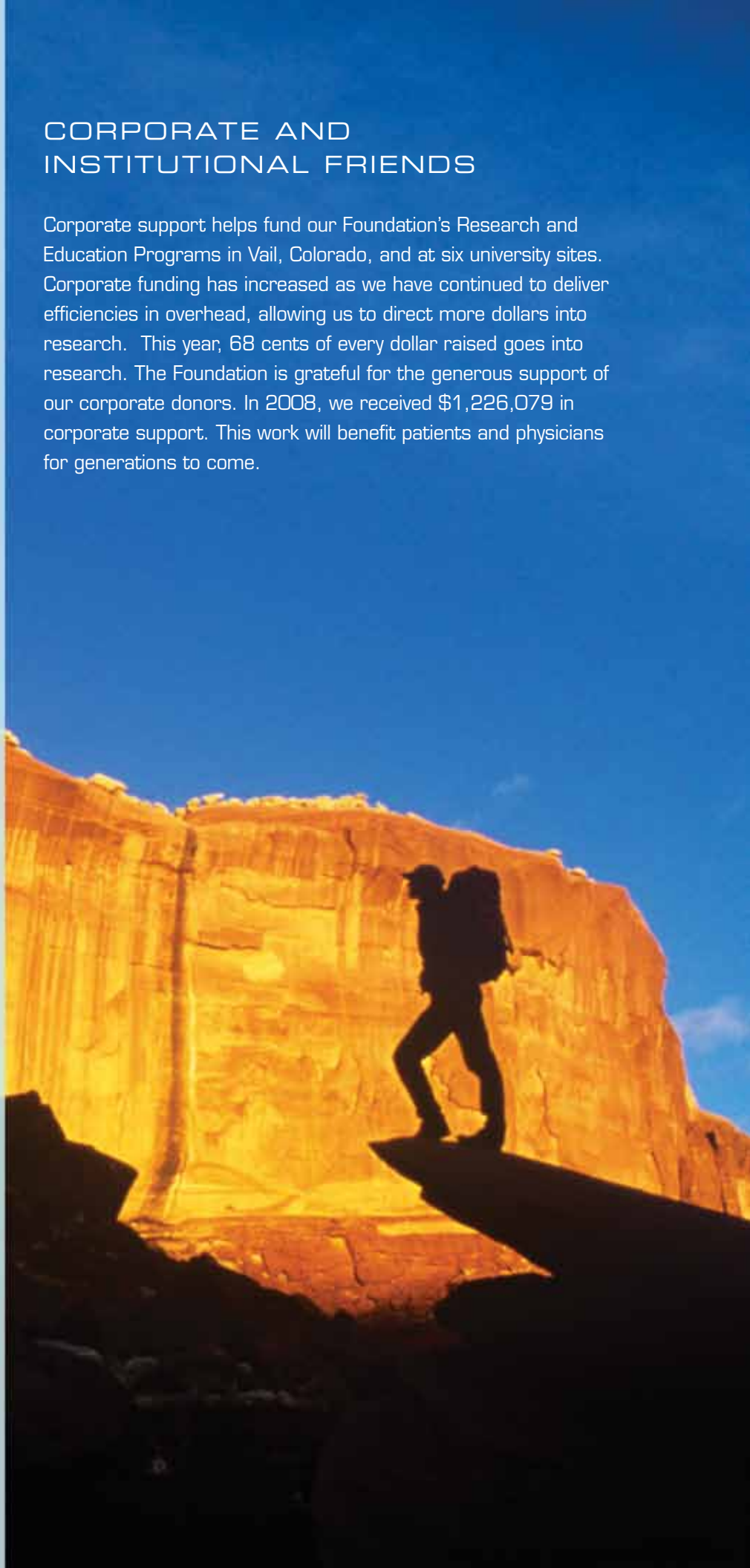


SMITH & NEPHEW ENDOSCOPY AWARDS GRANT TO SUPPORT RESEARCH AND EDUCATION

After six years of successful collaboration with the Foundation researchers, Smith & Nephew Endoscopy, a leading provider of arthroscopy tools and techniques, renewed its commitment to the Foundation.

In 2002, Smith & Nephew Endoscopy awarded the Foundation an educational grant for orthopaedic and arthroscopy research. As part of the grant, Smith & Nephew Endoscopy provided state-of-the-art endoscopy equipment for use in the BioSkills Lab.

"Our partnership with the Foundation has resulted in valuable research that helps us, as a medical device innovator, learn more about joint injuries and the most effective way to treat them," said Mike Frazzette, President, Smith & Nephew Endoscopy. "We are pleased that the research our grants underwrite will help patients around the world resume their active lifestyles."

"Smith & Nephew is a leading supplier of the systems, implants, and tools necessary to perform arthroscopic surgery," says Mike Egan, Foundation CEO. "They have a worldwide presence and are dedicated to providing innovative products to orthopaedic surgeons, focused on sports medicine procedures. We are very pleased to continue our comprehensive relationship with them. Important industry relationships like this one are vital to carrying out the Foundation's mission of allowing active people to remain active after injury. Sports medicine arthroscopic surgery in all joints is continually evolving. The surgeons' technical skills, coupled with innovative technology from industry, allow for improved patient outcomes. Our relationship with Smith & Nephew is a model for an industry-research partnership."

For example, during the 2005-6 fellowship year, the Smith & Nephew grant underwrote six research programs and more than 55 educational programs conducted at the Foundation. Smith & Nephew also provided lab equipment to support the educational programs and the studies. "These studies will result in better understanding of new treatments for arthroscopic injuries, and will expand the knowledge around hip and knee arthroscopy, ultimately leading to improved patient care," said Alain Tranchmontagne, Senior Vice President of Smith & Nephew Endoscopy Repair business unit.

Abstracts of the research were presented at key arthroscopy meetings, including the American Academy of Orthopaedic Surgeons (AAOS) and the Biennial Congress of the International Society of Arthroscopy, Knee Surgery and Orthopaedic Sports Medicine (ISAKOS) in Florence, Italy, last spring. Among the studies were research that:

- Determined the probability of football players' returning to competition after arthroscopic hip procedures.
- Described the prevalence of related injuries with posterior meniscus tears, as well as the risk of re-injury after repair.
- Classified different types of labral tears in the hip. This research will help determine what other structural defects need to be considered during repair procedures.
- Determined whether hip alpha angles – the measurement of anterior femoral head-neck offset – are significantly higher in contact athletes such as hockey and football players, when compared with non-contact athletes such as dancers and golfers. This research may have future implications in early screening programs for youth football and hockey.

"It's a privilege to have developed a long-term association with the Foundation and its talented researchers," said Jerry Goodman, Senior Vice President of Smith & Nephew Endoscopy. "This partnership benefits us as a company and orthopaedic patients everywhere, because the research generated from the Foundation supports us in our drive for innovative techniques that help get people moving again."

THE YEAR IN RESEARCH AND EDUCATION

AN INTERVIEW WITH DR. WILLIAM G. RODKEY, CHIEF SCIENTIFIC OFFICER, THE FOUNDATION

By Jim Brown, Executive Editor, the *Foundation News*

The Foundation has named William G. Rodkey, D.V.M., to the newly created position of Chief Scientific Officer. Dr. Rodkey currently serves as chairman of the Foundation's Scientific Advisory Board and Director of Basic Science Research for the Foundation, and he will continue to serve in both capacities.

Dr. Rodkey is recognized as one of the preeminent orthopaedic scientists in the world, and he has authored more than 100 articles, book chapters, and abstracts. Among the honors he has received are the American Orthopaedic Society for Sports Medicine Excellence in Research Award, the International Knee Society Albert Trillat Award, and the GOTS-Beiersdorf Research Award, which is the most prestigious orthopaedic research award in the German-speaking world.

In his new position, Dr. Rodkey will oversee the day-to-day scientific operations that are being conducted in the four research divisions of the Foundation: Basic Science, Biomechanics, Clinical Research, and the newest department, Imaging Research.

Dr. Rodkey has been with the Foundation since its inception. As we celebrate the 20th anniversary of the Foundation, we thought it would be appropriate to get Dr. Rodkey's perspective on the work of the Foundation over the past 20 years and to get his vision of what the Foundation can accomplish during the next two decades. Below are his answers to our questions.

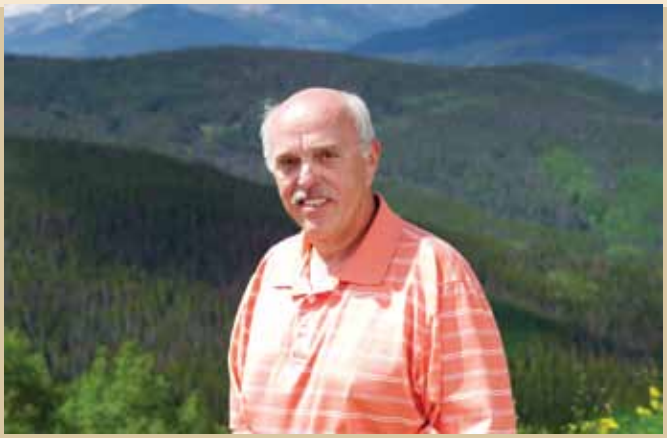
Looking back over the past 20 years, what is the most significant development in terms of the Foundation's organization?

Dr. Rodkey: "It is the fact that the Foundation has evolved from an idea — the brainchild of Dr. Steadman — into a structured organization with four distinct divisions. The organization and the physicians and scientists it has attracted have allowed the Foundation to become one of the world leaders in orthopaedic research. That position is based on our peer-reviewed publications, national and international presentations, and clinical outcomes."

What are the most significant breakthroughs or accomplishments in terms of research of those four divisions?

Dr. Rodkey: "I'll give you something for each division. In Basic Science we've been able to define the underlying molecular and cellular biological events that occur within the healing response for ACL injuries. Also, the work we've done on microfracture was a major event, especially in identifying the importance of removing calcified cartilage as part of the process and of being able to quantify molecular and cellular events at two, four, six, and eight weeks following the microfracture procedure. In doing so, we've been able to validate the rehabilitation protocol.

"The most important event in Clinical Research has been the development of a comprehensive patient database that is almost unique in the world. It is significant because we were doing evidence-based medicine (EBM) before there was even such a term. Now it's one of the hottest buzz-words in the medical and medical research communities.



"In Biomechanical Research, probably the most important milestone is our advance in computer modeling of various areas of the body, and manipulating those models based on actual human images.

"Our newest department, Imaging Research, will allow us to do things that will impact the other three divisions. For example, we might be able to image patients (rather than animals) periodically and correlate those images with Basic Science findings. In Clinical Research, we're already collecting data that enable us to correlate imaging results with our long-term studies of clinical outcomes. In Biomechanics, our researchers will be able to incorporate images into their computer models of shoulders, hips, and knees."

How is all of this going to affect a patient or a person who might consider supporting the Foundation?

Dr. Rodkey: "It goes back to trying to coordinate the efforts of all four research divisions. It will allow us to do a better job in trying to reach the same endpoint, which is clinical relevance. It will improve our overall efficiency and give the donor more 'bang for the buck.' Our overhead is already quite low when compared to other institutions. The great majority of the money given to the Foundation goes directly to true scientific effort that makes us more efficient, effective, productive, and capable. For the patient, having a more coordinated effort means there will be more science behind what we're doing. This scientific research is the basis for what Dr. Steadman, Dr. Millett, Dr. Philippon, and the other physicians at the Clinic are doing."

What do the added division (Imaging Research) and your new position mean for the future of the Foundation?

Dr. Rodkey: "Above all, it means that the future for the Foundation is bright. We can better focus on our emphasis, which is on biological healing — not the metal and plastic approach of replacement surgery. We have seen the pendulum swing so that people are more interested in this approach, and to a great degree, we have provided a springboard for that movement. From the professional athlete to the weekend skier, the coordinated research conducted by the four divisions will allow them to get back to their own level of activity as quickly and efficiently as possible."

BASIC SCIENCE RESEARCH

WILLIAM G. RODKEY, D.V.M., FOUNDATION CHIEF SCIENTIFIC OFFICER

The purpose of our Basic Science Research it to gain a better understanding of factors that 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 joint degeneration and osteoarthritis. In 2008, we collaborated with various educational institutions, predominantly Colorado State University. Our concerted efforts have significant potential to slow the degenerative processes while leading the way to enhance healing and regeneration of injured tissues.

The specialty discipline of regenerative medicine is an exciting one that has gained global attention and has led to many new and innovative techniques by scientists around the world. One of the broad goals of this work, and our main focus, can be stated simply as joint preservation. In 2008, we continued our efforts on regeneration of an improved tissue for resurfacing of articular cartilage (chondral) defects that typically lead to joint degeneration and osteoarthritis. We have worked in collaboration with Drs. Wayne McIlwraith and David Frisbie at Colorado State University. The focus of these efforts was on the use of adult autogenous (one's own) mesenchymal stem cells (MSCs) to stimulate and enhance healing of injured articular cartilage.

The following provides some background information and a 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, 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. 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 often is OA. Because of the tremendous economic costs of OA, our efforts in the area of regenerative medicine have been to address methods to ameliorate its impact.

As noted above, our major effort this year involves the use of adult autogenous 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 believe that there is a simple and inexpensive way to produce these stem cells, and then when added to the microfracture site, these stem cells will significantly enhance the speed and intensity of the healing process. If we can prove this method successful, it is likely that the rehabilitation protocol can be greatly accelerated, thus minimizing discomfort, lost time away from work or sports, and overall financial costs. And of course, we also hope that such treatment could help prevent or at least minimize degenerative osteoarthritis after chondral injury.

The primary objective of this ongoing research project is to test the potential of bone marrow derived MSCs to augment the healing response gained in full-thickness cartilage defects that have undergone the microfracture procedure. The working hypothesis is that the combined effects of intraarticular injection of autogenous bone marrow derived MSCs with microfracture will promote superior healing in full-thickness defects compared to microfractured defects alone, and furthermore, the healing with the MSCs will be superior to that observed in our earlier studies referenced above. We are using our well-established equine model to pursue the goals and objectives of this study. We are confident that we can definitively address the main question: Do bone marrow derived mesenchymal stem cells enhance the cartilage repair process when used in conjunction with the microfracture procedure?

This study is being carried out in twelve horses in conjunction with our collaborators at Colorado State University. Full-thickness cartilage lesions were made in each knee (stifle) joint and then microfractured in a standard manner. At the same time, bone marrow aspirates were obtained, MSCs were isolated, and the MSCs were expanded in culture for the next three weeks. After three weeks, randomly and in a fashion blinded to the investigators, one joint received an injection of the expanded MSCs while the opposite joint received a placebo control. Four months later, relook arthroscopy was performed on all of the joints, and photographic documentation of the joints was carried out. All of the tissue will be harvested at twelve months. Not until all samples have been analyzed will the investigators be allowed to know which joints received which treatment. We are all very excited to bring this study to its conclusion and find out if adult autogenous MSCs can make a significant difference in cartilage healing, and thus help prevent or at least minimize degenerative osteoarthritis after injury to the cartilage.

These exciting times and earlier outcomes are encouraging, and we believe that very important research results lie just ahead for the Basic Science Research group and the Foundation.

CLINICAL RESEARCH

KAREN K. BRIGGS, M.B.A., M.P.H., DIRECTOR OF CLINICAL RESEARCH; MARILEE P. HORAN, M.P.H.; LAUREN M. MATHENY, B.A.; CONNOR HAY, B.A.; RESEARCH INTERNS: EVAN CHRIS, HANNA AULTMAN, MISSY GIERACH

Introduction

This year the demand for healthcare reform became a major issue. One of the basics of reform includes outcome-based patient care. This concept focuses on how the patient does following surgery. If every doctor kept track of how their patients do following surgery, then patients would then know what to expect from a surgery. This would allow for patients to make informed decisions and improve satisfaction with healthcare. Ask your doctor how many of the surgeries has he/she done and what is the outcome of those patients. This would also help with the cost of healthcare. The goal would be to find the doctor that has the least failures and/or complications. The fewer failures that require a subsequent surgery and the fewer complications, the less money spent on healthcare. The Clinic has been practicing the model for years. For more than 20 years, Clinical Research has been defining patient outcomes in sports medicine. Over the years we have gone from just knee and shoulder to the addition of hip and spine. We are looking forward to adding ankle in 2009.

Dr. Steadman saw the need for the documentation of patient outcomes and now we have over 15 years of data. Clinical Research leads the way in documentation and collection of outcome data. We also use the data to publish patient outcomes and can answer when the patients ask, "How many of these surgeries have you done and how did they do?" Our clinical research database continues to be productive. We have increased the number of publications over last year, with 2008 being the most productive we have ever had. We are currently following over 17,000 knees, with 10,000 of these knees more than 10 years after their surgery. We also are tracking outcomes on 2,000 hip arthroscopies, which may be one of the largest series of consecutive cases with documented surgical details. Our shoulder database continues to grow, with nearly 5,000 shoulder surgeries, as does our spine database with nearly 1,000 spine surgeries. We look forward to the future of outcomes-based patient care, which has been practiced here for many years. The following studies are a few examples of the research we have conducted in 2008. All of these studies help contribute to outcome-based health care.

Knee Research

Approximately 250,000 anterior cruciate ligament (ACL) reconstructions are performed every year in the United States. ACL injuries are most commonly caused during an activity that involves a twisting or pivoting motion of the knee, causing the ACL to tear and creating a popping noise in the joint. Various studies have shown that ACL reconstructions with autograft tissue (tissue from the patient's own knee) report a failure rate of approximately 5-10 percent of all surgeries performed each year. Despite the prevalence of this procedure, a debate still exists regarding the ideal graft choice. The use of allograft tissue (cadaveric donor tissue) continues to gain popularity because it lacks the inherent disadvantages that are specific to the utilization of autograft tissue. Some of the disadvantages of autograft use include harvest-site morbidity (disease), scarring and tendinitis, patella fracture, etc. Despite these disadvantages, ACL autograft use is still considered advantageous for a number of reasons, including lower surgical costs, lack of cell death, improved graft incorporation, and lack of donor-to-host disease transmission. Contrary to autograft tissue, the use of allograft tissue avoids harvest-site morbidity, provides less peri-operative pain, and shortens operative time significantly. The preparation of allograft tissue has changed significantly in recent years, significantly decreasing the chances of disease transmission, while still preserving the collagen integrity of the graft.

The purpose of this study was to document ACL revision rates and subjective outcomes following anterior cruciate ligament reconstruction with Achilles allograft, bone-patellar tendon-bone (B-PT-B) allograft, hamstring autograft and B-PT-B autograft, while controlling for surgical technique and rehabilitation. Our hypothesis was that revision rates and outcomes of ACL allograft and ACL autograft procedures

would be similar among ACL reconstruction groups performed by the same surgeon with the same rehabilitation.

Four hundred and forty-four patients who underwent ACL reconstruction by two surgeons were tracked for outcomes and revision. There were four groups: Group 1-Allograft (n=70) ACL reconstruction with B-PT-B allograft, Group 1-Autograft (n=106) B-PT-B, and Group 2-Allograft (n=111) Achilles, and Group 2-Autograft (n=157)=hamstring. For survivorship analysis, a survivor was defined as a patient who did not require a revision ACL reconstruction.

The revision rate for Group 1-Allo was 1.8 percent (n=1), Group 1-Auto (n=2) was 2.4 percent, Group 2-Allo was 2.4 percent (n=2), and Group 2-Auto was 5.0 percent (n=4). Survivorship at four years for Group 1-Allo was 99 percent, for Group 1-Auto was 96 percent, for Group 2-Allo was 93 percent, and for Group 2-Auto was 85 percent. There was no significant difference between Group 1-Allo and 1-Auto or between Group 2-Allo and 2-Auto for Lysholm score, Tegner activity scale or patient satisfaction (p>.05). The revision rates and survivorship at four years for all four groups in this study were similar to that in current published meta-analyses of autograft ACL reconstruction.

This study showed that allograft use can produce as good or even better results than autograft use, allowing patients to feel confident and reassured with this surgical procedure.

Use of an Unloader Brace: A Prospective Cohort Study

The prevalence of osteoarthritis (OA) is constantly increasing, currently affecting 4.3 million adults in the United States, and making this chronic joint disorder the most prevalent worldwide. One contributing factor that may increase the severity of knee osteoarthritis is knee malalignment. Some studies have shown that an increase in the load of the knee can cause an increase in knee degeneration of that compartment.

There are many forms of non-surgical and surgical treatment options that exist in order to relieve pain, and therefore increase knee function. Non-surgical treatment options include oral supplementation, such as glucosamine and chondroitin, as well as corticosteroid and hyaluronic acid knee injections. Previous studies have shown that oral supplements, as well as knee joint injections, may cause a decrease in symptoms such as pain. However, these treatments are temporary and do not change the mechanics of the knee.

Unloader braces are specifically designed to decrease the load on the degenerative compartment of the knee in order to improve function and decrease symptoms related to malalignment and osteoarthritis. The purpose of this study was to document patients' expectations of treatment and outcomes following six months of use of an unloader brace. Outcomes and response to the brace were measured by symptoms, such as pain and stiffness, function, use of pain medication, and quality of life.

Pain relief was very important to only 69 percent of patients and somewhat important to 17 percent. If patients did expect pain relief, 39 percent expected most of the pain to be relieved and 57 percent expected all pain to be relieved. Seventeen (37 percent) also reported stiffness as a primary reason for seeking medical treatment. Eighty-six percent of the patients expected knee stiffness or swelling to stop. Improving their ability to walk was considered very important in 89 percent. The most important expectation in this group was to have confidence in their knee (97 percent very important), avoid future degeneration of their knee (90 percent very important), and improve ability to maintain general health (93 percent very important).

There was significant improvement in pain, stiffness, and function at three weeks, six weeks, and six months. Patients also had a significant improvement in their quality of life at

Lysholm and Tegner Scores

The Lysholm score (0-100, 100=highest) and Tegner activity level (0-10, 10=highest satisfaction) are common scoring systems utilized to evaluate outcomes of arthroscopic knee surgery. The Lysholm score measures symptoms and function. The Tegner categorizes individuals based on the activities in which they participate. Outcomes following arthroscopic knee surgery have recently shifted focus to the patient's perspective.

Patient perspective is often driven by various factors, including previous experiences. The Lysholm score and Tegner activity level measure the patient's perspective of function and activity. The pre-surgical score is often compared to the follow-up score to rate improvement. Improvement in function and activity, along with patient satisfaction, are primary goals for most knee surgeries. However, these results do not say how the knee compares to someone with normal knee function.

six months as shown by the SF-12 ($p<0.05$). At three weeks, 24 percent of patients reported a decrease in over-the-counter anti-inflammatories, and 16 percent reported a decrease in prescription anti-inflammatories. At six months, 23 percent reported a decrease in over-the-counter anti-inflammatories and 16 percent reported a decrease in prescription anti-inflammatories.

In this population, patients expected pain relief, improved function and improved activity level. It was very important for the patients to avoid future degeneration of the knee and to be able to maintain their general health. The unloader brace decreased pain in the initial weeks following bracing and maintained improvement throughout the study. Improved patient function and a decrease in stiffness were also seen in the initial weeks and were maintained at end point. Patients reduced medications and had improved overall physical health.

Patients suffering from osteoarthritis with knee malalignment who wish to remain active may find this brace to be an efficient means to relieve pain without undergoing surgery. Results have shown that patients who use this brace have an overall decrease in pain and a decrease in anti-inflammatory use. By unloading the degenerative knee compartment through brace use, patients are allowed to continue their active lifestyle without invasive surgical procedures.

The Reliability, Validity, and Responsiveness of the Lysholm Score and Tegner Activity Scale for Anterior Cruciate Ligament Injuries of the Knee: 25 Years Later

In 2007 and 2008, the Foundation had the honor of working with the original designers of the Lysholm Score and Tegner Activity Scale, Dr. Jack Lysholm and Dr. Yelverton Tegner of Sweden. Through email, we worked with these two great researchers and physicians to validate their scores 25 years after they had originally published them. The score was originally designed to be physician administered and measure outcomes after knee ligament surgery. The score emphasized the evaluation of instability and was intended to correspond with the patient's own opinion of function and signs of instability. Much has changed in the past 25 years. As rehabilitation programs have progressed, patients return to function much earlier. In the early 1980s, most patients returned to sports at one year or longer after ACL reconstruction. Currently, many patients return to sports at six to nine months. Over the same period of time, outcomes assessment has become a means of accountability. Consequently, new outcomes scores have been developed for use with ACL injuries. With all these changes, the Lysholm score and Tegner activity scale continue to be used. Both are most often used as patient-administered instruments.

The purpose of our study was to validate the Lysholm score and Tegner activity scale for ACL injuries of the knee and to determine whether these two outcomes measures are responsive to change at early time points after treatment. By doing this study, we wanted to update the documentation of the Lysholm score and Tegner activity scale according to today's standards of operative techniques and rehabilitation. We hypothesized that these two patient-administered measurements would remain valid and be responsive to change at six, nine, 12, and 24 months postoperatively.

Our study showed that the Lysholm score and Tegner activity scale were valid as patient-administered scores. We also showed that the two scores were able to measure change at

each of the time points. After 25 years of changes in treatment of anterior cruciate ligament injuries, the Lysholm score and the Tegner activity scale demonstrated validity and showed responsiveness in early return to function after anterior cruciate ligament treatment. This study was presented at the 2008 European Society of Sports Traumatology, Knee Surgery and Arthroscopy annual meeting in Porto, Portugal. The authors had the unique opportunity to sit down for lunch and discuss future research ideas with Drs. Lysholm and Tegner. This paper will be published in the *American Journal of Sports Medicine* in 2009.

Shoulder Research

Lesions of the Biceps Pulley: Are There Other Common Associated Pathologies?

Anterior shoulder pathology is often overlooked as a cause of shoulder pain. A descriptive study to look at shoulder pathologies associated with the biceps was completed by Dr. Millett with the help of Dr. Sepp Braun, Arthrex's European Visiting Scholar. Data was collected prospectively on 229 consecutive patients who underwent arthroscopic shoulder surgery and had documented tears or abnormal pathologies of the long head of the biceps (LHB) tendon.

Figure 1

This tendon travels from its origin within the joint, down through the bicipital groove, exiting the joint at the level of the biceps reflection pulley complex, which is a soft tissue restraint that stabilizes the tendon in the bicipital groove (Figure 1). The biceps tendon itself may be a pain generator in the shoulder joint because this tendon is filled with nerves. However, the role of the biceps "pulley" as a pain generator remains unclear.

Of the 229 surgeries, 118 shoulders were treated for rotator cuff tears, 52 had instability issues, 44 had osteoarthritis, and 15 had other shoulder problems that were treated surgically. Average age of these patients was 48.5 years. Twenty-one people had a missing biceps tendon (9.2 percent). Seventy-six patients had a biceps pulley tear. Patients with pulley tears were significantly older than those without (58 yrs. vs. 44 yrs.; p=0.001). For pulley tears, the mean width of the long head of the biceps was significantly larger in the torn group (6.3mm vs. 5.6mm; p=0.048) and was correlated to dislocated LHB tendons (p=0.001). The pulley was torn in all cases of biceps dislocation. There was a significant association between pulley tears and abnormal rotator cuffs (p=0.001).

The doctors concluded that pulley tears are associated with rotator cuff abnormalities. In this series, biceps instability and abnormalities of the long head of the biceps were correlated with pulley tears. Since the biceps pulley system can be easily overlooked on routine shoulder arthroscopy, it is essential to inspect the area for tears. This study was presented at the American Society of Sports Medicine, Specialty Day in Las Vegas, Nevada, in 2009.

A Prospective Cohort Study on the Association Between Coracoid Interval Narrowing and Anterior Shoulder Pathology.

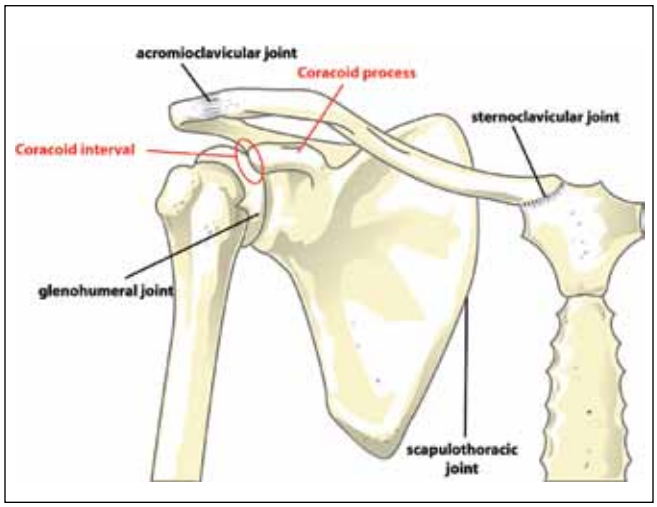


Illustration: Marty Bee

Figure 2

Coracoid impingement, although rare, should be considered, especially after the failure of previous surgery. The coracoid bony anatomy consists of a small hook-like structure on the upper front side edge of the scapula (Figure 2). The coracoid, together with the acromion, serve to stabilize the shoulder joint. The shoulder capsule and subscapularis tendon sit within the interval between the coracoid bone and the humeral head. These soft tissue structures can be put at risk during arm use in people with narrow intervals. Nonoperative care does not usually improve the symptoms associated with coracoid impingement. Surgery involves a coracoplasty in which the surgeon removes a portion of the coracoid process to increase the coracoid interval and relieve the impingement. Subscapularis tears are also treated with debridement and/or repair.

Little is known about what other shoulder pathologies are associated with coracoid impingement. The purpose of this study was to determine whether the width of the coracohumeral interval was related to anterior shoulder pathologies. The width of the coracohumeral interval was measured on MRI. Anterior shoulder pathologies, which were identified at surgery, were defined as tears of the rotator cuff tendons, tears of the shoulder capsule ligaments, and tears of the biceps tendon and biceps restraining tissue. Ninety-three patients were included in the study. The average age of these patients was 49 years.

The average measured width of the coracohumeral interval was 11.2mm, with a range of 3.8mm to 19.2mm. Patients with biceps "pulley" tears had a significantly narrowed coracohumeral interval compared to shoulders without tears (9.5mm vs. 11.9mm, p=.004). Narrowing of the coracoid interval was also significantly related to complete rotator cuff tears (p=.035). Patients with complete rotator cuff tears had a significantly narrower coracohumeral interval (9.4mm) than those with partial tears (11.4mm) and no tears (12.2mm). The coracohumeral interval was significantly narrower in patients with pathologies of the biceps (10.4mm) versus those who did not have biceps pathology (12.4mm) (p=0.009).

This study showed that a narrow coracohumeral interval was related to abnormalities of the anterior shoulder structures. The relationship to a narrow interval and abnormal shoulder pathologies may be underestimated. The threshold at which to perform a coracoidplasty has yet to be defined. However, we recommend assessment of the coracohumeral interval in all patients with anterior shoulder pathologies and coracoidplasty in appropriate clinical situations. This study was presented at the Arthroscopy Association of North America 2009 Annual Meeting in San Diego, California.

In a follow-up study, women did not have a smaller coracohumeral interval than men, which had been previously reported in the literature. The study also showed that the interval did not change as a person aged. Patients with instability had a significantly larger interval. Patients with a narrow interval also had increased pain and lower function as measured by the ASES (the American Shoulder and Elbow Surgeons Self-Report Form) score. This study was submitted to the American Academy of Orthopaedic Surgeons for consideration as a podium presentation for the upcoming meeting in 2010.

What We Know About Clavicle Fractures

The Foundation also has various clavicle fractures studies. The clavicle is the bone we commonly refer to as the collar bone and it connects the arm to the body. The bone is curved at each end, resembling a stretched "S", and fractures of this bone are common. These fractures often occur in the young active population and most are caused by sports, traffic accidents, or a blow to the shoulder. The most common treatment is nonoperative, where the bone is allowed to heal by itself. However, if the two fractured bone pieces don't line up, it is considered a displaced fracture, and surgical fixation may be needed.

Patients are treated with surgical open reduction of the fracture, where a plate and screws keep the bone fragments in place so healing can begin. The plate and screws are permanent hardware that is only removed if the patient experiences problems or pain. A newer fixation device that has gained popularity is an intramedullary pin that holds the two bone pieces in place for healing to begin and then is removed six weeks later. Both types of treatment have been studied and each has its advantages and disadvantages. However, the surgical techniques for pin fixation have improved and may decrease complications involved with surgical treatments.

Complications After Treating Midshaft Clavicle Fractures with Intramedullary Pinning

Complications were studied in 61 patients treated with pin fixations. Various data points collected, such as time to pin removal, age, gender, and mechanism of injury, were used, to determine whether any of these factors were associated with surgical complications. Of the 61 patients in this study, 18 (30 percent) experienced a complication. Overall, there was an excellent healing rate and good function was achieved in the majority of patients. Of clinical relevance was the need to further educate patients that intramedullary fixation has the potential for early but temporary hardware prominence. Patients sometimes became alarmed by the pin prominence and irritation of the skin around the pin. Other problems that the surgeon should discuss with the patient are the potential for hardware exposure through the skin and a slightly higher incidence of nonunion than in other fixations methods. However, patients with pin fixation can expect smaller scars, no long-term hardware complications, and small potential for re-fracture or further complications after hardware removal. This study was presented at the 2009 AOSSM Specialty Day in Las Vegas, Nevada.

Another study looked at the patient outcomes in displaced clavicle fractures that were fixed with the pin versus patients that were treated nonoperatively. The goal is to identify which treatment provides the best outcome for patients. Seven of 23 patients (30 percent) who were treated nonoperatively progressed to have surgery on their clavicle at an average of 1.6 years later. Five of 32 patients (15 percent) treated operatively with pin fixation progressed to another surgery for clavicle nonunion at an average of nine months after the pin was removed. There was no difference in patient satisfaction or patient pain and symptoms between the groups. Further analysis of this data may help physicians and patients make treatment decisions to strive for better function outcomes. This will result in higher patient satisfaction, which is the goal of all physicians.

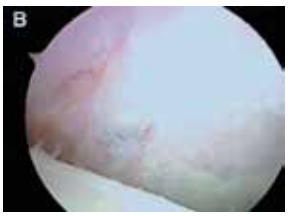
Hip Research

Can Microfracture Produce Repair Tissue in Acetabular Chondral Defects?

Injuries of the hip affecting the chondral surface of the joint may be either traumatic or atraumatic in origin. Chondral injuries are commonly associated with other intra-articular hip pathologies and disorders, including acetabular labral tears, femoroacetabular impingement (FAI), avascular necrosis (AVN) of the femoral head, hip dysplasia, and degenerative joint disease (DJD).

Extensive research efforts have shown that articular cartilage defects rarely heal spontaneously. The majority of research studies devoted to treatment of articular cartilage defects have been performed in the knee. Microfracture, developed by Dr. Steadman, has become the preferred treatment for knee chondral defects by many orthopaedic surgeons, and several studies have shown good long-term results. Microfracture is a marrow-stimulating procedure that brings undifferentiated stem cells from a subchondral perforation under the articular surface of the knee into the chondral defect. A marrow clot forms in the microfractured area, providing an environment for both pluripotent marrow cells and mesenchymal stem cells to differentiate into stable tissue. These same basic principles are thought to apply in the hip. However, literature reporting the ability of microfracture to produce repair tissue in the hip is scarce. The purpose of this study was to report second-look arthroscopic findings of microfractured lesions of the acetabulum.

Nine patients had second-look arthroscopy of their hips, which had previously undergone microfracture of a full-thickness chondral defect of the acetabulum (the cup of the hip joint). The size of the chondral defect was measured during the primary arthroscopy and the percent fill of the defect and repair grade were noted at the second-look hip arthroscopy.



The average fill of the acetabular chondral lesions at second-look was 91 percent (range: 25 - 100 percent). The one patient with 25 percent fill had diffuse osteoarthritis and required total hip arthroplasty 66 months after the microfracture. In this series of patients, acetabular chondral defects generally responded well to microfracture, with an average of 91 percent fill at an average of 1.6 years from surgery. Eight of nine patients had 95-100 percent coverage of an isolated acetabular chondral lesion or acetabular lesion associated with a femoral head lesion. This study shows successful outcomes with a less invasive treatment of cartilage repair (microfracture) of the hip joint. With microfracture of the hip available as a treatment option, patients may undergo a minimally invasive procedure to repair the chondral surface of the hip that can produce good results. This study was published in the *Arthroscopy Journal* in 2008.

Outcomes Following Hip Arthroscopy for Femoroacetabular Impingement with Associated Chondrolabral Dysfunction Minimum Two-Year Follow-Up

Femoroacetabular impingement (FAI), although unrecognized, was first reported in 1936. FAI is caused when either the head of the femur is too big or abnormally shaped to glide smoothly into the cup (acetabulum), causing hip pain and impingement, or when the acetabulum is misshapen, not allowing for the femoral head to rotate fully, also causing pain and impingement. The increased prevalence and diagnosis of acetabular labral tears, articular cartilage injury, in association with bony abnormality of the acetabulum and proximal femoral neck, have encouraged alternative less-invasive treatment options. Hip arthroscopy represents an evolution of orthopaedic sports medicine.

The purpose of this study was to report two-year outcomes following hip arthroscopy for the treatment of femoroacetabular impingement and lesions of the labrum and determine factors associated with outcomes.

A minimum two-year outcomes were obtained on 90 patients (88 percent). The Modified Harris Hip Score improved from 58 to 84. The average patient satisfaction with outcome was 8.4 out of 10. All returned to work. Patients with any joint space less than 2mm had an average postoperative modified Harris Hip score of 68, while patients with 2mm or greater

(continued on page 41)

The Modified Harris Hip Score is an outcome score that has been recently used to document outcomes following hip arthroscopy. It measures symptoms such as pain, as well as the patients' ability to do functional activities such as walking and climbing stairs.

REGGIE CRIST: SKIING AT THE TOP OF THE WORLD — FROM ICON TO INJURY AND BACK

By Jim Brown, Ph.D., Executive Editor, *The Foundation News*

In the world of skiing, words such as icon, pioneer, and superstar have been used to describe Reggie Crist. But on October 15, 2005, there was a different word to describe the world-famous skier: injured.

"I was surfing in Hawaii and got slammed sideways onto a reef," Reggie remembers. "That had happened many times, but this time it was different. It was like someone had whacked me with a ball-peen hammer as hard as he could, and the pinpoint impact went straight from the outer part of my hip bone to the socket."

For ordinary people, this event would have been unfortunate and painful, but not a life-changing event. However, Reggie Crist is not normal. He was a member of the United States Ski Team from 1986 to 1996. He has won multiple gold, silver, and bronze medals in ski cross, an X Games and 2010 Olympic event, and he is one of the world's premier "big mountain" skiers who stars in Warren Miller-produced ski films.

"When I finished ski racing in 1996," says Reggie, "I wanted to do something different. I had raced the world's most difficult downhill courses and that was an amazing experience, but I had never stood on the podium and received that gold medal. By most standards, I had a successful career, but I was frustrated."

Brother Act

"My brother Zach and I had spent our whole lives skiing," he continues. "We knew we were good at it, but we needed to find a new way to express ourselves. About that time, ski cross was gaining popularity through the X Games. (Ski cross is an event that combines timed trials and head-to-head racing over courses that can be as treacherous as they are demanding.) Zach and I had a seven-year run of consecutive podium finishes, capped in 2005 when we finished first and second. That was unquestionably the pinnacle of my ski-racing career."

But Reggie says his greatest overall achievement has been to maintain his passion for his job, which is the sport of skiing. "I started as a traditional ski racer, which led to ski cross, and now my focus is on big-mountain skiing in Alaska."

Big-mountain skiing is a broad term that refers to skiing in places where other (i.e., "normal") skiers don't ski. "There are steep grades, long runs, no gates, and exposure to rocks and crevasses," Reggie explains. "The best way to describe big-mountain skiing is that when you're standing at the top of a run, you can't see past the first turn because the mountain rolls away." For those not familiar with the sport, big-mountain skiing looks like people about to fall off the face of the earth.

Although Reggie finished second in an X Game event after being injured, he never felt right. He went through periods of feeling okay, then not so good. He had trouble putting weight on his leg. "I can't keep doing this," he remembers saying to himself. "Skiing is the one thing I'm getting paid to do, and I can't do it."

"A Good Hip Doctor"

To complicate matters, he couldn't get an accurate diagnosis. He went to doctor after doctor, but none of them could give him an answer. Then a friend who had had successful knee surgery at the Clinic told him about a guy there who was supposed to be "a good hip doctor." That "guy" turned out to be Dr. Marc Philippon, widely recognized as one of the most skilled orthopaedic surgeons and hip specialists in the world.

"I made an appointment, underwent some tests, and within 24 hours had gotten a diagnosis of a torn labrum," says Reggie. "Finally, I was talking to someone who knew what had happened to me. They told me exactly how they would fix it, how long recovery would take, and what I would be able to do as a result of the procedures they recommended."

"We can do this ten days from now," said Terie Holmquist, R.N., M.S., ANP-C, Dr. Philippon's nurse practitioner, "and you'll be skiing again in two months."

Reggie scheduled the surgery, made his plane reservations, and flew into Grand Junction, Colorado, on his way to Vail. Then he had what he calls a moment of panic. "You know, this thing doesn't really hurt that much," he thought. "I'm going to blow this thing off, get back on that plane, and not go through with the surgery." Then he had a change of mind (or maybe heart), decided to follow Terie's advice, and headed to Vail "to get this thing done."

"She was the one who never wavered," he says. "She personally cared about the decision I was making and was the one who instilled in me the confidence to trust the physicians at the Clinic.

"When I finally arrived at the Clinic, I knew I would be getting the best doctors in the world," says Reggie. He underwent left hip arthroscopy to repair the torn labrum, acetabular microfracture, osteoplasty, and acetabular rim trimming on December 12, 2006. All are procedures that were either developed or refined as a result of research conducted at the Foundation.

"What have I done to myself?"

When he woke up after surgery, he remembers the pain, the watermelon-like swollen leg, and thinking, "What have I done to myself? Is this really what I wanted?" But after the initial doubts, he was surprised and pleased that he hit every marker of recovery that Dr. Philippon and Terie Holmquist had predicted.

"In two months I was back on skis," he recounts. "After another seven weeks I was in Alaska, probably skiing better than ever before. Today, I can do anything I want. I feel some mild clicking in my hip, but no pain. I have a lot of clicking in other parts of my body, so I'm not worried about a little more noise in my hip.

"As a world-class athlete, there is nothing I value more than my health. To have that taken away from me for more than a year and to not even know what was wrong was a challenging time in

"I thank Terie and Dr. Philippon for giving me the most important thing in my life, which is my health, and the ability to enjoy my life at the highest level."

my life. I thank Terie and Dr. Philippon for giving me the most important thing in my life, which is my health, and the ability to enjoy my life at the highest level."

Reggie is now married and relatively settled in his Sun Valley, Idaho, home. He and his wife, Laura, an elementary school teacher, have a new baby girl, Jayden. A typical day for him — but remember, this guy is not typical — is to be Mr. Mom when Laura leaves for work, then head to the slopes by mid-morning.

Always a Skier

"Right now my hands are full with my family and working with my sponsors, Columbia Sportswear and K2 Sports." He provides feedback regarding outdoor clothing for Columbia and helps design ski equipment for K2 Sports. "My job is to be involved in the sport of skiing. I am a skier, always have been, always will be."

Asked what he wants to be doing 5-10 years from now, Reggie says, "I hope to be skiing with my daughter." For an athlete who has reinvented himself at least three times and succeeded at the very highest levels of competition, skiing with Jayden may become the most satisfying experience of his life.

SAMBA, SOCCER, AND SCIENCE

My name is Bruno Goncalves Schroder e Souza, and I am a Brazilian orthopaedic surgeon working on the new Visiting Scholarship Program in Hip Arthroscopy and Biomechanics of the Foundation. I graduated in my home town of Juiz de Fora and completed my residency in orthopaedics and fellowship in hip surgery at Santa Casa de Sao Paulo. I have a beautiful wife, Elaine, and I have been married now for almost five years.

When I first heard about the opportunity to come to the USA to do research and improve my skills in hip arthroscopy, I was in Paris in a meeting at the LaConcorde Hotel. Dr. Giancarlo Polesello, my supervisor during my hip surgery fellowship, had invited me to go to Europe and attend the course *Advances in Hip Arthroscopy*. That was a special occasion because the International Society for Hip Arthroscopy (ISHA) was being founded, and I had the chance to have dinner with all its founding members in what happened to be the very first official meeting of the Society. In that occasion, I heard from Dr. Marc Philippon that he was going to have a fellow from Brazil on the following year. I applied immediately.

It was not until some months later that I went through the selection program, along with many other doctors. Besides written tests, language skills assessment, and curriculum analysis, I took a flight to Rio, where I was interviewed by a renowned surgeon and the Director of the just-established Instituto Brasil de Tecnologias da Saude (Brazilian Institute of Health Technologies), Dr. Leonardo Metsavaht. Our meeting proved to be very productive and I could then envision that the objectives of the scholarship met all my aspirations. That is why I am so proud to receive the first Jorge Paulo Lemann Award, along with the one-year scholarship at the Foundation.

Vail was a very receptive town and I was impressed by its scenic landscapes. An even better surprise was the great infrastructure and organization of the Foundation. I started to work both in the Biomechanics department and Clinical Research. I was very well treated, and the staff was great helping me feel at home. I had the feeling, though, that they did not know much about my country, and demystifying some aspects about my country became a goal for me. Yes, we are the country of samba. This enchanting rhythm is probably the best expression of genuine Brazilian culture (just as jazz represents original American music). It conveys the happiness and energy of our people.

We are much more than that, though. Brazil is a young (509 years) country that covers most of South America. We speak Portuguese (not Spanish) and our 185 million people are proud of our natural beauties, our democracy, our history, our culture, and of our recent developments. Brazil, along with Russia, India, and China (a group now known as "BRICs"), is one of the biggest economies in the world, being self-sufficient in petroleum, possessing one of the greener energy matrices in the world, and guardian of two of the biggest treasures on earth: 40 percent of the world's potable water and the biggest rain forest on the planet. In recent years, Brazil's participation in the world economy has increased dramatically, and our commitment to develop leading-edge technology can be exemplified by the airplanes we produce and our involvement with the international space station.

Elaine and Bruno in Vail.

Yes, we also play soccer. And by the way, we are very proud of our national team that possesses five world titles (an undisputed feat). Nevertheless, I was taken aback when I enrolled in the local soccer league here in Vail this spring and found that not only Americans liked soccer but also they played very well (both women and men). Despite the fact that you don't call the sport football, as all the other 206 countries affiliated to FIFA (Fédération Internationale de Football Association). I really feel you already have the spirit of it. Your women's team has beaten ours in various occasions, and the men's team is not far from there. It was a great relief for me to see my team turn the game and win the Confederation's Cup this year against the U.S. team in the finals, but I feel that we had a little bit of luck.

I could stop my description at this point and most people would already have changed their minds about my country. However, I couldn't miss one of the most important points. Among the many friends I made during this year, one of them came up with a commentary that helped me understand one of my primary objectives in this program. As the first of many coming Visiting Scholars from Brazil, I heard positive feed-back about my work, so far. Besides being amused, I always felt curious about the way people really felt about that. It was only when a colleague confessed that nobody expected much from a scholar from a developing country that I understood why people looked so impressed. That motivated me to work harder and try to undo some of the misconceptions about my country. We are increasingly investing and participating in research because we believe in science's ability to make people's life better. The Visiting Scholarship program at the Foundation is an example of our interest to collaborate and advance. Americans should know we see the U.S. as a strategic partner to further progress with our scientific and development goals. So, the next time you think or hear about Brazil, you should remember we have good samba, we are proud of our soccer, we are working hard to help with the progress of science, and we have the 2016 Olympics.

(continued from page 37)
joint space had an average of 87(p=0.005). There was no difference in their preoperative scores.

Overall, this study showed good to excellent results following hip arthroscopy. Joint space of less than 2mm of the hip joint showed to be a predictor of poorer outcome than those with more than 2mm of joint space. This study is useful in that it has altered patient selection for hip arthroscopy, in that patients with less than 2mm of joint space are not recommended for this surgery because they are more likely to undergo total hip replacement. This study also demonstrates to patients and physicians that there is an option for a less invasive surgery for patients, other than total hip replacement. With hip arthroscopy showing good long-term outcomes, patients have more options available in order to continue with their active lifestyles and careers. This study was published in *The Journal of Bone and Joint Surgery, British Volume* in 2009.

Hip Arthroscopy Rehabilitation: The Sport Test

Following hip arthroscopy, patients typically undergo a multitude of rehabilitation exercises, clinical evaluations and standardized subjective assessments. Together, this extensive process provides both the physician and physical therapist with a clear account of patient progress and recovery. Nonetheless, one of the most difficult questions to answer is when can a patient return to sport or full physical activity. As the field of hip arthroscopy continues to develop, postoperative functional measures and testing become increasingly important to ensure patients do not return to activity too early and risk re-injury, new injuries or recurrence of symptoms.

In addition to the subjective assessments, we utilize an objective functional test called the Sport Test to evaluate the patient's rehabilitation progress and determine whether the patient can safely return to sport-specific training. A standardized functional exam is a useful tool to assess the ability of the involved extremity to perform safely at a functional level. Instead of isolated measures of range of motion and single plane strength, the Sport Test uses combined coordinated movements of the entire involved extremity assessing muscle power (strength over time), ability to maintain a correct form during exercise and the presence of pain in common training situations.

The Sport Test is comprised of four exercises with a 20-point scoring system. It is meant to test the patient's ability to demonstrate endurance and functional strength in the lower extremity. The four tests are the single knee bends, side-to-side lateral movement, diagonal side-to-side movement, and forward box lunges. The final test is a forward box lunge onto a box set at the height of the patient's knee. A score of 17 or higher is considered a passing score. The Sport Test is used as a pre-surgery functional exam as well as a return to training/play functional test. We recommend that once a patient passes the Sport Test, he or she may return to training prior to actual return to play. In a study we recently completed, failing or passing the Sport Test was associated with the level of return to sport activity. With 100 percent being return to full sport activity, at six months the sport activity score was 84 percent for patients who passed the Sport Test. Those who failed had a sport activity score at six months of 66 percent. The Sport Test result is associated with the level of sports activity six months after surgery. This test is an important adjunct to the patient's clinical exam and subjective impressions because it helps to quantify their ability to return safely to sports training. Creating a successful rehabilitation program following hip arthroscopy is imperative to successful patient outcomes. Rehab aids and accelerates function and progression to pre-injury activity level. This rehabilitation protocol creates a clear and concise plan that physicians can easily follow in order to get their active patients back to playing sports and regaining their pre-injury activities.

Hip Injuries in Professional Hockey Players

Ice hockey is a worldwide sport enjoyed and played by millions. As hockey is contact sport, the injuries that receive the most attention are those that are caused by collisions or other physical contact. However, there is one injury that occurs quite often to participants of this sport that is not caused by aggression, but by play itself. This injury not only causes debilitating pain, but results in early retirement for many professionals.

Femoroacetabular impingement (FAI) is caused by bony abnormalities of the acetabulum (pincer) or neck of the femur (cam). This atypical morphology results in collisions within the hip joint that would normally not occur. These impacts can, over time, damage the cartilaginous surfaces inside the joint as well as the labrum. If this pathology remains untreated, it will most likely lead to osteoarthritis and a reduction in

mobility for the patient. The stride during skating in ice hockey demands a mechanical cycle of motion that, when preformed, can lead to overload when the joint is placed in certain positions. For example, the butterfly technique used by goalies places the hip joint in a nearly constant state of internal rotation and flexion. If overload does occur, either suddenly or repetitively over time, it may result in further aggravation and degeneration of the joint.

Dr. Philippon is one of the pioneers of the modern technique of treating FAI and has successfully corrected this pathology in many ice hockey professionals. One study conducted by Dr. Philippon and his colleagues looked at 28 players who received hip arthroscopy surgery on one hip to correct FAI and labral damage. The participants of the study ranged from 18 to 36 years of age, and consisted of seven goaltenders, nine defensemen, and twelve offensive players. The time from the onset of symptoms to surgery averaged 19 months, with a range of 1.5 to 99 months. All patients' radiographs showed evidence of cam impingement, and 85 percent of radiographs showed pincer impingement. Rim trimming and osteoplasty followed by microfracture were used to correct FAI. All participants showed labral pathology with tears that occurred in the superior quadrant mostly between the 10 and 2 o'clock positions. Suture anchors were used for labral repair. After treatment, the average time to the return to skating was 3.8 months (range one to five months) and the average number of games played was 94 (range 3 to 252). There was no correlation between time to return to play and age. However, patients who had surgery within one year of the onset of symptoms returned to sport at three months, as compared to those who waited longer than one year returned at 4.1 months. Patient satisfaction ranged from 5 to 10, with 10 as the median. Follow-up was conducted within a range of 12 to 42 months, with an average of 24 months. This report concluded that professional hockey players who suffer from hip joint pathologies can return to skating and, furthermore, perform at a professional level. In addition, it highlights the player's responsibility to recognize symptoms and seek treatment in face of a desire to play now.

Spine Research

Pre-Operative Expectations in Workers' Compensation Cases Before Lumbar Spine Surgery

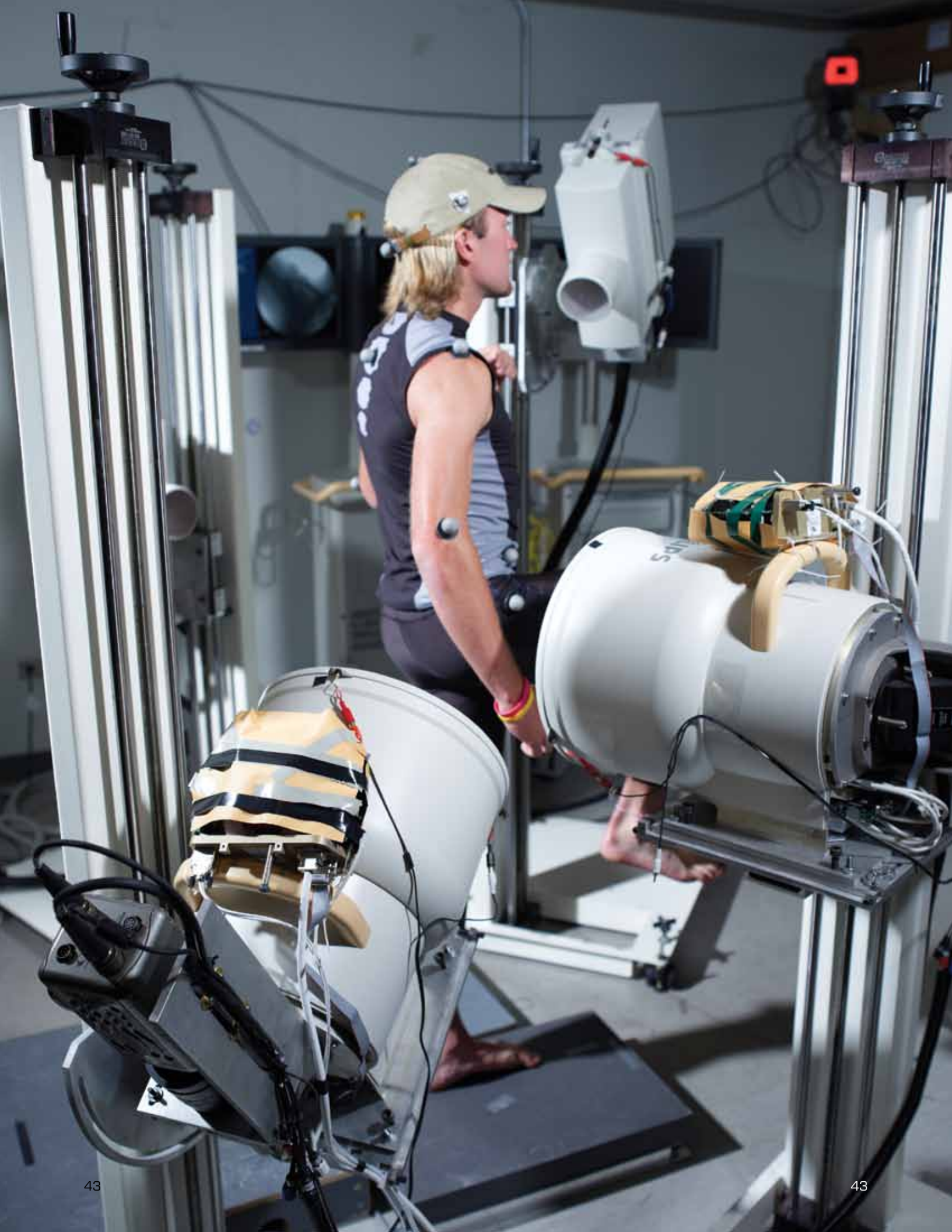
It has been shown that lower expectations regarding work status are associated with Workers' Compensation cases (WC). However, little research has been done regarding expectation of outcomes in WC patients. The purpose of this study was to determine the relationship between surgical expectations and WC in a patient population undergoing lumbar spine surgery. In this study, Workers' Compensation cases, on average, completed 46 weeks of physical therapy (PT) prior to surgery, versus an average of seven weeks of PT for all other patients ($p<.001$). WC patients were not as likely to expect relief from symptoms as other patients. Forty percent of WC patients thought getting back to their usual job was only somewhat likely and 40 percent thought this was extremely likely, while only 8 percent of other patients thought getting back to their usual job was only somewhat likely and 61 percent thought this was extremely likely ($p=.009$). Twenty-nine percent of WC patients thought that exercising and doing recreational activities was extremely likely, while 53 percent of other patients thought exercising and doing recreational activities was extremely likely ($p=.025$). Twenty-three percent of WC patients thought preventing future disability was extremely likely, while 43 percent of other patients thought preventing future disability was extremely likely ($p=.017$).

Conclusions: Workers' Compensation cases had lower surgical expectations than other patients undergoing lumbar spine surgery, even regarding expectations not related to work. They also had completed more physical therapy prior to surgery than the non-WC patient population. Patient expectations should be considered in patient preoperative assessment. This may help physicians assess the likelihood of surgical success in their WC populations.

Chronic Graft Site Pain and Activity Limitation Following Anterior Decompression and Fusion with Iliac Crest Bone Graft

When patients undergo a spinal fusion, bone may be taken from the hip to help fill in the fusion. Varying rates of chronic graft site pain following anterior cervical decompression and fusion (ACDF) with iliac crest bone graft (ICBG) have been reported. The purpose of this study was to determine the prevalence of chronic graft site symptoms and relationships to surgical details, disability and quality of life.

At six weeks following fusion, 83 percent of patients reported graft site pain. Twenty-nine patients reported chronic pain at their graft site at an average follow-up of 3.4 years. The average worst pain for those patients with chronic graft site pain was 2.7 on a 1 to 10 scale, with 10 being worst pain imaginable and 1 being no pain. This indicates that the graft site pain reported was very mild. Graft site pain did correlate to disability and quality of life. This study showed an overall prevalence of 35 percent chronic graft site symptoms and 29 percent chronic graft site pain following ACDF with ICBG. The physical aspect of quality of life as measured by the SF-12 (quality of life score) was lower in patients with more levels fused and in patients with graft site pain. Graft site pain also affected patients´ perceived neck disability. Graft site pain affects patients´ disability and quality of life and can limit patients in activity. More research is needed to determine more ways to decrease its prevalence.



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BIOMECHANICS RESEARCH LABORATORY

MICHAEL R. TORRY, PH.D., DIRECTOR; KEVIN B. SHELBURNE, PH.D., ASST DIRECTOR; J. ERIK GIPHART, PH.D., SENIOR STAFF SCIENTIST; JACOB KRONG, M.S., RESEARCH FELLOWSHIP; DANIEL PETERSON, M.S., RESEARCH FELLOWSHIP; MICHAEL J. DECKER, PH.D., POST-DOCTORAL FELLOWSHIP; FLORIAN ELSER, M.D., VISITING RESEARCH SCHOLAR; BRUNO SOUZA, M.D., VISITING RESEARCH SCHOLAR

The Foundation's Biomechanics Research Laboratory (BRL) is a multidisciplinary laboratory which applies quantitative, analytical, and integrative methods to the field of orthopaedic medicine. The staff of kinesiologists, mechanical engineers, biomedical engineers, and computer scientists integrate clinical care, research, and education with the resources of world-renowned medical doctors in order to improve the treatment of musculoskeletal diseases. This focused approach is designed to maintain and enhance athletic performance, health, and quality of life for the professional, semi-professional, collegiate, high school and the recreationally active individual. The programs provided by the Biomechanics Research Laboratory are unique and diverse and they encompass a complete range of services for the physically active or those wishing to return to an active lifestyle after injury.

In 2008, dual-plane fluoroscopy began to show its promise with nine presentations showcasing this technology at the 55th Annual Meeting of the Orthopaedic Research Society, and 37 publications and presentations worldwide. Each year our research gets stronger, more robust, and we are receiving recognition from our peers for the quality of our work.

Investigation of Male and Female Anterior Cruciate Injuries

The anterior cruciate ligament (ACL) is one of the major stabilizers of the knee joint. Each year, as many as 250,000 people (approximately one in 1,200) in the United States alone rupture their ACL. Among a younger population (age 15 to 45 years), the incidence of ACL injury is even higher, elevated to one in 1,750. The annual financial cost for ACL reconstruction is estimated to be well over one billion dollars. About 70 percent of these injuries are through non-contact mechanisms, involving such maneuvers as sudden deceleration, cutting, and pivoting. Further, females have a risk factor for ACL injuries that is two to eight times greater than males while playing the same sports. Such high incidence in females, coupled with a significant rise in the number of females participating in sports, has led many to consider the phenomenon as an epidemic.

This research initiative represents a collaborative effort between the Foundation and the Musculoskeletal Research Center (MSRC) at the University of Pittsburgh (Dr. Savio L-Y Woo). Extensive work has been performed to gain better understanding of the contribution of the ACL to joint stability, as well as to quantify the *in situ* (in place) force in the ACL. A significant portion of our findings have already been translated into clinical practice, as improved ACL reconstruction procedures have been developed based on sound biomechanical principles. In this research endeavor, we strive to build on the experience of these two institutes and study ACL function *in vivo*.

By combining the newly developed technology at both research centers, we will be able to advance our knowledge on the forces experienced by the ACL *in vivo* (as it happens). Thus, our overall objective is to obtain better quantitative data of gender-specific function of the ACL that would lead to the understanding of the causes and mechanisms of the higher rates of non-contact ACL injuries in females. To do this, we

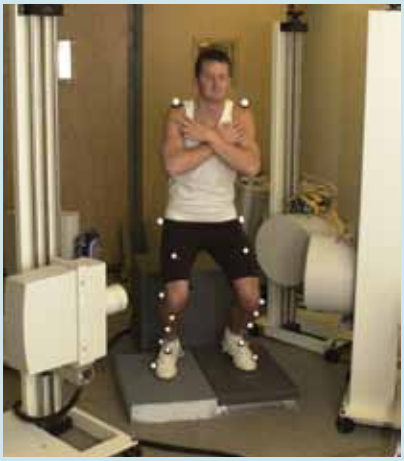


Figure 1

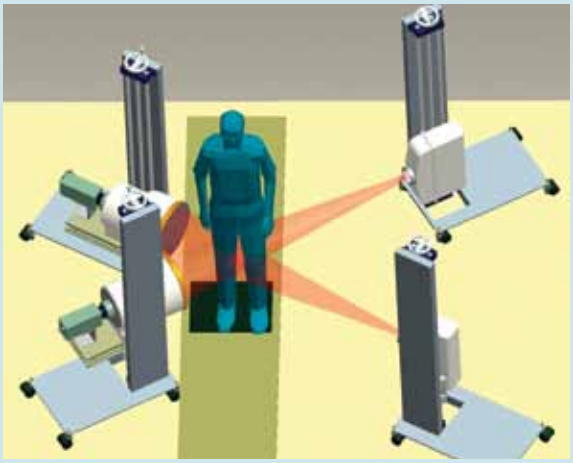


Figure 2

A rendering (left, figure 1) of our dual-plane fluoroscopy system imaging the knee. The gantry mechanism (figure 2) allows freedom of movement while imaging from the height of the ankle to the neck; this allows easy adjustments for different heights of subjects or landing platforms.

will quantify the *in situ* force and force distribution in the ACL during activities and examine potential differences between genders. In addition, we will evaluate how preventive training in female athletes can reduce the risk of ACL injury by lowering the force in this ligament. Knowledge of the mechanisms of ACL injuries will aid in the designing of effective prevention training programs to reduce non-contact ACL injuries, as well as designing gender- and/or patient-specific surgical treatment and postoperative rehabilitation protocols. This, in turn, will lead to improved patient outcomes by minimizing the risk of re-injury, as well as preventing the eventual development of osteoarthritis following ACL reconstruction.

To achieve our objective, we will utilize our high-speed, dual-plane fluoroscopy system that has been developed to collect accurate tibiofemoral-joint kinematics *in vivo* from healthy volunteers landing from a jump. Then, the subject-specific knee kinematics will be reproduced on matched human cadaveric knees using a high payload robotic/universal force-moment sensor (UFS) testing system at the University of Pittsburgh to determine the *in situ* force and force distribution in the ACL. The six degrees-of-freedom (6-DOF) *in vivo* knee kinematics will also be used as input data to subject-specific finite element models with a complex constitutive model of the ACL to determine the stress and strain distributions in the ACL during the same dynamic jump landing motion.

The dual-plane fluoroscopy system consists of two commercially available BV Pulsera c-arms (Philips Medical Systems, Best, Holland), which were modified under appropriate FDA guidelines and Colorado State Radiation Safety Regulations. The image intensifiers were removed from their c-arm configuration and mounted on a custom gantry (Figure 2) that allows for variable Source-to-Image-Distance (SID; generator to image plane distance) of 1.0-2.0 meters, as well as variable beam-angle configurations between the two fluoroscopy systems to allow for the ability to optimize viewing volume, movement freedom and technique factors.

With this system, knee motions will be captured with a knee-to-image-intensifier distance of 25-40 cm and exposure duration of 1.0 s. In order to capture the high speed nature of the landing motion, two coupled, high-speed, high-resolution (1024 x 1024) digital cameras with frame rates of 1,000 frames per second were interfaced with the two image intensifiers of the fluoroscopy systems using a custom design interface.

We then proceeded to validate the approach for a complex motion on human cadaveric knees. To this end, the kinematics of a cadaveric knee were recorded on the biplanar fluoroscopic system at the Foundation using both bead markers and bone tracking. The knee, along with its recorded kinematics, was then shipped to the MSRC in Pittsburgh to be replayed on our high payload Robotic/UFS testing system.

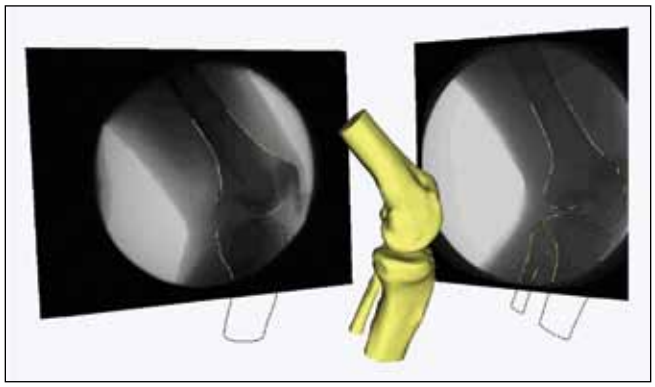


Figure 3. Example of the tracking analysis of one frame during a jump landing. Bone geometries reconstructed from CT scans are automatically matched onto calibrated fluoroscopy images after their contours are detected semi-automatically.

The kinematics show that the knee was flexed from 15 to 108 degrees and internally rotated by about 17 degrees as it was flexed. As is characteristic with knee motion, the tibia translated in the anterior-posterior direction with flexion, as part of the femoral-roll-back mechanism. Using the proposed methodology, the *in-situ* force in the ACL was measured during the replay of this motion and is shown in Figure 7. The forces in the ACL ranged from a minimum of 8 N towards extension and increased to a maximum of approximately 24 N in flexion.

Biomechanical Evaluation of Rehabilitative Exercises Pre- and Post-Hip Arthroscopy

Hip arthroscopy has evolved over the last five years and the rehabilitation techniques associated with this surgery are essential in the success of the procedures. Yet, validated protocols for the postoperative rehabilitation of arthroscopic labral repairs of the hip are non-existent in the peer-reviewed literature. The main purpose of this study is to assess a comprehensive hip rehabilitation protocol for the treatment of post-surgical hip labral injuries. Ultimately, the goal of this study is to help rehabilitation therapists establish proper protocols for post-surgical rehabilitation of arthroscopic hip labral repairs and to further characterize intra-articular movements of the hip and the muscles responsible. This project will involve cooperation from virtually every department located in the medical center, including the Foundation, the Clinic, Howard Head Sports Medicine Center, and Vail Valley Medical Center.

In addition to the main purpose of this study, we also expect to obtain new electromyographic data from muscles not previously examined. Specifically, examination of activity in the piriformis muscle has never been reported. The piriformis muscle is believed to play an important role in hip stabilization. Examining the activity of this muscle during movements of the hip will assess this belief. In order to record the activity of the piriformis muscle and other deep muscles, in-dwelling wire electrodes will be inserted into the muscle bellies and their positions verified using ultrasound imaging. With this technology, we are also assessing the roles of other muscles including the smaller, deeply positioned, hard-to-reach muscles of the hip. To date, this research has been presented at numerous clinical and scientific meetings.

Analysis of Ice Hockey Movements in Youth and Adult Players

Ice hockey is a popular winter sport throughout Canada and many parts of the United States, and its popularity is rising due to increased exposure in many non-traditional, geographic areas. Ice hockey combines tremendous speeds with aggressive physical play, and therefore has great inherent potential for injury. A large majority (more than 75 percent) of the injuries suffered by hockey players occur due to an impact with either another player or with the boards. These impacts lead to the high number of concussions, knee medial collateral ligament sprains, acromioclavicular joint injuries, and ankle sprains. In addition to these common injuries, many other injuries do not result from impact. Adductor strains, sacroiliac dysfunction, chondral injuries, labral injuries, and many of the previously mentioned problems occur without an impact.

Despite statistics that report each year 3.5 million youth and 750,000 adults participate in organized, recreational leagues across the United States, relatively little is known about the biomechanics associated with the game.

Various hockey movements, such as skating, shooting, and checking, appear to place the body in positions prone to injury. To recreate the ice rink environment, the BRL has laid down a 12' by 28' artificial ice slab with a force plate imbedded. The research project is designed to provide performance data on ice hockey players ranging in age from 8 (youth) to over age 40 years. Fifty-one youth and adult players have undergone biomechanical testing on the artificial ice.

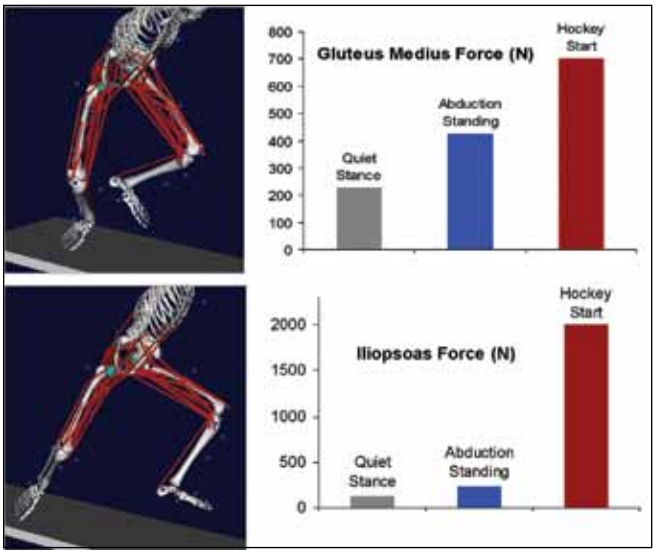


Figure 4: Sequence of pictures from OpenSim computational modeling lab showing the skate stride (push off of right foot). This forward dynamic model calculates the individual muscle forces that are producing the 3D motion of the limbs. The model can be scaled to mimic all physical sizes of youth and adult players.

Another unique aspect of this study is the application of modeling techniques to evaluate injuries that occur in hockey. Researchers at the Foundation have developed sophisticated upper and lower extremity models that are able to do this. With this technology, we will be able to estimate: (1) the individual muscles forces in all muscles that cross the hip, knee, and ankle to gain a better understanding of the load generated by each muscle; (2) determine which muscles are essential to the motion; (3) determine which muscles contribute most significantly to hip, knee, and ankle joint loads; and (4) determine when in the motion each muscle reaches its maximal force output. The latter is essential in understanding when in the skate stroke, for instance, a player might be generating muscle loads that are indicative of groin, hamstring, and quadriceps muscle strains.

The data derived from this study will be compared among the age ranges to determine similarities and differences in shot and skating mechanics across the lifespan. Inverse dynamics will also be used to calculate forces and moments within the hip, knee, and ankle joints during the various movements. This data, it is hoped, will provide information on how and why both youth and adult hockey players sustain or make orthopaedic injuries worse. We are already learning why youth are unable to perform some of the difficult motions and how some people adapt their performance when injured.

Figure 5

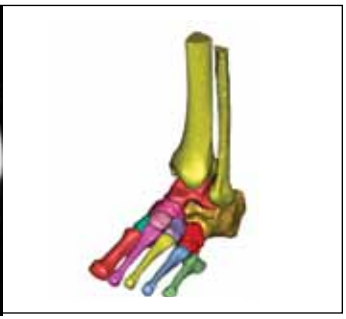


Figure 6

Figure 5: A radiographic image of the foot captured during a dynamic running trial.
Figure 6: A three-dimensional model of the foot reconstructed from a CT scan.

The Effects of Running Shoes on Foot Function and Running Injuries

Pronation, a combination of calcaneal eversion, external rotation, and dorsiflexion, is a normal movement of the foot during walking and running. In other words, the foot rolls inwards after it strikes the ground. Excessive pronation, however, has been linked to a multitude of leg injuries, including plantar fasciitis, Achilles tendinitis, and patellofemoral pain syndrome. Over 30 million Americans are classified as recreational or competitive runners, and up to half of them will be injured in any given year, many falling victim to the injuries associated with too much rear foot motion. Athletic shoe manufacturers have attempted to create more stable running shoes (especially on the inside of the shoe) to prevent overpronation and therefore reduce the chance of injury. We do not have a full understanding of how shoe technology affects how the foot moves, and therefore cannot accurately assess how the above-mentioned injuries occur and what can be done to prevent them. Traditional methods of measuring foot motion have not been able to capture how the foot moves within and interacts with the material in a shoe.

The Biomechanics group is starting a new foot project, sponsored by Saucony, that will (1) give us a better understanding of foot mechanics, and (2) allow us to identify how athletic shoes and shoe materials affect how the foot moves. This will be accomplished using our dual-plane fluoroscopy system, which allows measurement of individual bone motion within the foot to sub-millimeter accuracy. Such high levels of precision have never been previously achieved in quantifying foot motion during walking and running.

This study will involve testing competitive runners during the summer of 2009. They will walk and run through the biplane system both barefoot and in several different types of footwear. The data collected will give us important information about lower extremity injury mechanisms and how footwear may help reduce injury prevalence.

The Evaluation of Osteoarthritis Knee Braces on Tibiofemoral Joint Kinematics Using Dual-Plane Fluoroscopy

Osteoarthritis (OA) is the most common form of joint pain, affecting the knees of over 20 million Americans. OA generally develops as the knee joint's cartilage (the tough, smooth material at the end of bones) wears away over time. When cartilage wears away at the knee, the joint becomes "compacted" as the ends of the thigh bone and shin bone rub together. Usually, the compaction occurs on the inside (medial) part of the knee. Though the mechanism of OA is not fully understood, varus alignment (bowlegged) of the knee is often associated with compaction of the medial compartment of the knee, and thus an increased incidence of medial knee arthritis.

"Unloader" braces have recently been developed as a conservative and/or postoperative treatment for OA and have been prescribed with the intent of reducing knee pain. The proposed mechanism for reduced knee pain is a reduction of varus alignment, and thus a reduction of the load on the medial compartment of the knee (Figure 7). An additional possible effect of the brace is to increase the knee joint space in the medial compartment. Though unloader braces generally produce positive anecdotal results, and previous literature has shown them to reduce both valgus deformity and adduction moment, it is unknown if or how the brace changes kinematics within the knee joint, such as medial and lateral joint spacing.

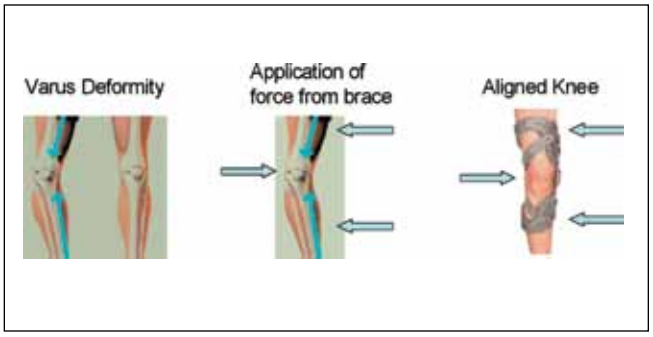


Figure 7: Proposed mechanism of knee re-alignment and pain relief.

The purpose of the current project is to use dual-plane fluoroscopy to determine the effects of unloader braces on medial joint space, adduction angle, and adduction moment, three variables that have been noted as determinants of osteoarthritis. These results will provide highly detailed information on the effects of the brace—specifically, its effects on spacing and movement of the medial compartment. Based on previous literature, as well as the positive anecdotal evidence, we hypothesize that the unloader brace does increase medial joint space and reduce adduction angle and moment. To date, data on three subjects have been collected and analyzed.

Biomechanical Evaluation of Femoroacetabular Impingement Pre- and Post-Surgical Treatment:

A Dual-Plane Fluoroscopy Study for Hip Femoracetabular Impingement

Femoroacetabular impingement is one common cause of hip pain and osteoarthritis. Three recognized patterns of lesion (cam, pincer, and mixed) have been recently described. In cam deformity, increased volume of bone in the head/neck junction and decreased head off-set to promote pathological contact of the femur to the anterior rim of the acetabulum, leading to intra-articular soft tissue damage (labral tears, chondral lesion). In pincer deformity, the acetabulum is prominent in its anterior portion. The conflict between bone structures occurs in extreme range of motions such as flexion, abduction, and/or internal rotation. Direct correlation between the zone of conflict and articular damage has been demonstrated by some studies. In the presence of that conflict with repetitive movements and load, the cartilage and the labrum, which are weaker than bone, will eventually fail. That explains why those lesions are more often diagnosed earlier in physically active people.

The treatment of this condition is based on the resection of the bone deformities in order to allow the most congruent range of articular motion, without the occurrence of further conflict. This treatment approach has been proved to be effective to relieve pain and resume function in short- and mid-term follow-up times both after arthroscopic and open surgeries. However, whether the treatment of this condition will be able to prevent the progression to articular degeneration is a question still to be answered. While long-term results (15 to 20 years) are not readily available, other indirect methods to evaluate the efficacy of that procedure can be performed immediately. Assessing whether the treatment is able to modify positively the joint biomechanics is feasible.

Our hypothesis is that, for painful range of motion, femoral head deformities cause a measurable decrease in the joint space and therefore increased articular pressure and shear forces. We believe that surgical treatment of FAI is able to increase range of motion and solve the conflict between the femur and the acetabulum, providing a measurable improvement of the articular space during the previously painful range of motion.

In a prospective study, patients with cam impingement will be enrolled and evaluated preoperatively and eight weeks after surgery. Computed tomographies will be obtained for each patient in order to provide a model to the computer software. The articular space of the hip will be then assessed in rest position and at painful range of motion during squat exercises by a dual-plane fluoroscopy system. Additionally, electromyography and 3-D motion analysis using retro-reflective markers and synchronized cameras will be obtained to provide additional information on the musculoskeletal dynamics of those patients.

Computer analysis will be carried on to determine the possible differences in articular space for determined ranges of motion between pre- and postoperative status.

The importance of this original study is to determine the dynamics of the articular space in painful hip range of motion on FAI patients. This will allow better understanding of the injury mechanism of softtissues within the joint. Additionally, it will provide biomechanical evidence of the potential long-term benefits of treatment of patients with FAI, indicating the advantages of early treatment of patients with such deformities.

Optimizing Hip Rehabilitation with Computer Simulation

Muscular weakness is a common consequence of chronic conditions and acute injuries requiring orthopaedic care. And in some cases, tendinitis occurs in muscles that are called upon to compensate for weakness in other muscles. This is no different for the hip. In particular, weakness of the gluteus medius muscle and iliopsoas tendinitis are common following hip injury. The gluteus medius acts to extend the hip, similar to the gluteus maximus muscles, but, more importantly, it also is the major muscle for abducting the hip – in other words, moving your leg away from the side of your body. During walking, this muscle is important for maintaining the proper tilt of the pelvis relative to the leg. The iliopsoas, on the other hand, acts to flex the hip, such as in a marching motion. In rehabilitation following hip injury or repair, abducting the leg while standing can help strengthen the gluteus medius muscle. The challenge is to design the exercise so that large loads are not placed on the hip joint and on the iliopsoas muscle.

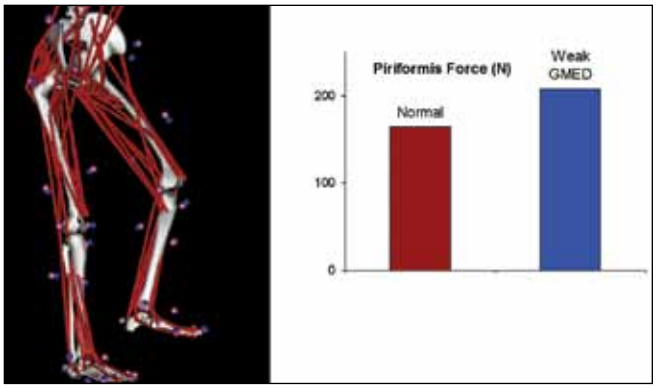


Figure 8

We undertook a study to examine whether sliding the heel against a wall during the exercise would reduce force in the iliopsoas muscle and not increase load in the injured or repaired hip joint. The idea is that wall sliding will induce patients to contract their hip extension muscles (gluteus muscles and hamstrings) and relax their hip flexor muscles (iliopsoas). For this study, we used a musculoskeletal computer model of the body. Computer models are excellent tools for asking "what if" types of questions and investigating ideas before more costly experiments are designed. The computer model contains all of the major and minor muscles spanning the hip joint. In the analysis, muscle and joint loads were calculated for two conditions: (1) leg abduction alone, and (2) leg abduction with the heel in light contact with a wall.

The results of the computer simulation revealed that sliding the heel against a wall had the desired effect, that the iliopsoas muscle force dropped to a level found during quiet standing. In fact, the wall sliding generated higher gluteus medius forces, which may help the strengthening effect of the exercise. These benefits were achieved without increasing load at the hip joint. Total joint load during abduction with and without wall sliding was about the same and only slightly higher than quiet standing.

In conclusion, it seems that wall sliding is a good idea when using leg abduction to strengthen the gluteus medius and rehabilitate the hip. Wall sliding reduces force in the tendinitis prone iliopsoas muscle while keeping joint loads about the same as normal abduction and quiet standing.

Long Head Biceps Tendon Function

Disorders of the tendon of the long head of the biceps brachii (LHB) are common. Many studies have attempted to identify the role of the LHB in shoulder function, but its significance in glenohumeral kinematics remains unclear. Some investigators describe the LHB as merely a vestigial structure, which may passively stabilize the shoulder, while others have emphasized its critical role as an active stabilizer of the glenohumeral articulation. Given the lack of consensus on the true function of the LHB in shoulder function, debate persists over surgical strategies to manage both isolated LHB pathology and disorders involving both the LHB and other critical shoulder structures, such as the rotator cuff.

Currently, the investigational techniques available to measure shoulder motion (kinematics) *in vivo* are quite limited, as there is no practical way to measure the motion of the scapula reliably or with accuracies required to fully appreciate the subtle rotations and translations of the glenohumeral joint. Therefore, new experiments are needed to improve our understanding of the shoulder. We are investigating the function of the LHB with the dual-plane fluoroscopy system that captures the osseous anatomy directly *in vivo* by measuring true 3D shoulder kinematics during dynamic activities with sub-millimeter accuracy.

Our aims for the study are to measure glenohumeral kinematics in the shoulders of subjects who have undergone unilateral biceps tenodesis (test shoulder) and compare it with the unoperated, normal shoulder (control group). This will show the side-to-side differences with and without the effects of the LHB. Subjects will serve as their own internal controls to minimize variability. Five subjects with a history of isolated LHB pathology treated by sub-pectoral biceps tenodesis and a

normal, asymptomatic opposite shoulder have been recruited for this study. Four subjects have already been tested.

The general hypothesis of the study is that the LHB confers stability to the glenohumeral joint.

Comparison of Throwing Mechanics Between Little League and Professional Baseball Pitchers

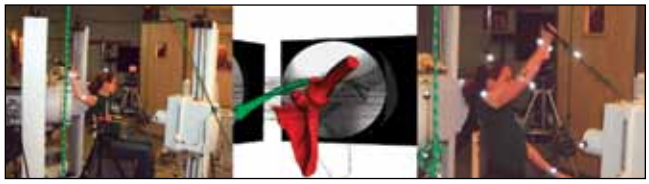


Figure 9: Simulated throw, 3D reconstruction, Forward flexion/ supination

After four years of investigating major league baseball pitching mechanics and injuries, in association with Drs. Tom Noonan (the Clinic – Denver) and Tom Hackett, and the Colorado Rockies medical staff, we have focused efforts to understanding the mechanics behind the Little League pitchers' throwing patterns and how these patterns contribute to their injury potential.

Clinically, the injuries seen in younger pitchers are much different from those observed in professional pitchers. This observation led us to believe that the pitching mechanics are most likely very different as well. Recently, the BRL has published several abstracts and papers that detail the pitching mechanics of Little Leaguers and, in conjunction with our professional pitching database, we are able to compare throwing patterns of developing young pitchers to successful mature pitchers. Although significant differences do exist, there are many more similarities.

For instance, the Little Leaguers only throw about 50-65 mph fastballs; but they execute the pitch sequence in a similar manner, with major differences from the pros being partly attributed to height, weight and physical strength.

So why are the injury patterns so different? This is most likely due to the physical strength and the skeletal maturity of the athletes. As we mature, the tissues become more rigid and able to withstand higher forces. An outcome of our research distinctly shows that young players (as early as 13 years old) need to have proper techniques taught to them as at this age these kids are already developing pitching mechanics that they will carry with them into adolescence. Also, the unique aspects of the developing skeleton in youth make their bodies more susceptible to a spectrum of injuries not commonly seen in adult pitchers. Although these injuries may be due to the musculoskeletal changes occurring during growth, they may also be, at least in part, due to pitching technique. Since the trunk (shoulders and hips) can be utilized to create enormous power and increased ball speed during the baseball pitch, it may be that the differences we observed in trunk motions

between the youth and professional baseball pitchers also may help explain the differences in patterns of injury between these groups.

We investigated the rotations of the trunk during the pitch between youth and professional pitchers. The peak rotational velocities of both the upper trunk and pelvis were greater in youth baseball pitchers than in professional pitchers. Peak upper trunk rotational velocity was 2102 ± 324°/s in youth pitchers and 1193 ± 176°/s in professional pitchers. Our data support the observation that youth baseball pitchers control their trunk motion in a less efficient way than elite pitchers. Peak pelvis rotation velocity occurred near the time of stride foot contact in the professionals, while it occurred much later in the youth pitchers. Proper timing of pelvis and upper trunk rotation are necessary to effectively transfer energy from the trunk to the throwing arm. Therefore, increased trunk rotational velocity may be a compensation for improper timing of segment rotations or insufficient muscle strength in youth pitchers. Improper energy transfer from the trunk to the upper extremity may lead to the increased shoulder internal rotation and elbow extension velocities in youth pitchers compared to the professionals. Ongoing research in this area will focus on pitch counts, arm fatigue, and how these two factors can contribute to injury mechanisms in the youth thrower.

Understanding and reducing injuries in youth baseball is very important because there is an alarming national trend occurring in youth baseball where parents are bringing their children into the sports medicine clinic and inquiring about surgeries such as the Tommy John (a relatively common shoulder surgery performed on professional pitchers).

The Effect of Clavicle Shortening on 3D Shoulder Motion

Clavicle fractures are quite common, accounting for 2.6 – 5 percent of all fractures. Seventy to 80 percent of clavicle fractures involve the middle third of the clavicle and 48 percent of these fractures are displaced. Most clavicle fractures occur in active younger individuals as the result of high-energy

mechanisms, including falls from a height, falls during sports such as cycling, skiing and snowboarding, and motor vehicle collisions.

The mechanism of injury is a direct blow to the superolateral shoulder. The intact clavicle is the only bony attachment of the upper extremity to the axial skeleton (chest). It acts as a strut, maintaining both scapular position and the length tension relationships of the muscles originating on the thorax and inserting on the scapula and humerus. Loss or alteration of this strut is thought to negatively affect shoulder function but has not been definitively determined. When treated nonoperatively, most displaced clavicle fractures heal with some degree of deformity, typically shortening with superior displacement of the medial fragment. The weight of the arm and pull of the pectoralis major on the lateral fragment and the upward pull of the sternocleidomastoid on the medial fragment are suspected causes of this deformity. The predictable malunion that follows alters the resting position of the scapula to one of protraction and downward rotation. The effect of this altered set-point of the scapula is thought to cause aberrant scapular movement during functional activities, leading to pain, fatigue, loss of strength, and possibly subacromial impingement. However, the functional capabilities and potential deficits of the acromioclavicular and glenohumeral joints due to loss of clavicle length have not been described or quantified.

Most non-displaced and minimally displaced clavicle fractures are successfully treated nonoperatively with excellent union rates with outcomes well described. However, controversy still exists regarding operative indications for more displaced middle-third clavicle fractures. Recently, several studies evaluating nonoperative treatment using patient-based outcome tools have reported less favorable results than similar studies done in the 1960s. In 2007, a randomized controlled trial of 111 displaced mid-third fractures randomized to open reduction and internal fixation versus nonoperative treatment found improved outcome scores, time to union, and union rates in the open reduction and internal fixation group at one year. A 2006 retrospective study of 132 patients with clavicle fracture treated with resultant union showed that 25 percent of the patients were dissatisfied at 30-month follow-up, and the dissatisfaction correlated with clavicular shortening of 18mm in men and 14mm in women. In a 1997 study of 52 displaced middle-third clavicle fractures treated nonoperatively, 31 percent of patients reported an unsatisfactory result and there was a 15 percent nonunion rate. The body of knowledge regarding orthopaedic management of displaced midshaft clavicle fractures is evolving.

Clavicle malunion is not well defined in the literature and although most authors suggest that over 15mm of shortening is malunion, angular and rotational malalignment have not been used to define clavicle malunion. Studies have shown that patients with clavicle malunion experience pain, weakness or fatigability, neurologic symptoms, and cosmetic deformity,

despite having full shoulder range of motion and strength on manual muscle testing. Many other patients with clavicle malunion are asymptomatic. Unfortunately, physical examination techniques can't reliably identify which patients have disability due to shoulder dysfunction from clavicle malunion. This is likely due to the fact that the complex three-dimensional motions of the clavicle and scapula are difficult to evaluate because the overlying muscle and skin obscure surface landmarks and there is no lever arm to help quantify scapular movements. Alteration of the strut function of the clavicle and of the length tension relationships of the periscapular and shoulder musculature could help explain the symptoms experienced by those with clavicle malunion. Currently, no study has been conducted that links basic science or biomechanical data to the problems associated with malunion or the improved patient-based outcomes seen with reduction and internal fixation of displaced clavicle fractures.

The purpose of this study is to evaluate and quantify the functional capabilities and potential deficits of the acromioclavicular and glenohumeral joints due to loss of clavicle length compared to the unaffected, opposite side during active motions.

Specifically, we will determine relationship changes in the acromioclavicular and glenohumeral joints due to loss of clavicle length and estimate linear translations of the humeral head relative to the glenoid to characterize the migration of the humeral head. Additionally, minimum linear distances between the humeral head and the coracoid and acromion will be calculated to investigate impingement which may result from the alterations in acromioclavicular and/or glenohumeral joint movement changes.

By identifying these changes and differences based on the function and shortening of the clavicle length, we hope to identify potentially deleterious changes in shoulder function that have not been previously identified, improve treatment and decision-making for clinicians treating patients with clavicle fractures, and provide prognostic recommendations for patient care when malunions and clavicle shortening do occur.

Measurement of Normal Shoulder Function: Providing the Data to Analyze Injured Shoulder Groups

The shoulder complex consists of four joints that move in concert to accomplish the largest range of motion of any joint complex in the human body. Previously, it was impossible to measure how these four joints move with the accuracy needed to influence clinical diagnosis, understanding, and treatment of injuries to these joints. Traditional methods of measuring shoulder motion in patients include palpation and attaching markers or sensors to the skin.

To understand how a healthy shoulder functions, 10 healthy subjects were recruited to perform four basic motions

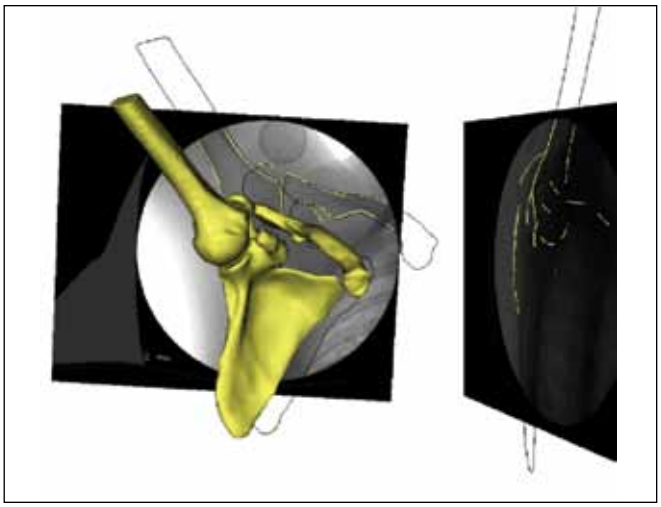


Figure 10

inside the dual-plane fluoroscopy system: raising the arm at the side and in front of the body as high as possible, as well as rotating the arm in and out as far as possible with the arm at the side and with the arm raised 90 degrees (as in throwing a ball). Measurement of these ranges of motion are important because these are common motions for activities of daily living, they represent common motions assessed clinically for shoulder pathology, and they are often used as the benchmark motions for the design of new surgical techniques and implants that must be reached to restore normal function. The images were analyzed (Figure 10) and rotations and translations of the joints were described.

Our results indicate that during arm raises the humeral head shifts approximately 1.0mm upwards when raising the arm from the side until just above shoulder height and then drops back down. This new data provides an important benchmark for patients with shoulder instability and rotator cuff tears because they have increased shifts inside the shoulder that may need surgical intervention. Further studies with these patient populations will indicate how much translation is too much and when surgery is necessary.

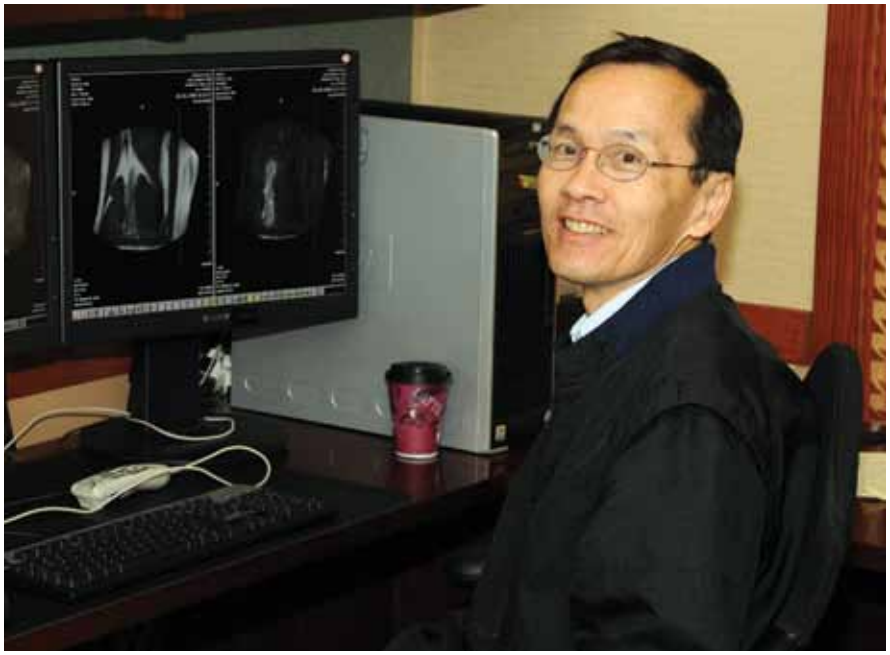
An important other finding was that during the arm raise, the acromioclavicular (AC) joint that connects the collar bone (clavicle) with the shoulder blade (scapula) moves significantly more than previously thought. This has significant implications for the surgical treatments of AC dislocations, separations, and clavicular fractures, which remain controversial. Most surgical techniques do not allow for the measured amount of motion and, therefore, are more prone to failure due to excess stresses on the repair. Further investigation is necessary to determine the best surgical technique that restores normal AC joint motion.

Analysis is underway to address additional clinical questions and to assess averages and ranges for normal motion with which pathological conditions can be compared.

IMAGING RESEARCH

CHARLES HO, PH.D., M.D., DIRECTOR

Imaging has become a vital part of orthopaedic and sports medicine for diagnosis, treatment, and postoperative evaluation. In 2008, the department of Imaging Research was established and a director was named, making the department the newest area of research at the Foundation and taking its place beside Basic Science Research, Clinical Research, and the Biomechanics Research Laboratory.



The Foundation entered a strategic alliance and research collaboration with Siemens Medical Solutions USA. The Foundation acquired state-of-the-art 3.0 Tesla (T) magnetic resonance imaging (MRI) technology with the Siemens Verio system. This technology provides the Foundation's researchers and the Clinic's doctors and patients better access to advanced medical imaging. Patients are now able to get a more comprehensive picture of what is going on within a joint or body part, receive a more accurate diagnosis, get more focused treatment, and learn how well they respond to that treatment.

The 3T Verio has an advanced imaging system with twice the field strength of conventional MRI scanners, and it can improve substantially the imaging resolution, quality, and speed of conventional scanners. The 3T system was installed in December of 2008 and has been in use since that date.

Part of the agreement with Siemens includes plans to test and validate new software developed specifically for the type of research being conducted at the Foundation. Clinically validating this process will be an important contribution to orthopaedic and sports medicine around the world. Siemens also agreed to fund this country's first clinical sports medicine imaging research fellowship at the Foundation.

The focus of Imaging Research in 2008 was to begin incorporating imaging data into the Foundation's clinical database. Imaging had been employed as an integral part of patient care at the Clinic, but the data it produced had not been collected and systematically entered into the Foundation's database until this year (2008). Now all clinical scans systematically become research scans as well.

The first initiative with the new research focus involved MRI of the knee, and the Foundation began collecting data during 2008 even before the 3T was installed. The MRI data on every patient now becomes a part of the database. The database development that began in 2008 established the framework that will include scans on other joints of the body, such as the shoulder, hip, and foot and ankle.

The data collected by using the 3T also allowed the Foundation to investigate specific areas related to imaging research. In one such study, a Clinic Orthopaedic Fellow conducted a study to determine the optimal positioning for scanning the elbow. There has been an ongoing debate, but no consensus, regarding the position that would provide the best view of the joint, as well as the most stable, reproducible, and comfortable position for the patient. Our research concluded that the best position, to meet these objectives, is one in which the patient lies on his/her back, elbow at the side, with palm down. The research began in 2008 and the conclusions were presented in 2009.

In summary, the highlights of Imaging Research during 2008 were (1) the establishment of the department, (2) the appointment of a director, (3) the strategic alliance and research collaboration forged between the Foundation and Siemens Medical Solutions USA, (4) the installation and operation of the 3T MRI technology, and (5) the beginning of a process that will allow every scan taken in the Clinic to be entered into the clinical database for scientific research conducted by the Foundation.

SIEMENS AND THE FOUNDATION TAKE SPORTS MEDICINE IMAGING RESEARCH TO THE NEXT LEVEL

3T MRI Technology Poised to Enhance Patient Diagnosis, Treatment, and Postoperative Evaluation

Siemens Medical Solutions USA and the Foundation have formed a strategic alliance that is adding 3.0 Tesla (T) magnetic resonance imaging (MRI) technology to the Foundation and allowing its clinicians and researchers better access to advanced sports medical imaging.

"Imaging has become a vital part of sports medicine for diagnosis, treatment, and postoperative evaluation," says J. Michael Egan, chief executive officer at the Foundation . "Patients from all over the world are treated at the Clinic, and they return for an assessment of their progress. With this strategic alliance, we look forward to all of the new avenues in imaging research that we can explore."

"With the strongest magnet field strength used clinically, the MAGNETOM Verio can be used for many applications, including neurology and functional neuro-evaluation, orthopaedic and cartilage assessment, breast, vascular, and cardiac imaging," says Jeffrey Bundy, vice president, Magnetic Resonance, Siemens Medical Solutions USA, Inc. "But we are especially honored to join with the Foundation to advance the field of orthopaedic imaging and sports medicine research."

Siemens MAGNETOM® Verio is a 3T MRI system with a 70 cm open bore and Total imaging matrix (Tim™) technology, the only system on the market today that combines all of these attributes into one solution. The MAGNETOM Verio represents a new class of MRI technology that increases access to advanced diagnostic capabilities and delivers high-field imaging to many patients who could not benefit from the technology before.

Once the MAGNETOM Verio was installed at the Foundation, the Clinic began using the data collected from it to test and validate new software being developed specifically for orthopaedic sports medicine and research being conducted in Vail. Researchers at the Foundation analyze the imaging data, compare it to their surgical data, and determine whether they can match the images with actual surgical observations.

For instance, researchers are able to evaluate physiology of cartilage tissue and determine the health and regeneration of that tissue in a totally noninvasive way, before and after treatment. Until now, a doctor would look inside a joint and perhaps take a biopsy just to evaluate the results of an operation or to measure progress. If the patient happens to be an athlete, in many instances it will be possible to determine the status of an injury without surgery and without keeping the player off the field until he or she recovers from the diagnostic procedure.

As the newest area of research at the Foundation, Imaging Research joins the Foundation's current departments of Basic Science Research, Clinical Research, and the Biomechanics Research Laboratory. All four departments will be integrated into the Foundation's Education and Fellowship Program.

The MAGNETOM Verio was installed at the Vail Valley Medical Center at the end of 2008. The Clinic is teaming with the Foundation to establish a new fellowship for sports medicine radiology, as well as developing specific clinical research programs for the hip, shoulder, and knee, in conjunction with Siemens.

Ribbon-cutting ceremony dedicating the Siemens MAGNETOM Verio 3T MRI machine.

Left to Right: Drs. Charles Ho and John Feagin; Lyon Steadman, CEO, the Clinic; Walter Märzendorfer, CEO of Siemens Medical Research; Foundation Board member Cindy Nelson; and Foundation CEO Mike Egan

FACT SHEET

Siemens MAGNETOM Verio 3T MRI System and new area of study "Imaging Research"

General Facts:

- The Foundation unveiled its new MRI scanner, a Siemens MAGNETOM Verio 3.0 MRI System, on December 5, 2008.
- The scanner, manufactured by Siemens Medical Solutions, operates at a field strength of 3.0 Tesla — twice that of most conventional MRI scanners used for orthopaedic imaging.
- The MAGNETOM Verio 3.0 will assist the Foundation in becoming a world leader in sports medicine imaging research, a new area of research at the Foundation.
- Charles Ho, Ph.D., M.D., of the Foundation Scientific Advisory Committee, is one of the world's leading MSK (musculoskeletal) radiologists and agreed to become the Director of Imaging Research at the Foundation. He will also be appointed to Siemens' advisory board for orthopaedic imaging.
- Siemens announced the MAGNETOM Verio 3.0 in October of 2007 and it is the only large-bore 3 Tesla MRI scanner on the market. It has a 70 cm bore allowing it to accommodate larger patients, with a table limit of 550 lbs.
- The MAGNETOM Verio 3.0 takes up the same amount of space as less powerful units, but operates at twice the field strength.

Application for Sports Medicine:

- The Foundation will design imaging data collection forms and begin collecting data on patients, which will be compared with surgical findings.
- The goal is to gauge accurately and noninvasively the severity of injuries using digital imaging.
- Additionally, the hope is, through validated research, to be able to track the healing process using imaging research produced by the scanner and collected at the Foundation.
- To support this research initiative, Siemens has agreed to fund this country's first clinical sports medicine imaging research fellowship.

AN INTERVIEW WITH DR. CHARLES HO, DIRECTOR OF IMAGING RESEARCH, THE FOUNDATION

Charles Ho, Ph.D., M.D., one of the world's leading orthopaedic sports medicine imaging experts, was recently named Director of Imaging Research at the Foundation. His appointment, combined with state-of-the-art 3-T imaging technology, provides what Dr. Ho describes as a "perfect storm" for the Clinic patients and for research conducted by the Foundation. Here are Dr. Ho's comments made during a recent conversation with the *Foundation News*.

What are the limitations of traditional imaging techniques such as x-rays and ultrasound?

Dr. Ho: "With x-rays, you are not able to see soft tissues (muscles, ligaments, tendons) well. Ultrasound allows you to see soft tissues better than x-rays, but it involves a much more localized exam. It does not provide a comprehensive view of a joint or other body part."

What can MRIs detect that other diagnostic techniques may not be able to recognize?

Dr. Ho: "In orthopaedic sports medicine, the gold standard for imaging is the MRI (magnetic resonance imaging). It allows us to see bones, bone structure, and the health of bone. But equally important, MRIs allow us to see inside joints, including cartilage, menisci, and soft tissue such as tendons, ligaments, and muscles."

Is all MRI technology the same?

Dr. Ho: "No. There is a whole spectrum of commercially available MRI machines. They vary from very "low-field" systems all the way up to high-field systems, such as the Siemens 3.0 Tesla MRI scanner. With a low-field scan, what you see is probably real. But if you don't see something, such as a defect in chondral tissue, a torn meniscus, or a torn muscle, it may not mean a problem doesn't exist. It might not be visible because of the scanner's limited resolution. The higher the field strength provided by the scanner, the more signal you get, the faster the scan, and the higher the resolution. It can see things low-field scanners can't see."

What kind of scanner is used at the Clinic?

Dr. Ho: "Since December of 2008 we have had a fully-installed, ready-to-go Siemens 3T scanner, which is the most advanced scanning technology in the world. And we have developed a strategic alliance with Siemens Medical Solutions, which is allowing us to validate its newest imaging technology."

How important is the physician who interprets an MRI scan?

Dr. Ho: "Once you have the results of a scan, regardless of the quality, interpretation of the results depends on the experience and comfort level of the person reading the scan. All areas of medicine are so specialized and developing so rapidly, it is very difficult for any single doctor to be familiar with each condition. Even within a specialty like orthopaedics or radiology, it is best to have someone who is familiar with, interested in, and comfortable with sports medicine, for example, to get the most out of an exam. A generalist may not be the best person to interpret the results of a scan compared to someone who is focused, experienced, and wants to help advance an understanding of this particular area of medicine."

What kinds of injuries present the greatest challenge in terms of diagnosis and treatment?

Dr. Ho: "There are several, but one that comes to mind is damage to articular cartilage (the tissue that covers the surfaces of bones). Not long ago, even with good-quality MRIs, articular cartilage was not being routinely evaluated or reported, not because you couldn't see it, but because the examiner was not aware that the tissue could have been seen and that it was important to evaluate."

What are the implications of the new Imaging Research department for the doctors and patients?

Dr. Ho: "The imaging system will be a huge boon to the doctors at the Clinic because they will be able to add imaging data to physical exams and laboratory tests. The 3-T imaging system allows us to evaluate the health of joints, bones, and soft tissue around joints, and we can do this noninvasively. Not only can that information be used to diagnose, manage, and treat an injury or condition, we're also able to evaluate a patient's response to treatment. Patients will be able to get a more comprehensive picture of what is going on with a joint or body part, receive a more accurate diagnosis, get more focused treatment, and see how well they respond."

What are the implications of Imaging Research for research being conducted by the Foundation?

Dr. Ho: "Until now, imaging has not been included in the Foundation's already massive database. By incorporating the results of imaging into that database, there will be a stronger tie to what happens in the Clinic. In fact, what happens in the Clinic is the database. Now we will be able to see how imaging has influenced treatment and outcomes.

"We are now knocking on the door of a whole new area of treatment. With our new imaging capabilities contributing to patient evaluation and treatment, we may be able to stabilize, arrest, or reverse the degeneration of tissue before a tear or defect in a joint occurs. We hope we can contribute to understanding, developing, and validating the type of diagnosis and treatment that no one has been able to do previously."

Let's go back to something you said earlier. What did you mean by the term "perfect storm" for both patients and the Foundation's research efforts?

Dr. Ho: "I mean that at a single place — the Clinic and the Foundation — a person can benefit from the very best combination of world-class physicians, state-of-the-art equipment (including cutting-edge imaging capabilities), information obtained from a long-standing, comprehensive patient database, and proven rehabilitation protocols. This combination of people, technology, information, and facilities makes it possible for those at the Clinic to diagnose, treat, and evaluate the response to treatment of any sports or occupational injury or musculoskeletal condition, whether caused by a traumatic event or overuse. The term to describe this capability may be trite, but for the patient it's a perfect storm."

(Editor's note: 3T technology has been available for several years, but its use in a clinical setting has not been validated nor widely available in the field of sports medicine. The Foundation is testing and validating new software developed specifically for the type of research being conducted at the Foundation.)

TRIPLE PLAY FOR ORTHOPAEDIC DIAGNOSIS: THOROUGH EXAMINATION, CUTTING-EDGE IMAGING TECHNOLOGY, ACCURATE INTERPRETATION

Siemens MAGNETOM Verio 3T MRI

The Foundation recently installed a 3-Tesla (3T) magnetic resonance imaging system from Siemens Medical MR. This system is unique in that it is the most technically advanced system for orthopaedics in the world, according to Mike Egan, the Foundation's Chief Executive Officer.

"We are grateful that Siemens Medical MR has chosen us to be its partner for clinically validating their latest technologies," says Egan. "We were also pleased to have hosted the president of Siemens Magnetic Resonance Division, Walter Märzendorfer, who came from Germany for our ribbon-cutting ceremony. Walter is personally interested in our research and very supportive of our new relationship."

Three Steps

The process of diagnosing sports injuries has become extremely important during the past several years. An accurate diagnosis is achieved through these three crucial procedures.

"The first is an excellent physical examination conducted by an orthopaedic surgeon," says Egan. "I am confident all of you will agree that we conduct the very best physical exams in the world of sports medicine. All of our physicians are trained and practice the latest scoring and grading methods in their exams. We also compare the data from our exams to our database of exams, for that particular joint, to ensure the highest quality control.

"The second is the image created by the technology being used," he continues. "There is a vast difference in available technology used to diagnose injuries. *The New York Times* quoted Dr. John Kennedy at the Hospital for Special Surgery as saying the difference in various imaging systems in this country is as great as the difference between black and white television and HDTV. We now have the absolute latest technology for imaging."

The third critical area involved in a proper diagnosis is the radiologist's interpretation (or read) of the image. "The *Times* article pointed out that there are significant differences in the skill levels of radiologists. In many cases, reads are performed by a general radiologist who has no specialized training. Our specialty is musculoskeletal expertise."

Dr. Charles Ho Now in Vail

The Foundation is very fortunate to have one of the premier musculoskeletal radiologists in the world — Charles Ho, Ph.D., M.D. Dr. Ho specializes in and reads only musculoskeletal images. Our patients now get the best possible radiological reads of their diagnostic images because of our advanced technology and Dr. Ho's specialized expertise.

"We are calling this examination-imaging-image read process our **Triple Play for Orthopaedic Diagnosis,**" concludes Egan. "While our patients already receive the most accurate diagnosis possible, we are equally excited about our future ability to diagnose the health of a person's cartilage and soft tissue in a noninvasive manner. Clinically validating this process is the genesis for our imaging research collaboration with Siemens and will be a very important contribution to the field of orthopaedic medicine around the world."

THE EUROPEAN VISITING SCHOLAR, DEVELOPED AND SPONSORED BY ARTHREX, INC., HAS BECOME THE MODEL FOR OUR VISITING SCHOLARS PROGRAM.

The Visiting Scholars programs are sponsored by corporate and individual donors. Our Visiting Scholars 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 Foundation. 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.

In 2009, the Foundation will be offering a unique, first of its kind, Sports Medicine Imaging Research Fellowship, sponsored by Siemens.

Dr. Florian Elser is the 2008-2009 European Visiting Scholar. He received his medical degree from the University of Munich (Ludwigs Maximilians Universität), Germany, in 1999. During his medical studies, he attended the University of Utah for six months. Dr. Elser began his residency in general surgery but changed focus in 2002 to orthopaedics and traumatology at the University Hospital Rechts der Isar in Munich.

This university hospital is part of the Munich Technical University, which is the highest-ranked university in Germany.

Florian Elser, M.D., the European Visiting Scholar (left), in surgery with Dr. Millett.

In January 2007, Dr. Elser became certified by the German board of Orthopaedic and Trauma Surgeons and worked as an attending physician at the Orthopaedic Trauma Service of the University Hospital Rechts der Isar, where he performed approximately 600 surgeries per year. He specializes in traumatology of the extremities and is a member of the German Traumatologic Society (DGU) and the AGA (German-speaking Arthroscopic Society). Dr. Elser has been a frequent presenter to medical students and residents and is author or co-author of seven national and international papers and two book chapters.

The focus of this fellowship is 60 percent research and 40 percent clinical education, under the direction of Dr. Peter Millett. His studies involve the function of the long head of the biceps tendon. Through the Visiting Scholars program, he looks forward to advancing his scientific knowledge and career, and to improving his clinical skills in orthopaedic sports medicine.

EDUCATION

The Foundation's primary mission is to conduct research that can be applied directly to orthopaedic medicine. To this end, education is also 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. In addition, the education department produces videotapes and educational programs on the Internet. 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.

FELLOWSHIP PROGRAM:

Learning As We Teach

Considered one of the most prominent and rigorous academic fellowship programs in orthopaedic sports medicine, the Fellowship Program is at the core of the Foundation's educational effort. Each year, six young orthopaedic surgeons are chosen from more than 160 candidates to become Fellows. They are with us for an intensive 12-month training period to refine their skills in orthopaedic surgery and to investigate the causes, prevention, and cures of degenerative arthritis, as well as the treatment and prevention of injuries. Our goal is to prepare our Fellows to be leaders in the field of orthopaedic sports medicine for the remainder of their careers.

The Foundation currently maintains a network of 173 Fellows who share advanced ideas and inspire each other to higher levels. We are fortunate in Vail to work with the best young physicians in the world. Their insight and enthusiasm during this rewarding program has demonstrated to us many times over that we, too, learn as we teach. We have successfully completed our second year of the Visiting Scholars Program, with Florian Elser, M.D., joining us from Germany and Bruno Souza, M.D., from Brazil. These educational and research-oriented programs are sponsored by corporate and individual donors. Arthrex, Inc., is sponsoring our European Visiting Scholar and Jorge Paulo Lemann is supporting our Brazilian Visiting Scholar. These scholars learn new surgical techniques and conduct research that is submitted for publication in leading orthopaedic journals.

How do surgeons get accepted into the Fellowship Program?

Every year, on average, approximately 600 surgeons graduate from orthopaedic residency programs in the United States. These surgeons become board certified and are ready to enter practice. A select few elect to continue their education for one more year in a fellowship program such as the Foundation's program. Last year more than 160 applications were received by the Foundation from young surgeons around the world. After interviews and presentations, six were selected by the screening committee.

In 2009, the Foundation will be offering a unique, first of its kind, Sports Medicine Imaging Research Fellowship, sponsored by Siemens.

2008-2009 Fellows

Six new members of the incoming "class" of Fellows spend a year refining their skills as they make final preparations for a career as orthopaedic surgeons. Each Fellow has the opportunity to be actively involved in Clinical Research, Basic Science, and Biomechanics Research. In addition, they also experience hands-on medical coverage of Major League Baseball's Colorado Rockies, the NFL's Denver Broncos, the U.S. Ski Team, and Eagle County high school sports teams.

The stream of knowledge and information flows both ways. The Fellows, having completed their formal training in leading orthopaedic programs, share knowledge they have gained from years of training with the physicians and scientists of the Foundation.

Christopher B. Dewing, M.D.

Dr. Dewing graduated magna cum laude with a degree in social studies from Harvard University, where he participated in competitive rowing. During medical school at Columbia University, Dr. Dewing excelled in marathons and endurance competitions. After his general surgery internship, Dr. Dewing, a Naval Officer, spent two years as a battalion surgeon with Marine infantry and was deployed to Iraq at the beginning of Operation Iraqi Freedom. He completed his orthopaedic residency at the Naval Medical Center San Diego. Dr. Dewing's research efforts have been widely recognized. He was a finalist for the prestigious Caspari Prize at the International Society of Arthroscopy, Knee Surgery and Orthopaedic Sports Medicine Annual Meeting in 2007 for his work on capsular volume in shoulder instability.

R. Timothy Greene, M.D.

Dr. Greene earned his Bachelor of Arts degree in molecular biology at Princeton University, where he also captained the football team. He was a member of the Alpha Omega Alpha Medical Honor Society at the Medical College of Georgia, and he completed his orthopaedic residency at Emory

Back row, left to right: J. Richard Steadman, M.D.; Peter J. Millett, M.D.; William I. Sterett, M.D.; Marc J. Philippon, M.D. Front row, left to right: Charles J. Petit, M.D.; Jason M. Hurst, M.D.; Christopher B. Dewing, M.D.; Jarrod T. King, M.D.; Ryan G. Miyamoto, M.D.; R. Timothy Greene, M.D.

University, where he worked with the Georgia Tech football team and other collegiate athletes. He has been involved in several research projects, including arthroscopic treatment of coracoid impingement, approaches to mini-open rotator cuff repair, and suture anchor placement for patella tendon repair.

Jason M. Hurst, M.D.

Dr. Hurst studied biology and played lacrosse as an undergraduate at Washington and Lee University, and went on to pursue a master's degree in human physiology and biophysics at Georgetown University. He earned his

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 2008/2009 Fellowship Class are **Mr. and Mrs. Harold Anderson, Mr. and Mrs. Lawrence Flinn, The Gustafson Foundation (Biomechanics Research Laboratory), Mr. and Mrs. Jay Jordan, Mr. and Mrs. Peter Kellogg, Mr. and Mrs. Al Perkins, Mr. and Mrs. Steven Read** and **Mr. and Mrs. Brian P. Simmons.**

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. Ronald V. Davis, Mr. J. Michael Egan, Mr. and Mrs. Milledge Hart, the Fred and Elli Iselin Foundation, Mr. and Mrs. John W. Jordan, Mr. and Mrs. S. Robert Levine, Mr. and Mrs. Kent Logan, Mr. Tim McAdam, Mr. and Mrs. Jay Precourt,** and **Mr. and Mrs. Stewart Turley.**

medical degree also at Georgetown and was a member of the Alpha Omega Alpha Honor Society. During his orthopaedic residency at Duke University, Dr. Hurst assisted with covering the Duke athletic teams. He received a Piedmont Orthopaedic Society research grant in 2005 for studying hamstring strains and has made presentations at two American Orthopaedic Society for Sports Medicine annual meetings and at the North Carolina Orthopaedic Association.

Jarrod T. King, M.D.

Dr. King studied kinesiology at the University of Texas at Austin and then pursued a degree in physical therapy at University of Texas - Southwestern. After four years as a physical therapist, which peaked his desire to delve deeper into patient evaluation and treatment, Dr. King decided to pursue a medical degree at the University of Texas - San Antonio, where he became a member of the Alpha Omega Alpha Honor Society. Dr. King then completed his orthopaedic residency at the University of Texas - Southwestern and worked on research projects investigating neurological complications with scoliosis instrumentation and also reverse total shoulder arthroplasty.

Ryan G. Miyamoto, M.D.

Dr. Miyamoto earned a degree in molecular biology and played football at Princeton University. He earned his medical degree from the University of Maryland School of Medicine. During his orthopaedic residency at New York University–Hospital for Joint Diseases, Dr. Miyamoto's team coverage of competitive football, coupled with his athletic experience, solidified his desire to pursue sports medicine as sub-specialty training. He has published articles in *Journal of Bone and Joint Surgery* and *Foot and Ankle International*, and his research interests include PCL reconstruction, medial collateral ligament injuries in the knee, and a biomechanical study on suture placement in SLAP lesion repair.

Charles J. Petit, M.D.

Dr. Petit graduated cum laude with a degree in economics from Yale University, where he captained the basketball team during his senior year and received two prestigious scholar athlete awards. He then attended medical school at the University of California at San Diego and completed orthopaedic residency at the Harvard Combined Program. Dr. Petit's research projects include operative treatment of intra-articular fractures in children, variability in the management of proximal humerus fractures, and arthroscopic removal of EndoButton after revision ACL reconstruction.

WHERE ARE THEY NOW?

The graduating class of 2007/2008 Fellows are busy establishing new careers in orthopaedics.

Casey D. Tabor, M.D.
Dr. Tabor joined a large private practice group in San Antonio, Texas, concentrating on a general orthopaedic practice with an interest in sports medicine. He also holds a Clinical Faculty position at the University of Texas - San Antonio Medical School and Orthopaedic Residency Program.

Douglass R. Weiss, M.D.
Dr. Weiss is currently practicing with Teton Orthopaedics in Jackson, Wyoming, located just off the town square and next to St. John's Medical Center.

Brian J. White, M.D.
Dr. White is now working in Denver at Western Orthopaedics.

Andrew B. Wolff, M.D.
Dr. Wolff has joined Nirschl Orthopaedic Center in Arlington, Virginia. He has been keeping himself busy wondering where all of the straightforward cases went. Dr. Wolff does an equal mix of hip, shoulder, and knee arthroscopy cases, and takes care of the athletes at Marymount University. He also teaches fellows at the Nirschl practice and Georgetown residents the finer points of the package procedure, as well as teaching the physical therapists the nuances of patellar mobs.

Chad T. Zehms, M.D.
Dr. Zehms is currently serving on active duty with the U.S. Navy in Great Lakes, Illinois. He is in a four-person group and is the sports specialist for this region. Dr. Zehms informs us that he has started to book hip scopes, ACL reconstructions, and shoulder stabilization and rotator cuff surgeries. He has been getting many difficult sports referrals from colleagues in the area due to the great training he received in Vail.

Bojan B. Zoric, M.D.
Dr. Zoric joined Stetson Powell Orthopedics and Sports Medicine in Burbank, California, where he is practicing orthopaedics with a focus on sports medicine. He is one of the team physicians for the U.S. Women's National Soccer Team and still has ties as a team physician with the U.S. Ski and Snowboard teams. Dr. Zoric has had the opportunity to teach several national courses and is planning a trip to Cuba in April 2009 with other partners in the group. They will participate in a humanitarian mission to develop current orthopaedics and arthroscopy in Cuba.

CHAD ZEHMS AND BOJAN ZORIC: U.S. NAVY AND U.S. WOMEN'S SOCCER TEAM NEXT STOPS FOR FOUNDATION FELLOWS

The United States Navy and the U.S. Women's National Soccer Team will benefit from the surgical, clinical, and research skills of Foundation Fellows Dr. Chad Zehms and Dr. Bojan Zoric. Both men completed their Fellowship programs and are now continuing their careers in completely different medical environments.

Lieutenant Commander Zehms, M.D., has been in the U.S. Navy since 2001, including the year he just spent with the Foundation, and has now resumed his service to the country as a sports medicine orthopaedic surgeon at Naval Health Clinic Great Lakes in Illinois. Dr. Zoric, a native of Sweden, has joined Stetson-Powell Orthopedics, a medical group in Burbank, California, with ties to the University of Southern California, and he has accepted a position to serve as a team physician for the United States Women's National Soccer Team.

Fourth-Generation Navy Man

The two orthopaedic surgeons made their way to the Foundation by different, but equally interesting, routes. Dr. Zehms graduated with honors from the University of Wisconsin – Milwaukee, where he was a record-setting distance runner and where he has been inducted into the university's Hall of Fame. At the Medical College of Wisconsin, he earned membership in the Alpha Omega Alpha Medical Honor Society. He completed his surgical internship and orthopaedic residency at the Naval Medical Center in Portsmouth, Virginia.

"I didn't want to take out loans to pay for my medical education," he explains, "so I went to a local Navy recruiter in Milwaukee and talked to him about the medical program in the military. I liked what I heard and signed up." His decision was not a surprise. Dr. Zehms is a fourth-generation family member to serve in the Navy.

"When I started looking into fellowship programs," says Dr. Zehms, "the Foundation was at the top my list, but I thought there was no way I could be accepted into a program as elite as this one. I made it to the interview phase and a half-hour after I left the room, they called and offered a Fellowship. I asked them where to sign."

To Vail by Way of Sweden, Rochester, Los Angeles, and Harvard

Dr. Zoric played professional soccer in Sweden, where his father is a physicist and his mother an immunologist — both with PhDs. He came to the United States and graduated magna cum laude in biology/molecular genetics at the University of Rochester, attended medical school at UCLA, and completed his residency at Harvard. His publications have appeared in the *American Journal of Sports Medicine, the Journal of Orthopaedic Research*, and *Arthroscopy.*

"When I was at UCLA, I had an inclination that I was going into orthopaedic surgery and sports medicine," says Dr. Zoric. "The doctors there told me about the Foundation. The combination of participating in a sports medicine fellowship while living in Vail was very attractive."

Working With the Team

Like every Foundation Fellow, both doctors have been busy and productive during the past year. Dr. Zehms has worked on two research projects, four book chapters, and three teaching videos.

Chad T. Zehms, M.D.

Bojan B. Zoric, M.D.

Among other projects, Dr. Zoric has used some of his research time to investigate ablation devices (instruments used to remove tissue) used in surgery and the effects of these devices on cartilage tissue.

Dr. Zehms and Dr. Zoric share similar views regarding their experiences at the Foundation.

Dr. Zehms: "I don't think any other institution in the country has a clinic-foundation relationship like the one that exists at the Foundation. I feel free to walk into an office and talk with some of the world's leading surgeons and researchers. In spite of the heavy workload, the Fellows get so much support from the Foundation that you are never in position where you feel stressed out. Prior to the past year, I had seen two hip arthroscopy procedures. Working with Dr. Marc Philippon, I've observed or assisted in 95 such operations. In fact, he's the reason I want to focus on hip-related surgery in my own practice."

Dr. Zoric: "I have never seen patients following treatment who believe so strongly in the philosophy of the Foundation and in the physicians who practice and conduct research there. Patients are willing to come from all over the world just to have the physicians treat them. The Foundation is different from many other institutions because Dr. Steadman and his colleagues don't look at a person's age, but rather at how active a person is and what his or her goals are. The objective is always to get the patients back to doing what they want to do, using the least-invasive procedure possible and requiring the least amount of recovery time. And all of this happens in a very informal, friendly environment."

Both Encourage Your Support

"I encourage people to support the Foundation so that ground-breaking research can continue," says Dr. Zehms. "Whether you are an elite athlete or the mother of three trying to get back to playing tennis on weekends, the Clinic and the Foundation are working together to improve the quality of surgical outcomes and the quality of life of those who benefit from the research that is being conducted."

"From my perspective," concludes Dr. Zoric, "the Foundation is at the forefront of orthopaedic research. It is a place that combines that research with orthopaedic practice. Personally, it has been an inspiration because of the teaching it offers and the new horizons it has created for me and other Fellows."

PRESENTATIONS & PUBLICATIONS

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A primary goal of the Foundation is to distribute the results of its research. In 2008, principal investigators and Fellows published 70 papers in scientific and medical journals and delivered 189 presentations to a variety of professional and lay audiences worldwide.

2008 PRESENTATIONS

Braun S, Millett PJ. Biceps Tendon Disorders: New Thoughts on Pathogenesis and Treatment. *3rd Annual Rocky Mountain Shoulder & Elbow Meeting.* Aspen, Colo., August 2008.

Briggs KK. Outcomes Following Use of an Unloader Brace: A prospective cohort study. *OSSUR Meeting.* Orlando, Fla., July 2008.

Briggs KK. Quality Outcomes as Key Differentiator. *Johnson & Johnson Hospital Management Meeting.* Stockholm, Sweden, November 2008.

Briggs KK, Rodkey WG, Steadman JR. Factors associated with longevity of improvements in function and activity levels following partial meniscectomy. *European Federation of National Associations of Orthopaedic Sports Traumatology (EFOST).* Antalya, Turkey, November 2008.

Briggs KK. Systematic Documentation of Practices and Results. *Johnson & Johnson Hospital Management Meeting.* Stockholm, Sweden, November 2008.

Briggs KK, Lysholm J, Tegner Y, Rodkey WG, Steadman JR. 25 years later: The reliability, validity and responsiveness of the Lysholm Score and Tegner Activity Scale for anterior cruciate ligament injuries of the knee. Podium. *Biennial meeting of the European Society for Sports Traumatology and Knee Arthroscopy.* Porto, Portugal, May 2008.

Briggs KK, Rodkey WG, Steadman JR. Factors associated with repeat meniscus surgery in patients undergoing suture meniscus repair. *American Academy of Orthopaedic Surgeons,* San Francisco, Calif., March 2008.

Briggs KK, Rodkey WG, Steadman JR. Certain factors may influence repeat meniscus surgery in patients after suture meniscus repair. *European Society of Sports Traumatology, Knee Surgery and Arthroscopy (ESSKA).* Porto, Portugal, May 2008.

Briggs KK, Rodkey WG, Steadman JR. Factors which influence improvements in function and activity levels after partial meniscectomy. *European Society of Sports Traumatology, Knee Surgery and Arthroscopy (ESSKA).* Porto, Portugal, May 2008.

Brunkhorst JP, O'Leary ET, Philippon MJ, Anstett TJ, Pault JE, Giphart JE, Torry MR. Hip kinematics during the ice hockey slap shot at the AAA Skill Level, *Rocky Mountain Chapter of American College of Sports Medicine.* Estes Park, Colo., February 22-23, 2008.

Corenman DS. The Physiology of Radiculopathy. *Steadman◆Hawkins Research Foundation Orthopaedic & Spine Lecture Series.* Vail, Colo., October, 2008.

Corenman DS. Back Pain in the Athlete. *Steadman-Hawkins Clinic Academic Session.* Vail, Colo., June 2008.

Corenman DS, Karli DC, Pateder DB, Kelley-Spearing SA, Strauch EL. Upper Extremity Range of Motion: Effect on Tension of the Cervical Nerve Roots. *Denver Spine Annual Winter Meeting.* Breckenridge, Colo., February, 2008.

Giphart JE, Shelburne KB. Understanding shoulder function and stabilization using combined 3D fluoroscopy and novel computational modeling approaches. Colloquium, *55th Annual Meeting of the American College of Sports Medicine.* Indianapolis, Ind., May 28-31 2008.

REACHING OUT TO THE WORLD

The Foundation's research findings are shared with physicians and scientists around the world. We offer training throughout the year to physicians-in-residence, visiting medical personnel, and participants at the international medical conferences that we host.

To reach professionals who are unable to come to us, Foundation scientists and physicians report their research worldwide through peer-reviewed publications and presentations. We have produced more than 609 papers, 1,563 presentations, and 80 teaching videos—many award-winning—that have been accepted by medical and scientific journals and organizations worldwide.

We disseminate our findings to the general public and students as well, through videotapes, educational programs, the Internet, and media outlets.

Giphart JE, Shelburne KB, Anstett T, Brunkhorst JP, Pault JD, Woo SLY, Steadman JR, Torry MR. Measurement of 3D in vivo knee motion using biplane fluoroscopy: investigation of non-contact ACL injuries. *The XVIth International Conference on Mechanics in Medicine and Biology.* University of Pittsburgh, July 23-25, 2008.

Gill, S. Evaluation and Treatment of Cervical Radiculopathy. *Steadman◆Hawkins Research Foundation Orthopaedic & Spine Lecture Series.* Vail, Colo., Nov 2008.

Kelley-Spearing SA, Corenman DS, Strauch EL. Diagnostic Value of the Straight Leg Raise and Braggards in Identifying Patients with Radiculopathy. *North American Spine Society 2008 Annual Meeting.* Toronto, Ontario, October 2008.

King DJ, Chen AL, Matheny LM, Briggs KK, Sterett WI. Correlation of Second-Look Arthroscopic Findings and Clinical Outcomes in the Treatment of Degenerative Chondral Lesions with Microfracture and Valgus High Tibial Osteotomy. Poster Presentation. *AAOS 75th Annual Meeting.* San Francisco, Calif., March 2008.

Looney CG, Matheny LM, Sterett WI, Millett PJ, Steadman JR. Early ACL Reconstruction in Combined MCL/ACL Injuries. Poster Presentation. *AAOS 75th Annual Meeting.* San Francisco, Calif., March 2008.

Miller BS, Steadman JR, Briggs KK, Downie B. Clinical Outcomes Following the Microfracture Procedure for Chondral Defects of the Knee: A Longitudinal Data Analysis. *2008 American Orthopaedic Society for Sports Medicine Annual Meeting.* Orlando, Fla., July 2008.

Millett PJ. Arthroscopic Rotator Cuff Repair – General Principles: Anatomy, Portal & Anchor Placement, Suture Passing, Knot Tying. *AAOS/ASES Open and Arthroscopic Techniques in Shoulder Surgery Course # 3201.* Rosemont, Ill., January 2008.

Millett PJ. Techniques for Rotator Cuff Repair, PASTA, Subcap Repair, Biceps Tenodesis. *Arthrex Master's course in Shoulder and Knee Reconstruction.* Denver, Colo., February 2008.

Millett PJ. Techniques for Instability. *Arthrex Master's course in Shoulder and Knee Reconstruction.* Denver, Colo., February 2008.

Millett PJ. AC Joint Reconstruction. *Arthrex Master's course in Shoulder and Knee Reconstruction.* Denver, Colo., February 2008.

Millett PJ. Proximal Humeral Fracture Repair. *Arthrex Master's course in Shoulder and Knee Reconstruction.* Denver, Colo., February 2008.

Millett PJ. Wet Lab, Rotator Cuff Repair. *Arthrex Master's course in Shoulder and Knee Reconstruction.* Denver, Colo., February 2008.

Millett PJ. Wet Lab, Suture Bridge. *Arthrex Master's course in Shoulder and Knee Reconstruction.* Denver, Colo., February 2008.

Millett PJ. Wet Lab, PASTA Repair. *Arthrex Master's course in Shoulder and Knee Reconstruction.* Denver, Colo., February 2008.

Millett PJ. Wet Lab, Biceps Tenodesis. *Arthrex Master's course in Shoulder and Knee Reconstruction.* Denver, Colo., February 2008.

Millett PJ. Wet Lab, Subcap Repair with Biceps Tenodesis. *Arthrex Master's course in Shoulder and Knee Reconstruction.* Denver, Colo., February 2008.

Millett PJ. Wet Lab, AC joint Reconstruction. *Arthrex Master's course in Shoulder and Knee Reconstruction.* Denver, Colo., February 2008.

Millett PJ. Wet Lab, Instability: SLAP and Bankart. *Arthrex Master's course in Shoulder and Knee Reconstruction.* Denver, Colo., February 2008.

Millett PJ. Surgical Anatomy of 10 Common Upper Extremity Conditions: A Refresher for the General Orthopaedic Surgeon. *American Academy of Orthopaedic Surgeons ICL.* San Francisco, Calif., March 2008.

Millett PJ. Complex and Revision Shoulder Instability - How to deal with difficult problems. *Grand Rounds.* Taos, N.M., March 2008.

Millett PJ. Simplified management of Subscapularis tears including Corocoplasty and Biceps tenodesis; Live surgical demonstration. *Arthrex 1st Annual Western Faculty Symposium.* Tracey, Calif., April 2008.

Millett PJ. Proximal Humeral Fracture Solutions. *Arthrex 1st Annual Western Faculty Symposium.* Tracy, Calif., April 2008.

Millett PJ. Complex glenohumeral instability. *Arthrex 1st Annual Western Faculty Symposium.* Tracy, Calif., April 2008.

Millett PJ. Subcap Repair with Biceps Tenodesis. *Arthrex 1st Annual Western Faculty Symposium.* Tracey, Calif., April 2008.

Millett PJ. Treatment of osteoarthritis in the young patient. *First Antonius Orthopaedic Course - Challenging Shoulder Surgery.* Nieuwegein, Holland, April 2008.

Millett PJ. Live surgery cuff repair. *First Antonius Orthopaedic Course - Challenging Shoulder Surgery.* Nieuwegein, Holland, April 2008.

Millett PJ. Arthroplasty of the shoulder. *Challenging Shoulder Surgery.* Nieuwegein, Holland, April 2008.

Millett PJ. Live surgery shoulder replacement. *Challenging Shoulder Surgery.* Nieuwegein, Holland, April 2008.

Millett PJ. Complex and revision shoulder instability. *Challenging Shoulder Surgery.* Nieuwegein, Holland, April 2008.

Millett PJ. Arthroscopic treatment of Suprascapular nerve entrapment. *Challenging Shoulder Surgery.* Nieuwegein, Holland, April 2008.

Millett PJ. Future developments in shoulder surgery. *Challenging Shoulder Surgery.* Nieuwegein, Holland, April 2008.

Millett PJ. Subscapularis/Biceps Lesions Management. *Annual Meeting of the Mexican Society.* Mexico City, Mexico, May 2008.

Millett PJ. Double Row Rotator Cuff Repair. *Annual Meeting of the Mexican Society.* Mexico City, Mexico, May 2008.

Millett PJ. Subpectoral Biceps Tenodesis. Surgical demonstration, *AOSSM 2008 Surgical Skills Course: Arthroscopy for the Athlete's Shoulder.* St. Louis, Mo., May 2008.

Millett PJ. Advanced strategies for arthroscopic shoulder stabilization. Surgical demonstration, *AOSSM 2008 Surgical Skills Course: Arthroscopy for the Athlete's Shoulder.* St. Louis, Mo., May 2008.

Millett PJ. Latest techniques in arthroscopic RC repair. Surgical demonstration, *AOSSM 2008 Surgical Skills Course: Arthroscopy for the Athlete's Shoulder.* St. Louis, Mo., May 2008.

Millett PJ. Arthroscopic Neuroanatomy: Suprascapular Nerve and Brachial Plexus. *3rd Annual Rocky Mountain Shoulder & Elbow Meeting.* Aspen, Colo., August 2008.

Millett PJ. Cuff Repairs, Subscapularis Tears. *3rd Annual Rocky Mountain Shoulder & Elbow Meeting.* Aspen, Colo., August 2008.

Millett PJ. Shoulder Anatomy, the Anatomic Prosthesis, and the Univers II Design. *Arthrex Advanced Shoulder Arthroplasty and Trauma Course.* Chicago, Ill., August 2008.

Millett PJ. Outcomes/Complications of Shoulder Arthroplasty. Arthrex *Advanced Shoulder Arthroplasty and Trauma Course.* Chicago, Ill., August 2008.

Millett PJ. Percutaneous and plate fixation of proximal humerus fractures. *Arthrex Advanced Shoulder Arthroplasty and Trauma Course.* Chicago, Ill., August 2008.

Millett PJ. Hemiarthroplasty for Proximal Humerus Fractures: Univers Fracture Stern. *Arthrex Advanced Shoulder Arthroplasty and Trauma Course.* Chicago, Ill., August 2008.

Millett PJ. What's New in Shoulder Surgery? *2008 Orthopaedics & Spine Lecture Series.* Vail, Colo., September 2008.

Millett PJ. Arthroscopic and Open Repairs #3208. *AAOS-ASES Management of the Unstable Shoulder Course.* OLC - Rosemont, Ill., October 2008.

Millett PJ. Shoulder and Elbow Surgical Techniques and Management #3301. *AAOS-ASES Management of the Unstable Shoulder Course.* OLC - Rosemont, Ill., October 2008.

Millett PJ. Arthroscopic stabilization of the unstable shoulder - where are the limits? *VOCA Shoulder Surgery Congress.* Utrecht, Netherlands, October 2008.

Millett PJ. Biceps tenodesis or tenolysis during arthroscopic cuff repair *VOCA Shoulder Surgery Congress.* Utrecht, Netherlands, October 2008.

Millett PJ. Hour interactive round table discussion. *VOCA Shoulder Surgery Congress.* Utrecht, Netherlands, October 2008.

Millett PJ. Choosing the Right Practice – Training to Practice Program. *Hospital for Special Surgery Alumni Association 90th Annual Meeting.* New York, N.Y., November 2008.

Millett PJ, Yen Y, Horan MP, Bennett JT. Clinical Presentation of Propionibacterium acnes infection following Shoulder Surgery. *Proceedings of the American Orthopaedic Society.* San Francisco, Calif., March 2008.

Philippon MJ. "Basic Hip Arthroscopy." *Advanced Arthroscopy Course.* Courmayeur, Italy, January 2008.

Philippon MJ. "Outcome of Arthroscopic FAI of the Hip in Professional Athletes." *Advanced Arthroscopy Course.* Courmayeur, Italy, January 2008.

Philippon MJ. "Labral Repair in the Hip: Outcome and Rationale." *Advanced Arthroscopy Course.* Courmayeur, Italy, January 2008.

Philippon MJ. "Reconstruction of Hip Labrum." *Advanced Arthroscopy Course.* Courmayeur, Italy, January 2008.

Philippon MJ. "History and Indications of Hip Arthroscopy." *MSC Meeting.* Sun Valley, Idaho, February 2008.

Philippon MJ. "Can the Labrum Heal?" *Vail Hip Symposium.* Vail, Colo., February 2008.

Philippon MJ. "Labral Repair." *Vail Hip Symposium.* Vail, Colo., February 2008.

Philippon MJ. "Outcomes of Microfracture of the Hip." *Vail Hip Symposium.* Vail, Colo., February 2008.

Philippon MJ. "Outcomes of Arthroscopic FAI in the Professional Athlete." *Vail Hip Symposium.* Vail, Colo., February 2008.

Philippon MJ. "Hip Arthroscopy: Operative Set-up and Anatomically Guided Portal Placement." *American Academy of Orthopaedic Surgeons.* San Francisco, Calif., March 2008.

Philippon MJ. "Arthroscopic Acetabular Labral Repair: Surgical Technique." *American Academy of Orthopaedic Surgeons.* San Francisco, Calif., March 2008.

Philippon MJ. "Optimizing the Management of Symptomatic Labral and Articular Cartilage Lesions in the Hip." *American Academy of Orthopaedic Surgeons.* San Francisco, Calif., March 2008.

Philippon MJ. "Arthroscopic Treatment of FAI." *Bernese Hip Symposium.* Bern, Switzerland, April 2008.

Philippon MJ. "History and Indications of Hip Arthroscopy." *Bernese Hip Symposium.* Bern, Switzerland, April 2008.

Philippon MJ. "Perspectives of Arthroscopic Surgery." *Bernese Hip Symposium.* Bern, Switzerland, April 2008.

Philippon MJ. "Hip Pain in Athletes: How do I Assess its Importance." *World Congress of Sports Trauma / Asia-Pacific Orthopaedic Society for Sports Medicine Meeting.* Hong Kong, April 2008.

Philippon MJ. "FAI: How I Manage it?" *World Congress of Sports Trauma / Asia-Pacific Orthopaedic Society for Sports Medicine Meeting.* Hong Kong, April 2008.

Philippon MJ. "Arthroscopic Labral Repair: Tips and Traps." *World Congress of Sports Trauma / Asia-Pacific Orthopaedic Society for Sports Medicine Meeting.* Hong Kong, April 2008.

Philippon MJ. "Hip Instability." *Symposium on Joint Preserving and Minimally Invasive Surgery of the Hip.* Montreal, Canada, May 2008.

Philippon MJ. "Dealing with the Damaged Labral-Chondral Complex: When to Repair or Microfracture." *Symposium on Joint Preserving and Minimally Invasive Surgery of the Hip.* Montreal, Canada, May 2008.

Philippon MJ. "Hip Instability." *Smith and Nephew Advances in Hip Arthroscopy.* Paris, France, May 2008.

Philippon MJ. "Labral Repair / Rim Trimming: Results." *Smith and Nephew Advances in Hip Arthroscopy.* Paris, France, May 2008.

Philippon MJ. "FAI Syndrome: Indications, Surgical Technique and Outcome." *Congress AQMS-CMSQ.* Montebello, Montreal, May 2008.

Philippon MJ. "Treatment of Labral Tears: Which Patient will Improve and which will Deteriorate?" *Combined Meeting of the American Orthopaedic Association and Canadian Orthopaedic.* Quebec City. June 2008.

Philippon MJ. "Hip Pain in Soccer Players." The Football Association and the Royal College of Surgeons, *20th Joint Conference on Sports Injury.* Daventry, Northamptonshire. July 2008.

Philippon MJ. "Intra-Articular Treatment: FAI and Labral Repair." *The Football Association and the Royal College of Surgeons, 20th Joint Conference on Sports Injury.* Daventry, Northamptonshire. July 2008.

Philippon MJ. "Hip Arthroscopy Indications." *AANA Masters Course.* Rosemont, Ill., July 2008.

Philippon MJ. "Labral Repair and Outcomes in Athletes." *AANA Masters Course.* Rosemont, Ill., July 2008.

Philippon MJ. "Pincer Impingement." *AANA Masters Course.* Rosemont, Ill., July, 2008.

Philippon MJ. "The Modified Supine Approach." *AANA Masters Course.* Rosemont, Ill., July 2008.

Philippon MJ. "Surgical Evaluation and Management of FAI." *Current Issues of MRI in Orthopaedics and Sports Medicine.* San Francisco, Calif., August 2008.

Philippon MJ. "Biological Healing in the Hip." *South African Orthopaedic and Sports Medicine Conference.* Cape Town, South Africa, September 2008.

Philippon MJ. ,"Clinical Demonstration of Clinical Signs." *South African Orthopaedic and Sports Medicine Conference.* Cape Town, South Africa, September 2008.

Philippon MJ. "Post-operative Rehab." *South African Orthopaedic and Sports Medicine Conference.* Cape Town, South Africa, September 2008.

Philippon MJ. "Theater Set-up." South *African Orthopaedic and Sports Medicine Conference.* Cape Town, South Africa, September 2008.

Philippon MJ. "Femoroacetabular Impingement Syndrome." *South African Orthopaedic and Sports Medicine Conference.* Cape Town, South Africa, September 2008.

Philippon MJ. "Labral Lesions." *South African Orthopaedic and Sports Medicine Conference.* Cape Town, South Africa, September 2008.

Philippon MJ. "Hip Instability and Management Thereof." *South African Orthopaedic and Sports Medicine Conference.* Cape Town, South Africa, September 2008.

Philippon MJ. "Results and Outcomes of Hip Arthroscopy." *South African Orthopaedic and Sports Medicine Conference.* Cape Town, South Africa, September 2008.

Philippon MJ. "Future Developments." *South African Orthopaedic and Sports Medicine Conference.* Cape Town, South Africa, September, 2008.

Philippon MJ. "Hip Instability and Management." *Hip Surgery Congress.* Toulouse, France, September 2008.

Philippon MJ. "FAI and Labrum." *Hip Surgery Congress.* Toulouse, France, September 2008.

Philippon MJ. "New Trends." *AGA Congress.* Interlaken, Switzerland, September 2008.

Philippon MJ. "Labral Repair and Outcomes in Athletes." *AANA Masters Experience.* Rosemont, Ill., September 2008.

Philippon MJ. "Physical Exam of the Hip." *AANA Masters Experience.* Rosemont, Ill., September 2008.

Philippon MJ. "Pincer Impingement." *AANA Masters Experience.* Rosemont, Ill., September 2008.

Philippon MJ. "Acetabular Labral Pathology." *SCUHS Extremities Symposium.* Los Angeles, Calif., October 2008.

Philippon MJ. "Presentation and Diagnosis of FAI." *SCUHS Extremities Symposium.* Los Angeles, Calif., October 2008.

Philippon MJ. "Microfracture Technique and Results." *Sports Hip Surgery Conference.* Warwick, UK, October 2008.

Philippon MJ. "Autologous Grafts for Labral Reconstruction." *Sports Hip Surgery Conference.* Warwick, UK, October 2008.

Philippon MJ. "Hockey Players." *Sports Hip Surgery Conference.* Warwick, UK, October 2008.

Philippon MJ. "Diagnosis and Arthroscopic Treatment of Hip Instability and Ligamentum Teres Injury." S*ports Hip Surgery Conference.* Warwick, UK, October 2008.

Philippon MJ. "Shelf Osteotomy." *Extreme Hip Symposium.* Coventry, England, November 2008.

Philippon MJ. "Advanced Hip Arthroscopy for Other Indications with Results." *AANA Fall Course.* Phoenix, Ariz., November 2008.

Philippon MJ. "How I Detach the Labrum, Trim the Rim, and Repair the Labrum." *3rd International Hip Arthroscopy Meeting.* Homburg/Saar, Germany, November 2008.

Philippon MJ. "Arthroscopic Technique of FAI." 3*rd International Hip Arthroscopy Meeting.* Homburg/Saar, Germany, November 2008.

Philippon MJ, Ho CP, Briggs KK, Kuppersmith DA, Schlegel TF. Abnormal Imaging Findings of the Hip in the Elite Level Football Player. Podium. *Annual Meeting of the National Football League.* Indianapolis, Ind., February 2008.

Philippon MJ, Kuppersmith DA, Briggs KK. Arthroscopic findings following traumatic hip dislocation in 14 professional athletes. Poster. *American Academy of Orthopedic Surgeons.* San Francisco, Calif., March 2008.

Philippon MJ, Briggs KK, Kuppersmith DA, Yen YM, Maxwell RB. Outcomes following hip arthroscopy in the pediatric patients. Podium. *American Academy of Orthopedic Surgeons.* San Francisco, Calif., March 2008.

Philippon MJ, Huang MJ, Briggs KK, Kuppersmith DA. Arthroscopic acetabular labral repair: surgical technique. Video Presentation. *American Academy of Orthopedic Surgeons.* San Francisco, Calif., March 2008.

Philippon MJ, Stubbs AJ, Briggs KK. Hip arthroscopy: operative set-up and anatomically guided portal placement. Video Presentation. *American Academy of Orthopedic Surgeons.* San Francisco, Calif., March 2008.

Philippon MJ, Briggs KK, Hines SL, Kuppersmith DA. Correlation of a functional exam to patient function and activity following hip arthroscopy. Poster. *Annual meeting of the Arthroscopy Association of North America.* Washington D.C., May 2008.

Philippon MJ, Kuppersmith DA, Briggs KK. Outcomes Following Arthroscopic Labral Reconstruction in the Hip Using Iliotibial Band Autograft. Poster. *Annual meeting of the Arthroscopy Association of North America.* Washington D.C., May 2008.

Philippon MJ, Briggs KK, Kuppersmith DA. What hip score should be used to document outcome following hip arthroscopy in the active patient? Poster. *Annual meeting of the Arthroscopy Association of North America.* Washington D.C., May 2008.

Philippon MJ, Briggs KK, Kuppersmith DA. Abnormal Structure of the Acetabular Labrum: Prevalence in 1000 Hip Arthroscopies. Podium. *Biennial meeting of the European Society for Sports Traumatology and Knee Arthroscopy.* Porto, Portugal, May 2008.

Philippon MJ, Briggs KK, Wolff AB, Kuppersmith DA. The Location of Acetabular Labral Tears Identified at the Time of Arthroscopy. Podium. *Biennial meeting of the European Society for Sports Traumatology and Knee Arthroscopy.* Porto, Portugal, May 2008.

Philippon MJ, Briggs KK, Kuppersmith DA, Yen YM. Predictors of progression to total hip arthroplasty following arthroscopic decompression of femoroacetabular impingement. Podium. *Biennial meeting of the European Society for Sports Traumatology and Knee Arthroscopy.* Porto, Portugal, May 2008.

Philippon MJ, Kuppersmith DA, Briggs KK. Arthroscopic Findings Following Traumatic Hip Dislocation in 14 Professional Athletes. Poster. *Biennial meeting of the European Society for Sports Traumatology and Knee Arthroscopy.* Porto, Portugal, May 2008.

Philippon MJ, Briggs KK, Yen YM, Kuppersmith DA, Hay CJ. 2-year outcomes of hip arthroscopy. Poster. *Biennial meeting of the European Society for Sports Traumatology and Knee Arthroscopy.* Porto, Portugal, May 2008.

Philippon MJ, Briggs KK, Kuppersmith DA, Yen YM. Determinants of patient satisfaction and outcome following arthroscopic treatment of femoroacetabular impingement. Poster. *Biennial meeting of the European Society for Sports Traumatology and Knee Arthroscopy.* Porto, Portugal, May 2008.

Philippon MJ, Briggs KK, Kuppersmith DA. What hip score should be used to document outcome following hip arthroscopy in the active patient? Poster. *Biennial meeting of the European Society for Sports Traumatology and Knee Arthroscopy.* Porto, Portugal, May 2008.

Philippon MJ, Briggs KK, Hines SL, Kuppersmith DA. Correlation of a functional exam to patient function and activity following hip arthroscopy. Poster. *Biennial meeting of the European Society for Sports Traumatology and Knee Arthroscopy.* Porto, Portugal, May 2008.

Philippon MJ, Briggs KK, Kuppersmith DA. Outcomes following arthroscopic labral reconstruction using iliotibial band autograft. Poster. *Biennial meeting of the European Society for Sports Traumatology and Knee Arthroscopy.* Porto, Portugal, May 2008.

Philippon MJ, Briggs KK, Kuppersmith DA. "Determinants of Patient Satisfaction and Outcome Following Arthroscopic Treatment of Femoroacetabular Impingement." *Combined Meeting of the American Orthopaedic Association and Canadian Orthopaedic.* Quebec City, Quebec, June 2008.

Philippon MJ, Briggs KK, Kuppersmith DA. 2-Year Outcomes Following Hip Arthroscopy for Femoroacetabular Impingement. *Combined Meeting of the American Orthopaedic Association and Canadian Orthopaedic.* Quebec City, Quebec, June 2008.

Philippon MJ, Briggs KK, Kuppersmith DA, Hay CJ. 2-year outcomes of hip arthroscopy. Podium. *American Orthopaedic Association / Canadian Orthopaedic Association.* Quebec, City, Quebec, June 2008.

Philippon MJ, Briggs KK, Kuppersmith DA. What hip score should be used to document outcome following hip arthroscopy in the active patient? Poster. *Annual meeting of the American Orthopaedic Association / Canadian Orthopaedic Association.* Quebec City, Quebec, June 2008.

Rodkey WG. On the horizon: Meniscus replacement using a novel collagen meniscus implant. *Arthroscopy Association of North America Specialty Day.* San Francisco, Calif., March 2008.

Rodkey WG. Microfracture: The scientific basis. *South African Orthopaedic Sports Medicine Conference on Biological Healing.* Cape Town, South Africa, September 2008.

Rodkey WG. Evidence-based medicine. *South African Orthopaedic Sports Medicine Conference on Biological Healing.* Cape Town, South Africa, September 2008.

Rodkey WG. Long-term outcomes of partial meniscectomy: Where, when, why and how much? *South African Orthopaedic Sports Medicine Conference on Biological Healing.* Cape Town, South Africa, September 2008.

Rodkey WG. Meniscus replacement using a novel collagen meniscus implant (CMI). *South African Orthopaedic Sports Medicine Conference on Biological Healing.* Cape Town, South Africa, September 2008.

Rodkey WG. Failed microfracture: Causes and revision results. *South African Orthopaedic Sports Medicine Conference on Biological Healing.* Cape Town, South Africa, September 2008.

Rodkey WG. Meniscus replacement using Collagen Meniscus Implants (CMI). *European Federation of National Associations of Orthopaedic Sports Traumatology (EFOST).* Antalya, Turkey, November 2008.

Rodkey WG. Validated instruments for documenting outcomes following treatment of the meniscus. *European Federation of National Associations of Orthopaedic Sports Traumatology (EFOST).* Antalya, Turkey, November 2008.

Rodkey WG, Briggs KK, Steadman JR. Collagen Meniscus Implants (CMI) decrease reoperation rates in chronic knee patients compared to meniscectomy only: A 5-year survivorship analysis. *2008 Meniscus Transplantation Study Group. San Francisco,* Calif., March 2008.

Rodkey WG, Briggs KK, Steadman JR. Function and activity levels correlate with location of tissue loss following meniscectomy. *American Academy of Orthopaedic Surgeons.* San Francisco, Calif., March 2008.

Rodkey WG, Briggs KK, Steadman JR. Collagen Meniscus Implants (CMI) decrease reoperation rates in chronic knee patients compared to meniscectomy only: A 5-year survivorship analysis. *European Society of Sports Traumatology, Knee Surgery and Arthroscopy (ESSKA).* Porto, Portugal, May 2008.

Rodkey WG, Briggs KK, Steadman JR. Function and activity levels correlate with anatomic location of tissue loss after partial medial meniscectomy. *European Society of Sports Traumatology, Knee Surgery and Arthroscopy (ESSKA).* Porto, Portugal, May 2008.

Rodkey WG, Briggs KK, Steadman JR. Survivorship of collagen meniscus implants (CMI) compared to meniscectomy only: A 5-year analysis in chronic knee patients. *World Congress on Osteoarthritis 2008, Osteoarthritis Research Society International.* Rome, Italy, September 2008.

Rodkey WG, Briggs KK, Steadman JR. Six-year results with collagen meniscus implants (CMI) with emphasis on location and amount of meniscus remaining. *World Congress on Osteoarthritis 2008, Osteoarthritis Research Society International.* Rome, Italy, September 2008.

Shelburne KB. Using Modeling and Simulation to Investigate Non-contact ACL Injury. *Symposium on Non-Contact ACL Injury, American College of Sports Medicine.* Indianapolis, Ind., May 2008.

Steadman JR. ACL Deficiency with and without Arthritis in the Mature Athlete. *American Academy of Orthopaedic Surgeons, Boomeritis: Musculoskeletal Care of the Mature Athlete.* Hilton Head, S.C., April 2008.

Steadman JR. Arthroscopic Treatment of the Degenerative Knee. *American Academy of Orthopaedic Surgeons, Boomeritis: Musculoskeletal Care of the Mature Athlete.* Hilton Head, S.C., April 2008.

Steadman JR. Update on Microfracture: Patient Selection, Technology, Results. *American Academy of Orthopaedic Surgeons, Boomeritis: Musculoskeletal Care of the Mature Athlete.* Hilton Head, S.C., April 2008.

Steadman JR. 554. Presentation. *Herodicus Societ*y, Naples, Italy, April 2008.

Steadman JR. Debridement with or without Microfracture. *Cartilage Innovation Summit.* Cleveland, Ohio, May 2008.

Steadman JR. Rehabilitation after ACL reconstruction. *9th EFFORT Congress.* Nice, France, May 2008.

Steadman JR. Pain Management and OA Bracing. *Össur Meeting.* Orlando, FL, July, 2008.

Steadman JR. The Need for Non-Invasive Treatment Options in OA. *Össur Meeting.* Orlando, Fla., July 2008.

Steadman JR. The Current Treatment of Articular Cartilage Defects How are We Really Doing? Microfracture/ACI/Oats. *AOSSM Annual Meeting.* Orlando, Fla., July 2008.

Steadman JR. Anterior Interval Scarring: A Cause of the Arthritic Knee. *17th Annual Current Issues of MRI in Orthopedics and Sports Medicine.* San Francisco, Calif., August 2008.

Steadman JR. Biological Healing: The Vail Experience. Keynote. *South African Orthopaedic Sports Medicine Conference Keynote.* Cape Town, South Africa, September 2008.

Steadman JR. Evidence-Based Medicine. *South African Orthopaedic Sports Medicine Conference on Biological Healing.* Cape Town, South Africa, September 2008.

Steadman JR. Microfracture. *South African Orthopaedic Sports Medicine Conference on Biological Healing.* Cape Town, South Africa, September 2008.

Steadman JR. Microfracture: Indication, Techniques and Results. *International Cartilage Repair Society: 2nd Surgical Skills Course.* Miami, Fla., October 2008.

Steadman JR, Briggs KK, Rodkey WG, Casio B. 5-year survivorship of patients treated with an arthroscopic regimen for osteoarthritis of the knee. Poster Presentation. *American Academy of Orthopaedic Surgeons,* San Francisco, Calif., March 2008.

Sterett WI. Lower and a Few Upper Extremity Injuries Overview. *USSA Medical Emergencies in Skiing and Snowboarding* (MESS) Course. Vail, Colo., December 2008.

Sterett WI. Common Orthopaedic Injuries and Mechanisms in Alpine Skiing. *Beaver Creek Ski Patrol.* Beaver Creek, Colo., November 2008.

Sterett WI. Proximal Tibial Valgus Opening Wedge EBI Plate Technique. *ICRS Surgical Skills Course.* Miami, Fla., November 2008.

Sterett WI. Lower Extremity and ACL Issues in Patrolling. *Vail Ski Patrol.* Vail, Colo., October 2008.

Sterett WI. Allograft in ACL and Meniscus Replacement. *Spine Lecture Series.* Vail, Colo., August 2008.

Sterett WI, Huang M, Matheny LM, Briggs KK, Glassman RD. Chondral Resurfacing and High Tibial Osteotomy in the Varus Knee: Survivorship Analysis. Poster Presentation. *AAOS 75th Annual Meeting.* San Francisco, Calif., March 2008.

Strauch, EL. Perioperative Spine Surgical Management Update. *Vail Valley Medical Center Educational Lecture.* Vail, Colo., December 2008.

Strauch, EL. Recognition and Management of Spinal Injuries. *Vail Ski Patrol Educational Lecture.* Vail, Colo., October 2008.

Strauch, EL. Clearing the C-Spine. *Steadman Hawkins Clinic Academic Session.* Vail, Colo., July 2008.

Torry M.R, Shelburne KB, Giphart JE. Knee biomechanics: mechanical factors that load and unload the knee, *Rocky Mountain Chapter of American College of Sports Medicine.* Estes Park, Colo., February 2008.

Torry MR, Biomechanical Analysis of Youth Pitching, *Department of Mechanical Engineering,* Stanford University, June 2008.

Torry MR, Predictors of Pitch Velocity in Youth and Professional Baseball Pitchers, *Department of Mechanical Engineering,* Stanford University, June 2008.

Torry MR and Shelburne KB, Effects of Valgus Bracing on the Knee During Gait, *Department of Orthopedics and Sports Medicine,* Stanford University, June 2008.

Torry MR, Predictors of Pitch Velocity in Youth and Professional *Baseball Pitchers, Saint Ambrose Un*iversity, *Department of Physical Therapy.* Davenport, Iowa November 2008.

Torry MR, Shelburne KB, Effects of Foot Orthoses and Valgus Bracing on the Knee During Gait, *Saint Ambrose University, Department of Physical Therapy.* Davenport, Iowa November 2008.

Torry MR, How Valgus Bracing and Knee Action Tights Work, *Alignmed/Opedix LLC sales training meeting.* Vail, Colo., December 2008.

Torry MR, Biomechanical Analysis of Youth Pitching, *Saint Ambrose University, Department of Physical Therapy.* Davenport, Iowa November 2008.

Yen YM, Philippon MJ, Briggs KK, Kuppersmith DA. Determinants of patient satisfaction and outcome following arthroscopic treatment of femoroacetabular impingement. Podium. *Annual meeting of the American Orthopaedic Association/ Canadian Orthopaedic Association.* Quebec City, Quebec, June 2008.

2008 PUBLICATIONS

Bharam, S, Philippon MJ. Diagnosis and management of acetabular labral tears in the athlete. *International Journal of Sports Medicine.* 2008; 9:1-10.

Braun S, Millett PJ. Open Anterior Capsular Reconstruction of the Shoulder for Chronic Instability Using a Tibialis Anterior Allograft. *TSES* 2008;9:102-107.

Briggs KK, Lysholm J, Tegner Y, Rodkey WG, Steadman JR. 25 years later: The reliability, validity and responsiveness of the Lysholm score and Tegner activity scale for anterior cruciate ligament injuries of the knee. *Knee Surg Sports Traumatol Arthrosc.* 2008;16 (Suppl1):S34.

Briggs KK, Philippon MJ, Kuppersmith DA, Maxwell RB. What hip score should be used to document outcome following hip arthroscopy in the active patient? *Knee Surg Sports Traumatol Arthrosc.* 2008;16 (Suppl1):S104.

Briggs KK, Steadman JR, Matheny LM. Treatment with Hylan G-F 20 and corticosteroid: Expectation of treatment and outcomes six months following treatment. *Osteoarthritis and Cartilage.* 2008;16:S131-132.

Briggs KK, Steadman JR, Methany LM, Tello T. Patient evaluation of an unloader knee brace: A prospective cohort study. *Osteoarthritis and Cartilage.* 2008;16:S133.

Briggs KK, Matheny LM, Steadman JR. Psychometric properties of the Lysholm knee score and Tegner activity scale for osteoarthritis of the knee. *Osteoarthritis and Cartilage*. 2008;16:S133.

Feagin JA, Steadman JR, eds. *The Crucial Principles in Care of the Knee.* Philadelphia: Lippincott Williams & Wilkins, 2008 .

Gobezie R, Millett PJ, Zurakowski D, et al. Analysis of Interobserver and Intraobserver Variability in the Diagnosis and Treatment of SLAP Tears Using the Snyder Classification. *Am J Sports Med.* 2008;36:1373-9.

Huang MJ, Millett PJ. Multidirectional and Posterior Shoulder Instability. In Glatz LM, Ed. Orthopaedic Knowledge Update: *Shoulder and Elbow 3.* AAOS, Rosemont, Ill., 2008.

Ilizaliturri VM Jr, Byrd JW, Sampson TG, Guanche CA, Philippon MJ, Kelly BT, Dienst M, Mardones R, Shonnard P, Larson CM. A geographic zone method to describe intra-articular pathology in hip arthroscopy: cadaveric study and preliminary report. *Arthroscopy*. 2008;24:534-9.

Johnston TL, Schenker ML, Briggs KK, Philippon MJ. Relationship between offset angle alpha and hip chondral injury in femoroacetabular impingement. *Arthroscopy* 2008;24:669-75.

Keeley DW, Hackett T, Keirns M, Sabick MB, Torry MR. A Biomechanical Analysis of Youth Pitching Mechanics, *Journal of Pediatric Orthopaedics.* 2008;28:452-459.

Kelley-Spearing SA, Corenman DS, Strauch EL. Diagnostic Value of the Straight Leg Raise and Braggards in Identifying Patients with Radiculopathy. *The Spine Journal,* September 2008;8:126S.

Kernozek TW, Torry MR, Iwasaki M. Gender Differences in Lower Extremity Landing Mechanics Caused by Neuromuscular Fatigue, *American Journal of Sports Medicine,* 36:3:554-565, 2008.

Kokmeyer D, Allwein C, Millett PJ. Advanced strategies for shoulder rehabilitation. *Instructional DVD.* 2008.

Lawrence R, Kernozek T, Miller E, Torry MR, Reutemann P. Influences of Hip External Rotation Strength on Knee Mechanics during Single-Leg Drop Landings in Females. *Clinical Biomechanics.* 23;806-13 2008.

Martin RL, Philippon MJ. Evidence of reliability and responsiveness for the hip outcome score. *Arthroscopy.* 2008 Jun;24(6):676-82.

McIlwraith CW, Rodkey WG. The horse-human relationship: Research and the future. In: **Feagin JA**, **Steadman JR,** eds. *The Crucial Principles in Care of the Knee.* Philadelphia: Lippincott Williams & Wilkins (Wolters Kluwer); 2008:221-227.

Millett PJ. Arthrofibrosis of the Knee: Diagnosis and management. In: **Feagin JA, Steadman JR,** eds. *The Crucial Principles in Care of the Knee.* Philadelphia: Lippincott Williams & Wilkins, 2008.

Millett PJ, Steadman RJ. Surgical Management of Arthrofibrosis - *VuMedi* 2008.

Millett PJ. Endoscopic management of snapping scapula - *VuMedi* 2008.

Millett PJ, Gobezie R, Boykin R. Degenerative Shoulder Disease: Diagnosis and Management. *American Family Physician.* 2008; 78: 1-7.

Millett PJ, Horn N. Arthroscopic suprascapular nerve release. *VuMedi* 2008.

Millett PJ, Sanders B, Gobezie R, Braun S, Warner JJP. Interference Screw vs. Suture Anchor Fixation for Open Subpectoral Biceps Tenodesis: Does it Matter? *BMC Musculoskelet Disord.* 2008;9:121.

Millett PJ, Yen Y, Huang MJ. Arthroscopically Assisted Latissimus Dorsi Transfer for Irreparable Rotator Cuff Tears. *TSES 2008*;9:76-79.

Meyers WC, McKechnie A, Philippon MJ, et al. Experience with "sports hernia" spanning two decades. *Ann Surg.* 2008;248:656-65.

Miller L, Grant C, Lin SJ, Shay J, Weier G, Topol E, Arya S, Miller R, Torry MR, Patil C, Ono S, Tse I. The Future of Human Healthspan, Demography, Evolution, Medicine and Bioengineering: Cellular and Molecular Mechanisms of Biological Aging: The Roles of Nature, Nurture and Chance in the Maintenance of Human Healthspan, The National Academies Keck Futures Initiative, *Task Group 7B Technical Report,* The National Academies Press, Washington, D.C., 2008 Pgs. 84-88.

Miyamoto RG, Kaplan KM, Levine BR, Egol KA, Zuckerman JD. Surgical management of hip fractures: an evidence-based review of the literature. I: femoral neck. fractures. *J Am Acad Orthop Surg.* 2008;16:596-607.

Petit CJ, Millett PJ. Arthroscopic Removal of EndoButton after Revision Anterior Cruciate Ligament Reconstruction. *Am J Orthop.* 2008;37:618-20.

Philippon MJ, Briggs KK, Kuppersmith DA. Abnormal structure of the acetabular labrum: Prevalence in 1000 hip Arthroscopies. *Knee Surg Sports Traumatol Arthrosc.* 2008;16 (Suppl1):S50.

Philippon MJ, Briggs KK, Kuppersmith DA. Arthroscopic Findings Following Traumatic Hip Dislocation in 14 Professional Athletes (SS-03). *Arthroscopy.* 2008;24:e2.

Philippon MJ, Briggs KK, Kuppersmith DA. Abnormal Structure of the Acetabular Labrum: Prevalence in 1,000 Hip Arthroscopies (SS-58) *Arthroscopy.* 2008;24:e33.

Philippon MJ, Briggs KK, Kuppersmith DA, Huang M, Yen YM. Outcomes following arthroscopic labral reconstruction in the hip using iliotibial band autograft. *Knee Surg Sports Traumatol Arthrosc.* 2008;16 (Suppl1):S104.

Philippon MJ, Briggs KK, Hines S, Kuppersmith DA, Maxwell RB. Correlation of a functional exam to patient function and activity following hip arthroscopy. *Knee Surg Sports Traumatol Arthrosc.* 2008;16 (Suppl1):S104.

Philippon MJ, Briggs KK, Kuppersmith DA. 2-year outcomes of hip arthroscopy. *Knee Surg Sports Traumatol Arthrosc.* 2008;16 (Suppl1):S104.

Philippon MJ, Briggs KK, Yen YM, Kuppersmith DA. Determinants of patient satisfaction and outcome following arthroscopic treatment of femoroacetabular impingement. *Knee Surg Sports Traumatol Arthrosc.* 2008;16 (Suppl1):S105.

Philippon MJ, Kuppersmith DA. Arthroscopic findings following traumatic hip dislocation in 14 professional athletes. *Knee Surg Sports Traumatol Arthrosc.* 2008;16 (Suppl1): S103.

Philippon MJ, Kuppersmith DA, Briggs KK, Yen YM. Predictors of progression to total hip arthroplasty following arthroscopic decompression of femoroacetabular impingement. *Knee Surg Sports Traumatol Arthrosc.* 2008;16 (Suppl1):S50.

Philippon MJ, Kuppersmith DA, Yen YM, Briggs KK. Predictors of progression to total hip arthroplasty following arthroscopic decompression of femoroacetabular impingement. *Osteoarthritis and Cartilage.* 2008;15(Suppl 3):C38-C39.

Philippon MJ, Schenker ML, Briggs KK, Maxwell RB. Can microfracture produce repair tissue in acetabular chondral defects? *Arthroscopy.* 2008;24:46-50.

Philippon MJ, Wolff AB, Briggs KK, Kuppersmith DA. The location of acetabular labral tears identified at the time of arthroscopy. *Knee Surg Sports Traumatol Arthrosc.* 2008;16 (Suppl1):S50.

Philippon MJ, Yen YM, et al. Early Outcomes Following Hip Arthroscopy for Femoroacetabular Impingement in the Athletic Adolescent Patient: A Preliminary Report. *J Pediatr Orthop.* 2008;28:705-10.

Rodkey WG. A look beyond the horizon. In: **Feagin JA, Steadman JR**, eds. *The Crucial Principles in Care of the Knee.* Philadelphia: Lippincott Williams & Wilkins (Wolters Kluwer); 2008:197-201.

Rodkey WG, Briggs KK, Steadman JR. Certain factors may influence repeat meniscus surgery in patients after suture meniscus repair. *Knee Surg Sports Traumatol Arthrosc.* 2008;16 (Suppl1):S151.

Rodkey WG, Briggs KK, Steadman JR. Six-year results with collagen meniscus implants(CMI) with emphasis on location and amount of meniscus remaining. *Osteoarthritis and Cartilage.* 2008;16:S201.

Rodkey WG, Briggs KK, Steadman JR. Survivorship of collagen meniscus implants (CMI) compared to meniscectomy only: A 5-year analysis in chronic knee patients. *Osteoarthritis and Cartilage.* 2008;16:S200-201.

Rodkey WG, Briggs KK, Steadman JR. Certain factors may influence repeat meniscus surgery in patients after suture meniscus repair. *Knee Surg Sports Traumatol Arthrosc.* 2008;16 (Suppl1):S151.

Rodkey WG, Briggs KK, Steadman JR Collagen Meniscus Implants (CMI) decrease reoperation rates in chronic knee patients compared to meniscectomy only: A 5-year survivorship analysis. *Knee Surg Sports Traumatol Arthrosc.* 2008;16 (Suppl1):S14.

Rodkey WG, Briggs KK, Steadman JR. Factors which influence improvements in function and activity levels after partial meniscectomy. *Knee Surg Sports Traumatol Arthrosc.* 2008;16 (Suppl1):S48.

Rodkey WG, Briggs KK, Steadman JR. Function and activity levels correlate with anatomic location of tissue loss after partial medial meniscectomy. *Knee Surg Sports Traumatol Arthrosc.* 2008;16 (Suppl1):S49.

Rodkey WG, DeHaven KE, Montgomery WH 3rd, Baker CL Jr, Beck CL Jr, Hormel SE, Steadman JR, Cole BJ, Briggs KK. Comparison of the collagen meniscus implant with partial meniscectomy. A prospective randomized trial. *JBJS Am.* 2008;90:1413-26.

Schlegel TF, Faber KJ, Chen AL, Hawkins RJ. The effect of postoperative immobilization on the healing of radiofrequency heat probe modified tissue: assessment of tissue length, stiffness, and morphology. *Orthopedics.* 2008;31: 134.

Shelburne KB, Torry MR, Pandy MG. Functional Knee Biomechanics of Healthy, Anterior Cruciate Ligament-Deficient and Reconstructed Knees. In: **Feagin JA, Steadman JR,** Eds. *The Crucial Principles in Care of the Knee,* Philadelphia: Lippincott Williams & Wilkins, p 229-245, 2008.

Shelburne KB, Torry MR, Steadman JR, Pandy MG. Effects of foot orthoses and valgus bracing on the knee adduction moment and medial joint load during gait. *Clin Biomech*. 2008;23:814-821.

Steadman JR, Dragoo J, Hines S, Briggs KK. Arthroscopic release for symptomatic scarring of the anterior interval of the knee. *AJSM* 2008;36:1763-9.

Steadman JR. Philosphy of care of the knee. In: **Feagin JA, Steadman JR**, eds. *The Crucial Principles in Care of the Knee.* Philadelphia: Lippincott Williams & Wilkins, 2008.

Steadman JR. ACL Reconstruction. In:**Feagin JA, Steadman JR**, eds. *The Crucial Principles in Care of the Knee.* Philadelphia: Lippincott Williams & Wilkins, 2008.

Steadman JR. Microfracture. In: **Feagin JA, Steadman JR**, eds. *The Crucial Principles in Care of the Knee.* Philadelphia: Lippincott Williams & Wilkins, 2008.

Steadman JR, Briggs KK, Rodkey WG. Microfracture. In **Cole B.** Ed. Biologic joint reconstruction: An alternative to joint arthroplasty. *Slack Inc.* In Press.

Steadman JR, Rodkey WG. The healing response technique. A minimally invasive procedure to stimulate healing of anterior cruciate ligament (ACL) injuries using the microfracture technique. In: **Feagin JA, Steadman JR,** eds. *The Crucial Principles in Care of the Knee.* Philadelphia: Lippincott Williams & Wilkins, 2008.

Steadman JR, Rodkey WG. Microfracture technique: Treatment of full-thickness chondral lesions. In: **Jackson DW,** ed. *Master Techniques in Orthopaedic Surgery. Reconstructive Knee Surgery.* 3rd ed. Philadelphia: Lippincott Williams & Wilkins; 2008:385-394.

Steadman JR. Arthroscopic treatment of the degenerative knee. In: **Feagin JA, Steadman JR,** eds. *The Crucial Principles in Care of the Knee.* Philadelphia: Lippincott Williams & Wilkins, 2008.

Sterett WI, Adickes M, Briggs KK. Joint Preservation. Care of the older athlete. In: **Feagin JA, Steadman JR,** eds. *The Crucial Principles in Care of the Knee.* Philiadelphia: Lippincott Williams & Wilkins, 2008.

Sterett WI, Miller BS, Joseph TA, Rich VJ, Bain EM. Posterior tibial slope after medial opening wedge high tibial osteotomy of the varus degenerative knee. *J Knee Surg.* 2009;22:13-6.

Tokish JM, Curtin MS, Kim YK, Hawkins RJ, Torry MR. Glenohumeral internal rotation deficit in the asymptomatic professional pitcher and its relationship to humeral retroversion, *Journal of Sports Science and Medicine.* 7:78-83, 2008.

Torry MR. Scientific and clinical advances leading to improved treatment of knee osteoarthritis. *Med Sci Sports Exerc.* 2008;40:191-2.

Yanagawa T, Goodwin CJ, Shelburne KB, Giphart JE, Torry MR, Pandy MG. Contributions of the individual muscles of the shoulder to glenohumeral joint stability during abduction. *J Biomech Eng.* 2008;130:210-22

Yeargan A, Briggs KK, Horan MA, Black A, Hawkins RJ. Determinants of patient satisfaction following surgery for multidirectional instability. *Orthopedics* 2008;31:647.

Yen YM, Cascio B, O'Brien L, Stalzer S, Millett PJ, Steadman JR. Treatment of Osteoarthritis of the Knee with Microfracture and Rehabilitation. *Med Sci Sports Exerc.* 2008;40:200-5.

IN THE MEDIA

New York and National Media Feature Dr. Marc J. Philippon Following Surgery of Yankees Super-Star Alex Rodriguez

The operation by Dr. Philippon to repair the torn labrum of Alex Rodriguez has generated plenty of media interest. "The surgery went exactly as we planned," Dr. Philippon said in a March 9, 2009, interview in *The New York Times* article, "Alex Rodriguez to Begin Rehab After Hip Surgery," by Joe Lapointe. "There were no surprises. Exactly what we prepared for was there. The labrum was repaired and the cartilage was stabilized." A second surgery in November was scheduled to correct pincer and cam impingement in Rodriguez's hip.

Seven months later, Dr. Philippon was again interviewed by *The New York Times* in an article titled "Rodriguez's Hip Health Impresses His Doctor," published October 9. Dr. Philippon examined Rodriguez's hip at Yankee Stadium as the Yankees prepared for their American League playoff series. "I am impressed with his progression. We accomplished most of what we needed to in the first surgery, and we got a very positive response. At this point in time, based on my clinical examination and what I saw in batting practice — I need a little more tests — but so far, I don't think he will need surgery."

Dr. Philippon has pioneered an arthroscopic procedure to repair impingement (femoroacetabular impingement) on the labrum. He has operated on Greg Norman, Priest Holmes, Mario Lemieux, Kurt Warner, and Marian Gaborik of the New York Rangers. He has performed more than 3,500 hip arthroscopies and treated more than 380 elite Olympic and professional athletes.

Charlie Rose Hosts Dr. Richard Steadman

On Friday, October 24, the PBS-syndicated *Charlie Rose Show* featured Dr. Steadman in a 22-minute interview session. Topics during the interview included rehabilitation and joint mobility following surgery, harnessing the body's own healing powers, imaging, and microfracture. *Charlie Rose* is an American television interview show, with Charlie Rose as producer and host.

One viewer commented, "You featured someone I greatly admire, and who made a significant contribution to my life, Dr. Steadman. After what he called a 'career-ending injury,' when my anterior cruciate ligament was torn from bone in a soccer game, he helped my knee reattach the ACL through an arthroscopic procedure that punctured the bone at the previous attachment site. Today, 13 years later, no one can tell at all that my ACL was once injured, and I have no pain. And I am far short of an outstanding athlete. He wants to help anyone over 35 stay active. I am 58 and still playing hockey. Thanks for having him on!"

Rose interviews well-known thinkers, writers, politicians, athletes, entertainers, business leaders, scientists, and other newsmakers. Guests have included Presidents Bush and Clinton, presidential candidates John McCain and Barack Obama, American investor and businessman Warren Buffett, and Mikhail Gorbachev, former President of the Soviet Union.

World Soccer

In its May 2008 edition, the international magazine *World Soccer* published a list of the 100 most powerful and influential personalities in the game. And **Dr. Richard Steadman**, "the famous American knee surgeon who has saved the careers of many a player," was ranked 82nd. In its introduction to this unique ranking, *World Soccer* set out the following criteria used in its selection-making process: "Our aim is to identify the most influential figures in the world of football, the decision makers, the kingmakers, and the icons who have changed the way we look at the game."

RECOGNITION

Dr. Marc J. Philippon Founding Member of the International Society for Hip Arthroscopy

On May 18, 2008, in Paris, France, Dr. Philippon joined 11 other orthopaedic surgeons to formally establish the International Society for Hip Arthroscopy (ISHA). The society's role is to be the premier international society for education and research in arthroscopic hip surgery. ISHA's Founding Members represent but a few of the many individuals around the world who are interested in this evolving area of hip surgery and research. Dr. Philippon serves on the executive committee as research secretary.

U.S. Ski and Snowboard Association (USSA) Honors Dr. Steadman

Dr. Richard Steadman, who has headed the USSA's renowned volunteer physicians' program for more than 30 years, was honored April 12 as the first recipient of the U.S. Ski and Snowboard Association's Dr. J. Leland Sosman Award. The award was presented by the USSA President and CEO Bill Marolt during the team's spring medical summit meeting in Park City. The USSA is the national governing body for Olympic skiing and snowboarding, and the parent organization for the U.S. Ski Team and U.S. Snowboarding.

The USSA's newly developed J. Leland Sosman Award is presented to a member of the USSA Physicians' Pool who has made great contributions as a volunteer medical provider. The award is named in honor of "Doc Sosman" for his endless commitment as a volunteer for the USSA. Doc Sosman was known for his energy, persistence, and passion for USSA sports as an alpine official and technical delegate. The award recognizes that individual of the medical community who best exemplifies those traits.

Sosman passed away on April 3 at the age of 87. A New England native, Sosman was an alpine ski racing official who served the sport for more than 50 years at the domestic and international level. In his professional career, he was a noted radiologist in Boston.

"Much of the success of our organization and our athletes stems from volunteers like Dr. Steadman and Doc Sosman, who gladly give their time and resources to help young men and women achieve their goals," said Marolt. "Dr. Steadman has played a critical role in our sport for 30 years. Through his efforts, we now have hundreds of physicians who donate their time to ensure that our athletes have medical support worldwide."

A native Texan, Steadman played football under the legendary Paul "Bear" Bryant at Texas A&M. He opened an orthopaedic practice in Lake Tahoe with an increasing emphasis on knee problems. In 1976, he was named chief physician for the U.S. Ski Team and helped develop surgical and rehabilitation techniques that allowed many of the world's top skiers — including Phil and Steve Mahre, Cindy Nelson, Christin Cooper, Tamara McKinney, and Picabo Street — to resume their careers after major knee injuries. In 1989, his work was recognized with his election to the U.S. National Ski Hall of Fame.

One of the key accomplishments in his role with the team was providing early direction in the little-known area of sport science and sports medicine. Today, the USSA's $1.4 million sport science program is considered the best in the world within the sport and one of the most important factors in the recent success of U.S. Ski Team and U.S. Snowboarding athletes.

"Dr. Steadman is well known as a surgeon, but his leadership in the early days of our sport science program is one of the most important elements of his legacy with our sport," said Marolt. In addition to his medical role, Steadman also serves as a trustee of the U.S. Ski and Snowboard Team Foundation.

"It's a real honor to be recognized with this award," said Steadman. "I always had great respect for Dr. Sosman. He gave his whole heart and soul to his volunteer work for athletes."

Arthroscopy Accepts First Microfracture in the Shoulder Research

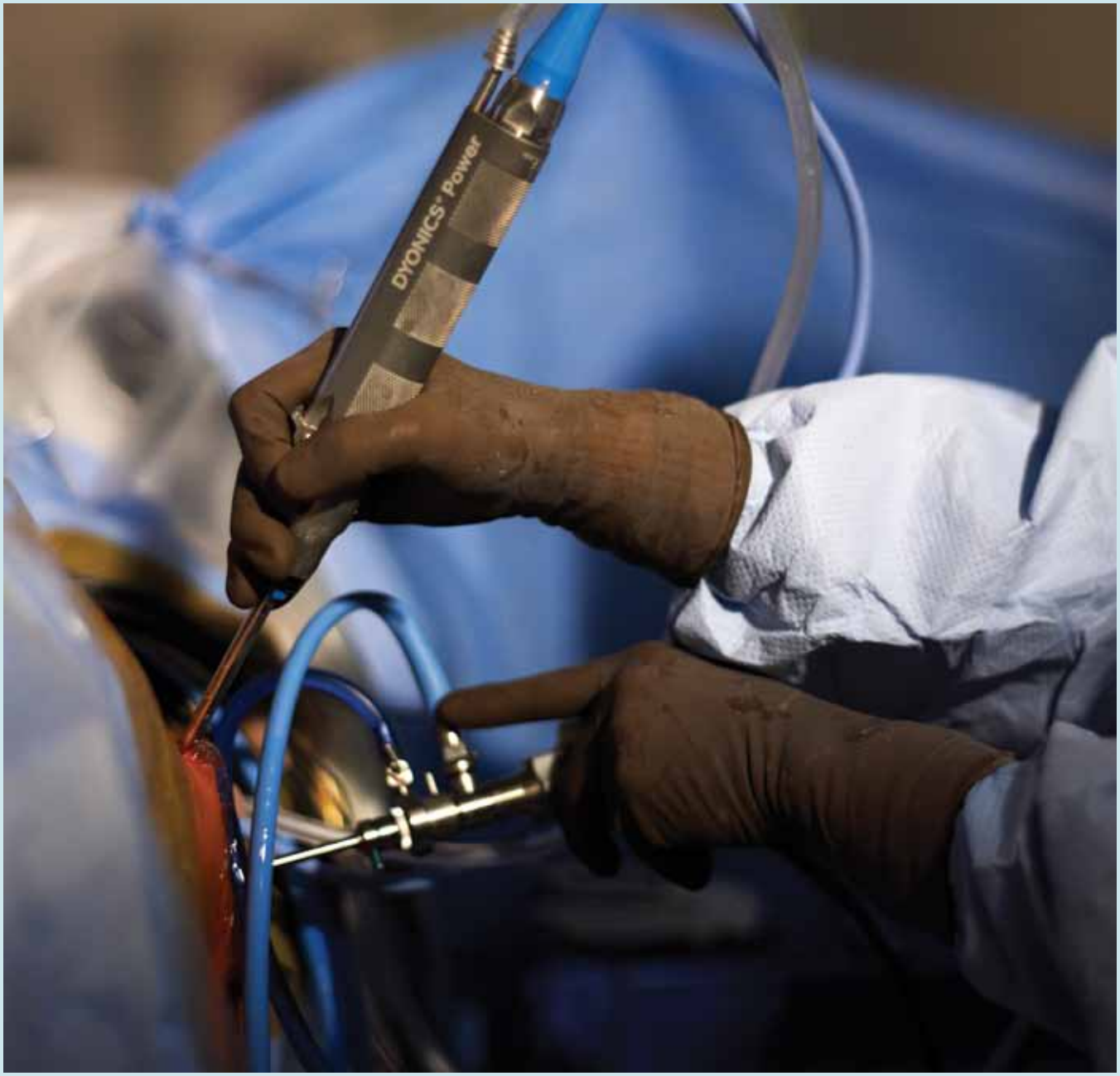
Congratulations to Dr. Peter Millett and the Clinical Research team headed by Marilee Horan. For the first time ever, an article will be published on microfracture in the shoulder. The article, titled "Outcomes of Full-thickness Articular Cartilage Injuries of the Shoulder Treated with Microfracture," will appear in an upcoming issue of the journal *Arthroscopy*. The authors of the article are Peter J. Millett, M.D., M.Sc.; Benjamin H. Huffard, M.D.; Marilee P. Horan, M.P.H.; Richard J. Hawkins, M.D.; and J. Richard Steadman, M.D.

Dr. Peter J. Millett Named Principal Reviewer

In January, the Foundation Board member Dr. Millett was named a principal reviewer for the prestigious *American Journal of Sports Medicine*. Based upon his performance of reviews for the journal during 2008, his name will appear on the masthead for the next 12-month cycle beginning in March 2009.

The number of submissions to *AJSM* continues to increase. In 2008, the submissions of original articles numbered more than 880. As the selection process becomes ever more difficult, it is important to have dedicated reviewers to provide high-quality evaluations of submitted papers. In the minds of submitting authors, Dr. Millett's words will be the face and voice of the journal.

The American Journal of Sports Medicine is a peer-reviewed scientific journal, first published in 1972. It is the official publication of the *American Orthopaedic Society for Sports Medicine (AOSSM)*, and it is ranked 4th out of 72 sports sciences journals in *Thomson Scientifics* 2007 Journal Citation Reports. The journal acts as an important forum for independent orthopaedic sports medicine research and education, allowing clinical practitioners the ability to make decisions based on sound scientific information.



FOUNDATION RESEARCH LEADS THE WORLD

2008 European Society of Sports Traumatology, Knee Surgery and Arthroscopy (ESSKA) Annual Meeting, May 21-24, Porto Portugal

At the 2008 annual meeting of ESSKA, 13 Foundation research papers out of a total of 145 (9 percent) were accepted for presentation. ESSKA promotes the exchange of information data covering research into the scientific and practical aspects of knee ailments.

2008 Annual Meeting of the American Academy of Orthopaedic Surgeons

The 75th Annual Meeting of the American Academy of Orthopaedic Surgeons (AAOS), San Francisco, March 5-9, accepted four podium and five poster presentations highlighting Foundation research, as well as three instructional video presentations.

The Academy provides education and practice management services for orthopaedic surgeons and allied health professionals. The Academy also serves as an advocate for improved patient care and informs the public about the science of orthopaedics. Founded as a not-for-profit organization in 1933, the Academy has grown from a small organization serving less than 500 members to the world's largest medical association of musculoskeletal specialists. The Academy now serves more than 34,000 members internationally.

Additionally, The American Orthopaedic Society for Sports Medicine Specialty Day accepted three podium presentations and one symposium.

2008 Arthroscopy Association of North America Annual Meeting, April 24-27, 2008, Washington, D.C.

The Arthroscopy Association of North America (AANA) is an accreditation council for continuing medical education. AANA exists to promote, encourage, support, and foster the development and dissemination of knowledge of arthroscopic surgery in order to improve upon the diagnosis and treatment of diseases and injuries of the musculoskeletal system. AANA accepted three presentations.

Annual Meeting of the American Orthopaedic Association/ Canadian Orthopaedic Association. June 4-7, 2008, Quebec City, Canada

The mission of the American Orthopaedic Association (AOA) is to *identify, develop, engage and recognize leadership to further the art and science of orthopaedics.* Founded in 1887, the AOA is the oldest and most distinguished orthopaedic association in the world and has a membership of 1,400. Membership in the AOA is achieved by those who have made a significant contribution to education, research, and the practice of orthopaedic surgery.

The annual meeting provides an opportunity for AOA members to come together to discuss, debate and disseminate information regarding orthopaedics for the purpose of setting the direction of the specialty. The Association accepted two podium and one poster presentations.

VAIL HIP ARTHROSCOPY SYMPOSIUM

Smith & Nephew Endoscopy and Dr. Marc J. Philippon of the Clinic hosted the 2nd Vail Hip Arthroscopy Symposium at the Vail Cascade Resort and Spa. Fifty-five physicians from the U.S. and abroad attended the symposium held February 14-16. With some of the top hip arthroscopists in the world, the faculty included Marc Philippon, M.D.; J.W. Thomas Byrd, M.D. (Nashville, Tenn.); Richard Villar, F.R.C.S. (London, England); Damian Griffin, F.R.C.S. (Coventry, England); and Victor Ilizaliturri, M.D. (Mexico City, Mexico). The first two days of the conference consisted of faculty presentations and discussions, followed by a day of cadaveric lab demonstrations. Topics included the latest techniques and approaches to hip arthroscopy, femoroacetabular impingement, labral repair, microfracture in the hip, and outcomes research.

ASSOCIATES

The Foundation is proud to recognize its team of associates, who carry out the Foundation's research and educational mission in Vail. The staff has been nationally selected for its diverse training and background in biomechanics, engineering, clinical 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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ERIK GIPHART, PH.D. — RAISING THE LEVEL OF BIOMECHANICAL RESEARCH

When asked about working with so many world-class scientists and physicians at the Foundation, Erik Giphart, Ph.D., replied, "It makes this environment unique. The questions asked are at a different level. The presence of colleagues like this raises the level of the entire discussion." Dr. Giphart is Senior Staff Scientist in the Biomechanics Research Laboratory.

Does that create extra pressure to perform? "No, it adds to the challenge," he responds. "Pressure has a negative connotation, but I see pressure as a positive thing. It presents opportunities and possibilities. Trust me, there is never a dull moment working here. I prefer that over sitting around and wondering what's next."

Dr. Giphart is eminently qualified to take his position at the conference table with his esteemed colleagues at the Foundation. A citizen of the Netherlands, he earned his M.S. degree in electrical engineering from Delft University of Technology in 1994 with a focus on computer science and information theory. As part of his degree program he was required to complete a three-month internship, which he completed at the NeuroMuscular Research Center (NMRC) in Boston. "That experience," he remembers, "sparked my interest into the human physiology and human motion areas and away from strict computer science."

In 2001 he received his Ph.D. in biomedical engineering at Boston University after performing his dissertation work at the NMRC on postural control. After graduation, he created a Virtual Reality laboratory at Sargent College of Health and Rehabilitation Sciences, Boston University, to study how deficits in perception modify movement in patients who suffer from various diseases.

"You have to be flexible to take advantage of great opportunities," says Erik. "I was going to visit the U.S. for three months, plus a vacation. That was 16 years ago. While I was at Boston University, my colleagues in the Athletic Training Department told me about the Foundation and said I ought to check it out. I liked what I saw, was able to get an internship, and later joined the Foundation as a staff member."

The decision to join the Foundation was both professional and personal. "My wife, Courtney (who has her own architecture firm in Eagle), and I wanted to be closer to our families," he recalls. "She is from Colorado and I am from Holland, so we had to decide between 300 days of rain a year or 300 days of sunshine. We chose sunshine." He adds that Colorado is also a great place to raise their two children.

Dr. Giphart's career was also influenced by his family. His mother had polio when she was a child that caused partial paralysis of her ankle. After several less-than-successful

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operations, Erik began to realize that there had to be a better way to treat his mom's condition. "That got me interested in orthopaedics," he says. His sister also developed an interest in medicine and is now a physician who serves as Country Director for the Elizabeth Glaser Foundation in Tanzania, Africa.

Why didn't Erik become a physician? "At the time, I wasn't very comfortable with blood and needles. But I'm much better now. In fact, we just published a study in the *American Journal of Sports Medicine* in which we used biplane fluoroscopy to examine the biceps tendon in cadaver shoulders."

At the Foundation, Dr. Giphart's primary focus is working on research projects that use a state-of-the-art high-speed biplane fluoroscopy system. The sophisticated technology creates movies of moving bones and shows joint motion that can be tracked with sub-millimeter accuracy. This allows for the measurement of ligament lengthening and perhaps even cartilage indentation during real-time activities such as walking, running, and throwing a ball. Not only are these measurements currently unknown, they are critical in understanding ligament and cartilage function, their surgical reconstruction or repair, and their contribution to the development and progression of osteoarthritis.

"Incorporating this system into the work of the Foundation took a while and involved many people (such as Drs. Michael Torry and Kevin Shelburne) who were here before I arrived," says Erik. "But I learned that when Dr. Steadman says something is a good idea, it will happen.

"When I joined the Foundation in 2004," he continues, "we concentrated on establishing the biplane fluoroscopy system, dealing with technology issues, and learning how to best use the technology. Now we can focus on clinical research questions that are providing scientific support and validating certain procedures our physicians are performing. I see the Biomechanics Laboratory as a unit that is between Basic Science Research and Clinical Research. We can look at the mechanics of movement and see what goes on inside a joint — how bones move relative to each other and how various loads affect joint structures.

"Now that our biplane fluoroscopy system is in full force for the knee and shoulder, we are beginning to look at more joints in the body, including the hip and foot, concludes Dr. Giphart. "The Foundation already has a grant from the National Institutes of Health to use biplane fluoroscopy to investigate the unusually high incidence of anterior cruciate ligament (ACL) in female athletes and exercisers."

Dr. Giphart is as active locally as he and his colleagues are nationally and internationally. In February, he became the acting President of the Rocky Mountain Chapter of the American College of Sports Medicine. He was elected at the Annual Meeting in 2008 and will serve a total of three years on the Governing Board. The Rocky Mountain Chapter consists of over 200 academic, medical, professional, and student members in the Colorado and Wyoming area.

Regarding the future of the Foundation, Dr. Giphart observes, "The Foundation is in a position today to continue the exciting biplane fluoroscopy research programs already underway and to explore bigger and longer-term projects. And we're also starting to publish a lot of the data that has resulted from the hard work of the people in the Biomechanics Research Laboratory at the Foundation. Lastly, we are eager to start incorporating 3T MRI data into our work, which will add another level and dimension to our research."

EXPERIENCED PROFESSIONALS: OUR FINANCIAL ENGINEERS

Investment Committee:

Our Investment Committee, chaired by Howard Berkowitz, includes George Gillett, Julie Esrey, Damaris Skouras, and Stewart Turley. "We are very fortunate to have such skilled professionals who, along with Marc Prisant, are overseeing the financial engineering of our investment portfolio and financial management," says Mike Egan.

The Investment Committee meets several times a year to review the investment performance reports of the portfolio. These reports are reviewed in detail by the committee during its meetings. The committee takes its fiduciary responsibilities seriously, and capital preservation is always at the forefront. There is considerable discussion of the macro- and microeconomic aspects of the economy and of our asset allocations before any decision is made regarding whether or not to change the portfolio's composition.

Marc Prisant:

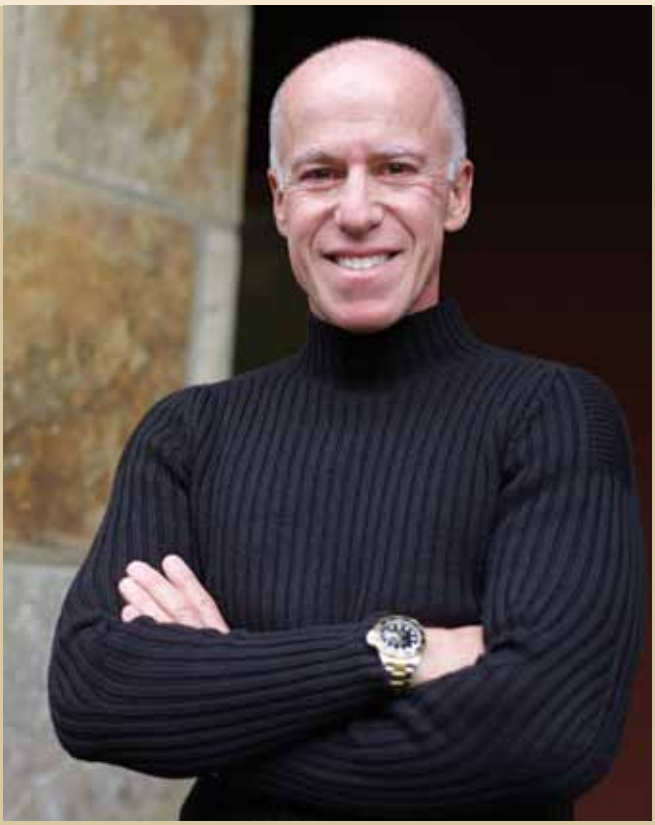
Injuring your knee in a ski accident and being treated at the Clinic is not a prerequisite for joining the Foundation, but it was part of the process for Marc Prisant. Prisant began his work as Executive Vice President and Chief Financial Officer in May 2007.

To Vail, Via Spain

Marc Prisant took a different route to get to Vail. With more than 20 years of venture capital experience, he has an extensive finance and business background, including work with numerous biotechnology and medical device portfolio companies in the U.S. and Europe, several of which went public. In his last position, he served as the Executive Vice President and CFO of Bluebird Development, LLC, where he worked with Mike Egan. "Marc and I have a successful business track record together," says Egan. "We recruited Marc to join us because his skill set was exactly what we needed and necessary for our future growth."

"I've known Richard Steadman since the early '90s and have always been impressed with his dedication to improving medicine. I had met Marc Philippon while working in venture capital and have since been impressed with his dedication to clinical outcomes and research," says Prisant. "I simply couldn't say no to this truly unique opportunity. My criteria for returning to work were simple. It had to be a worthy pursuit that involved stimulating work with intelligent and interesting people. I've found this at the Foundation."

An avid cyclist and skier, he spent two years living in Girona, Spain, before accepting the position with the Foundation. During that time he traveled, learned Spanish, skied in the Pyrenees and Alps, and cycled with some of the professional cyclists who live in Girona during their racing season.



Marc Prisant

Prisant inadvertently became a patient at the Clinic in early 2007. "After sustaining a partial tear of the ACL in my right knee while skiing in Zermatt, I learned first-hand how the work done at the Foundation can be applied to benefit anyone who wishes to stay active in life. I also learned that Dr. Steadman's reputation extends to the medical community worldwide."

While being attended to immediately following his injury in Switzerland, Marc mentioned to the clinician that he would be seeing Dr. Steadman, to which came the reply, "So you'll be much better taken care of than if you stayed here."

The procedure used to treat Prisant's injury was the "healing response." Dr. Steadman developed the procedure in an effort to minimize the complications associated with the treatment of specific types of ACL injuries and to jump-start the body's own healing process. It involves producing 3-10 microfracture holes into the bone at the origin of the ACL, as well as perforating the stump of the remaining ACL with the microfracture awl. No other intervention is performed, and the blood clot from the bleeding bone at the end of the ACL holds the ligament in place while the healing occurs.

Of his outcome, Marc says, "I have fully recovered, and I'm back skiing and cycling as hard, if not harder, than I did before the injury. Literally, my knee feels as strong and stable as if nothing had happened."

2008 FINANCIAL STATEMENTS

INDEPENDENT AUDITORS' REPORT

To the Board of Directors
Steadman◆Hawkins Research Foundation
Vail, Colorado

We have audited the accompanying statements of financial position of Steadman◆Hawkins Research Foundation (the "Foundation") (a Colorado non-profit corporation) as of December 31, 2008, and the related statements of activities, functional expenses, and cash flows for the year then ended. These financial statements are the responsibility of the Foundation's management. Our responsibility is to express an opinion on these financial statements based on our audit. The financial statements of the Foundation as of December 31, 2007 were audited by other auditors whose report is dated July 1, 2008 expressed an unqualified opinion.

We conducted our audit 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 financial statements are free of material misstatements. An audit includes examining, on a test basis, evidence supporting the amounts and disclosures in the financial statements. An audit also includes assessing the accounting principles used and significant estimates made by management, as well as evaluating the overall financial statement presentation. We believe that our audit provides a reasonable basis for our opinion.

As discussed in Note 12, the 2007 financial statements have been restated due to an error in accounting related to depreciation expense. Accordingly, the 2007 financial statements have been restated and an adjustment has been made to net assets as of January 1, 2008 to correct the error.

In our opinion, the financial statements referred to above present fairly, in all material respects, the financial position of Steadman◆Hawkins Research Foundation as of December 31, 2008, and the results of its activities and its cash flows for the year then ended in conformity with accounting principles generally accepted in the United States of America.

Ehrhardt Keefe Steiner & Hottman PC

June 30, 2009
Denver, Colorado

STATEMENTS OF FINANCIAL POSITION

December 31 2008 2007 (Restated)

ASSETS	December 31	
	2008	**2007 (Restated)**
Current assets		
Cash and cash equivalents	**$ 1,813,945**	$ 1,419,892
Accounts receivable	**105**	21,078
Accounts receivable, related parties	**807**	27,983
Contributions receivable, current portion (Note 3)	**106,400**	101,400
Contributions receivable, related parties	**750**	750
Prepaid expenses and other assets	**2,281**	15,909
Investments (Note 2)	**3,204,453**	4,342,493
Total current assets	**5,128,741**	5,929,505
Contributions receivable, less current portion (Note 3)	**209,352**	230,707
Property and equipment, net (Note 4)	**2,380,128**	543,913
Total assets	**$ 7,718,221**	$ 6,704,125
LIABILITIES AND NET ASSETS		
Current liabilities		
Accounts payable	**$ 14,003**	$ 166,463
Accrued expenses	**126,487**	107,315
Line-of-credit (Note 5)	**32,036**	-
Deferred revenues	-	20,023
Current portion of capital leases (Note 6)	**238,083**	68,220
Total current liabilities	**410,609**	362,021
Long-term liabilities		
Capital leases, net of current portion (Note 6)	**1,839,536**	379,629
Total liabilities	**2,250,145**	741,650
Commitments		
Net assets		
Unrestricted	**4,600,404**	5,188,247
Temporarily restricted (Note 8)	**867,672**	774,228
Total net assets	**5,468,076**	5,962,475
Total liabilities and net assets	**$ 7,718,221**	$ 6,704,125

See Notes to Financial Statements

STATEMENTS OF ACTIVITIES

	For the Years Ended					
	December 31, 2008			December 31, 2007 (Restated)		
	Unrestricted	Temporarily Restricted	Total	Unrestricted	Temporarily Restricted	Total
REVENUES, GAINS, AND OTHER SUPPORT						
Contributions	$ 1,416,271	$ 890,880	$ 2,307,151	$ 1,254,250	$ 538,101	$ 1,792,351
Grants	-	-	-	-	242,215	242,215
Corporate sponsors	796,509	429,570	1,226,079	926,000	-	926,000
Fundraising events	397,700	-	397,700	401,227	-	401,227
Fellows and other meetings	3,100	-	3,100	-	-	-
Bioskills lab	30,550	-	30,550	22,739	-	22,739
Video income	2,080	-	2,080	4,740	-	4,740
Other income	49,509	-	49,509	4,912	-	4,912
Total revenues, gains, and other support	2,695,719	1,320,450	4,016,169	2,613,868	780,316	3,394,184
Net assets released from restrictions	1,227,006	(1,227,006)	-	779,305	(779,305)	-
Total revenues, gains, and other support	3,922,725	93,444	4,016,169	3,393,173	1,011	3,394,184
Expenses and losses						
Biomechanics research	796,272	-	796,272	692,195	-	692,195
Basic science	204,940	-	204,940	92,991	-	92,991
Bioskills	119,539	-	119,539	88,245	-	88,245
Clinical research	611,693	-	611,693	560,099	-	560,099
Education	253,052	-	253,052	247,018	-	247,018
Information services	210,585	-	210,585	213,569	-	213,569
Imaging research	174,455	-	174,455	-	-	-
Management and general	420,215	-	420,215	625,615	-	625,615
Fundraising	660,978	-	660,978	582,733	-	582,733
Total expenses and losses	3,451,729	-	3,451,729	3,102,465	-	3,102,465
Other income (expense)						
Investment return	(1,034,109)	-	(1,034,109)	347,259	-	347,259
Interest expense	(24,730)	-	(24,730)	(11,489)	-	(11,489)
Total other income (expense)	(1,058,839)	-	(1,058,839)	335,770	-	335,770
Change in net assets	(587,843)	93,444	(494,399)	626,478	1,011	627,489
Net assets at beginning of year	5,188,247	774,228	5,962,475	4,561,769	773,217	5,334,986
Net assets at end of year	$ 4,600,404	$ 867,672	$ 5,468,076	$ 5,188,247	$ 774,228	$ 5,962,475

See Notes to Financial Statements

STATEMENTS OF CASH FLOWS

	For the Year Ended December 31	
	2008	2007 (Restated)
Cash flows from operating activities		
Change in net assets	**$ (494,399)**	$ 627,489
Adjustments to reconcile change in net assets to net cash provided by operating activities		
Depreciation and amortization expense	**197,505**	125,395
Loss on disposition of assets	**-**	22,625
Net unrealized (gains) loss on investments	**1,086,045**	(272,695)
Changes in assets and liabilities		
Accounts receivable	**48,149**	81,942
Contributions receivable	**16,355**	(52,214)
Prepaid expenses and other assets	**13,628**	49,700
Accounts payable	**(152,460)**	93,869
Accrued expenses	**19,172**	11,167
Deferred revenues	**(20,023)**	2,023
	1,208,371	61,812
Net cash provided by operating activities	**713,972**	689,301
Cash flows from investing activities		
Purchase of investments	**(30,872)**	(184,340)
Proceeds from sale of investments	**82,867**	245,421
Additions to buildings and equipment	**(318,730)**	110,167
Net cash (used in) provided by investing activities	**(266,735)**	171,248
Cash flows from financing activities		
Payments on capital leases	**(85,220)**	(25,668)
Net proceeds from line-of-credit	**32,036**	-
Net cash used in financing activities	**(53,184)**	(25,668)
Net increase in cash and cash equivalents	**394,053**	834,881
Cash and cash equivalents at beginning of year	**1,419,892**	585,011
Cash and cash equivalents at end of year	**$ 1,813,945**	$ 1,419,892

Supplemental disclosure of non-cash activity:

During the years ended December 31, 2008 and 2007, the Foundation acquired $1,714,990 and $473,517, respectively, of equipment through capital leases.

See Notes to Financial Statements

STATEMENT OF FUNCTIONAL EXPENSES

For the Year Ended December 31, 2008

	Biomechanics Research	Basic Science	Bioskills	Clinical Research	Education	Information Services	Imaging Research	Total	Management and General	Fundraising	Total
Salaries and benefits	$ 537,381	$ -	$ 11,036	$ 505,201	$ 117,686	$ 123,590	$ 104,464	$ 1,399,358	$ 288,344	$ 179,726	$ 1,867,428
Consulting and contract labor	12,333	85,333	-	12,333	-	172	40,919	151,090	1,137	79,128	231,355
Supplies (office, computer, lab)	14,814	691	43,902	8,329	1,768	9,058	7	78,569	4,617	5,930	89,116
Events and fund raising	-	-	-	-	-	-	-	-	-	171,281	171,281
Printing	1,764	362	-	11,817	1,602	294	-	15,839	834	89,977	106,650
Maintenance and supplies	18,917	-	987	2,591	1,727	34,281	150	58,653	4,296	5,856	68,805
Rent and leases	15,515	568	11,025	10,297	5,861	9,841	1,798	54,905	2,338	3,302	60,545
Telephone and utilities	20,720	-	8,624	12,851	5,012	7,713	3,858	58,778	8,308	4,705	71,791
Travel	9,263	4,022	-	11,165	556	200	7,044	32,250	976	10,992	44,218
Legal and accounting	41,449	-	230	15,143	935	3,596	1,917	63,270	9,120	4,773	77,163
Fellows	-	-	-	-	23,254	-	-	23,254	-	-	23,254
Education meetings/lectures	-	-	-	-	51,699	-	-	51,699	-	-	51,699
Direct mail/planned giving	-	-	-	-	-	-	-	-	-	60,904	60,904
Meals and entertainment	4,248	908	-	2,834	28,010	369	2,261	38,630	13,763	24,143	76,536
Gifts	628	1,817	-	705	78	157	78	3,463	7,572	559	11,594
Postage	4,849	380	7,946	4,733	1,445	1,477	22	20,852	2,656	8,445 3	1,953
Insurance	1,265	-	2	1,306	80	-	-	2,653	53,850	313	56,816
Meeting fees/registrations and dues and subscriptions	3,863	-	-	704	8,487	128	-	13,182	113	2,437	15,732
Bank/credit card fees	-	-	-	-	-	-	-	-	14,117	- 1	4,117
Meetings (Board and SAC)	-	859	-	-	233	-	-	1,092	1,298	-	2,390
Grant writing/medical editing	-	-	-	-	-	-	-	-	-	6,433	6,433
Research grant	-	110,000	-	-	-	-	-	110,000	-	-	110,000
Advertising	4,000	-	-	-	90	-	-	4,090	177	177	4,444
	691,009	204,940	83,752	600,009	248,523	190,876	162,518	2,181,627	413,516	659,081	3,254,224
Depreciation and amortization	105,263	-	35,787	11,684	4,529	19,709	11,937	188,909	6,699	1,897 1	97,505
Total	$ 796,272	$ 204,940	$ 119,539	$ 611,693	$ 253,052	$ 210,585	$ 174,455	$ 2,370,536	$ 420,215	$ 660,978	$ 3,451,729

See Notes to Financial Statements

STATEMENT OF FUNCTIONAL EXPENSES

For the Year Ended December 31, 2007 (Restated)

	Biomechanics Research	Basic Science	Bioskills	Clinical Research	Education	Information Services	Imaging Research	Total	Management and General	Fundraising	Total
Salaries and benefits	$ 428,116	$ -	$ 1,070	$ 427,810	$ 106,624	$ 78,276	$ -	$ 1,041,896	$ 477,392	$ 197,053	$ 1,716,341
Consulting and contract labor	14,298	86,610	16,019	39,925	862	9,470	-	167,184	17,025	56,847	241,056
Supplies (office, computer, lab)	81,717	-	48,365	14,408	6,395	6,495	-	157,380	12,293	6,870	176,543
Events and fund raising	-	-	-	-	-	-	-	-	-	152,406	152,406
Printing	1,139	262	-	5,599	131	248	-	7,379	1,846	88,694	97,919
Maintenance and supplies	11,339	-	265	3,250	1,016	64,587	-	80,457	2,478	1,750	84,685
Rent and leases	23,167	-	11,682	12,263	6,745	6,738	-	60,595	5,038	4,947	70,580
Telephone and utilities	18,557	-	9,451	11,066	5,884	5,890	-	50,848	10,966	7,167	68,981
Travel	6,890	-	-	12,988	7,305	-	-	27,183	22,390	1,450	51,023
Legal and accounting	20,088	70	923	9,722	1,860	1,990	-	34,653	6,166	5,108	45,927
Fellows	-	-	-	-	45,634	-	-	45,634	-	-	45,634
Education meetings/lectures	-	-	-	-	27,049	-	-	27,049	-	-	27,049
Direct mail/planned giving	-	-	-	-	-	-	-	-	-	42,213	42,213
Meals and entertainment	5,677	512	-	4,859	10,735	915	-	22,698	7,483	3,058	33,239
Gifts	1,675	5,463	-	1,983	5,044	700	-	14,865	15,737	2,345	32,947
Postage	5,768	74	373	6,284	1,658	1,275	-	15,432	5,051	6,455	26,938
Insurance	961	-	-	961	259	-	-	2,181	18,808	591	21,580
Meeting fees/registrations and dues and subscriptions	4,282	-	-	1,211	9,191	21	-	14,705	277	695	15,677
Bank/credit card fees	-	-	-	-	-	-	-	-	11,547	-	11,547
Meetings (Board and SAC)	-	-	-	-	4,679	-	-	4,679	3,897	-	8,576
Grant writing/medical editing	-	-	-	-	-	-	-	-	-	3,350	3,350
Advertising	2,000	-	-	-	90	-	-	2,090	769	-	2,859
	625,674	92,991	88,148	552,329	241,161	176,605	-	1,776,908	619,163	580,999	2,977,070
Depreciation and amortization	66,521	-	97	7,770	5,857	36,964	-	117,209	6,452	1,734	125,395
Total	$ 692,195	$ 92,991	$ 88,245	$ 560,099	$ 247,018	$ 213,569	$ -	$ 1,894,117	$ 625,615	$ 582,733	$ 3,102,465

See Notes to Financial Statements

NOTES TO FINANCIAL STATEMENTS

NOTE 1 - ORGANIZATION AND SUMMARY OF SIGNIFICANT ACCOUNTING POLICIES

Organization

The Steadman◆Hawkins Research Foundation (the "Foundation"), a non-profit Foundation, 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"). The Foundation is located in Vail, Caolorado, 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. The Foundation's primary sources of support are public donations, grants, special events and corporate partners.

The Foundation has agreements with several corporations who sponsor the Foundation's research. This research is for the general use of and publication by the Foundation. These agreements are recorded as income in the year payment is due.

Basis of Presentation

Financial statement presentation follows the recommendations of the Financial Accounting Standards Board ("FASB") in its Statement of Financial Accounting Standards ("SFAS") No. 117, *Financial Statements of Not-for-Profit Organizations*. Under SFAS No. 117, the Foundation is required to report 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 Foundation'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 Foundation for the restricted purpose.

Permanently restricted amounts are assets that must be maintained permanently by the Foundation as required by the donor; but the Foundation is permitted to use or expend part or all of any income derived from those assets. As of December 31, 2008, the Foundation did not have any permanently restricted amounts.

Cash and Cash Equivalents

The Foundation 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. At December 31, 2008, the Foundation had cash in excess of federally insured limits totaling $1,563,945.

Investments

The Foundation accounts for investments in accordance with SFAS No. 124. Under SFAS No. 124, the Foundation is required to report 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 statements of activities.

The Foundation holds alternative investments, which are not readily marketable, and are carried at fair value as provided by the investment managers. The Foundation 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 statements of activities as unrestricted, temporarily restricted, or permanently restricted based upon the existence and nature of any donor or legally imposed restrictions.

Fair Value Measurements

Beginning in 2008, the Foundation adopted SFAS No. 157, Fair Value Measurements. SFAS No. 157 requires use of a fair value hierarchy that prioritizes the inputs to valuation techniques used to measure fair value into three levels: quoted market prices in active markets for identical assets and liabilities (Level 1); inputs other than quoted market prices that are observable for the asset or liability, either directly or indirectly (Level 2); and unobservable inputs from the asset or liability (Level 3).

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 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.

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.

Property and Equipment
Land, buildings and improvements, and equipment purchased by the Foundation 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 depreciated over the shorter of the lease term plus renewal options or the estimated useful lives of the improvements.

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

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 and 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.

Reclassifications
Certain amounts in the 2007 financial statements have been reclassified to conform to the 2008 presentation.

NOTE 2 - INVESTMENTS

Long-term investments consist of the following:

	As of December 31,	
	2008	2007
Stock and equity funds	**$ 1,070,991**	$ 1,628,242
Money markets	**589,543**	671,586
Limited partnerships	**1,543,919**	2,042,665
	$ 3,204,453	$ 4,342,493

Investment return consists of the following:

	As of December 31,	
	2008	2007
Dividends and interest - reinvested	**$ 51,936**	$ 74,564
Net unrealized (loss) gain on investments	**(1,086,045)**	272,695
Total return on long-term investments	**$ (1,034,109)**	$ 347,259

NOTE 3 - CONTRIBUTIONS

Contributions receivable consist of the following:

	As of December 31,	
	2008	2007
Due in less than one year	**$ 106,400**	$ 101,400
Due in one to five years	**232,800**	264,200
	339,200	365,600
Less unamortized discount	**(23,448)**	(33,493)
	$ 315,752	$ 332,107

The discount rate was 5% for both 2008 and 2007.

NOTE 4 - PROPERTY AND EQUIPMENT

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

	As of December 31,	
	2008	2007
		(Restated)
Equipment	**$ 233,363**	$ 205,411
Furniture and fixtures	**97,477**	96,627
Leasehold improvements	**38,361**	38,361
Machines and video equipment	**1,061,520**	1,031,307
Medical equipment	**1,974,704**	-
	3,405,425	1,371,706
Less accumulated depreciation and amortization	**(1,025,297)**	(827,793)
	$ 2,380,128	$ 543,913

NOTE 5 - LINE-OF-CREDIT

The Foundation has a $250,000 line-of-credit with a bank, which bears interest at 0.25% below the prime rate per annum (3% at December 31, 2008) and matures August 26, 2009. The outstanding balance is $32,036 and $0 at December 31, 2008 and 2007, respectively.

NOTE 6 - CAPITAL LEASES

The Foundation 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 October 1, 2012 and January 31, 2014. Amortization of the leased property is included in depreciation expense.

The assets under capital lease have cost and accumulated amortization as follows:

	As of December 31,	
	2008	2007
		(Restated)
Equipment	**$ 2,188,507**	$ 473,517
Less accumulated amortization	**(201,157)**	(77,584)
	$ 1,987,350	$ 395,933

Maturities of capital lease obligations are as follows:

Year Ending December 31,	
2009	$ 288,702
2010	482,470
2011	482,470
2012	539,327
2013	387,536
Thereafter	101,387
Total minimum lease payments	2,281,892
Amount representing interest	(204,273)
Present value of net minimum lease payments	2,077,619
Less current portion	(238,083)
Long-term capital lease obligation	$ 1,839,536

NOTE 7 - RETIREMENT PLAN

The Foundation 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 Foundation's contributions to the Plan are determined annually. The Foundation contributed $17,278 and $19,021 to the Plan in fiscal year 2008 and 2007, respectively.

NOTE 8 - TEMPORARILY RESTRICTED NET ASSETS

The temporarily restricted net assets represent the net proceeds of donations which have been restricted by the donors to be used only for the following purposes:

	As of December 31,	
	2008	2007
		(Restated)
Biomechanics research	**$ -**	$ 131,433
Education	**542,127**	540,957
Administration	**-**	101,838
Imaging research	**325,545**	-
	$ 867,672	$ 774,228

NOTE 9 - RELATED PARTY TRANSACTIONS

During 2008 and 2007, the Foundation received approximately $450,000 and $531,000, respectively, in contributions from related parties including various Board members, as well as the Steadman Hawkins Clinic (the "Clinic").

In addition, the Foundation received $48,750 from the Clinic during 2008 for the use of certain equipment.

NOTE 10 - FAIR VALUE MEASUREMENTS

The Foundation has adopted SFAS No. 157, *Fair Value Measurements*. SFAS No. 157 establishes a framework for measuring fair value and requires enhanced disclosures about fair value measurements. SFAS No. 157 clarifies that fair value is an exit price, representing the amount that would be received to sell an asset or paid to transfer a liability in an orderly transaction between market participants. SFAS No. 157 also requires disclosure about how fair value is determined for assets and liabilities and establishes a hierarchy for which these assets and liabilities must be grouped, based on significant levels of inputs.

Investments measured on a recurring basis and reported at fair value are classified and disclosed in one of the following categories:

Level 1: Quoted prices in active markets for identical assets or liabilities. For the Foundation, Level 1 investments consist of equity securities and investments in mutual funds;

Level 2: Quoted prices in active markets for similar assets and liabilities and inputs that are observable for the asset or liability; or

Level 3: Unobservable inputs in which there is little or no market data, which require the reporting entity to develop its own assumptions. Included in this category for the Foundation are investments in limited partnerships.

The determination of where assets and liabilities fall within this hierarchy is based upon the lowest level of input that is significant to the fair value measurement. The above classifications are intended to reflect the observability of inputs used in the valuation of investments and are not necessarily an indication of risk or liquidity.

The following table summarizes the Foundation's fair value of assets measured on a recurring basis by the above SFAS No. 157 fair value hierarchy levels as of December 31, 2008:

Description	Level 1	Level 2	Level 3	Total
Investment in common stock	$ 1,070,991			$ 1,070,991
Investment in mutual funds	589,543	-	-	589,543
Investment in limited partnerships	-	-	1,543,919	1,543,919
Total	$ 1,660,534	$ -	$ 1,543,919	$ 3,204,453

The following is a reconciliation of the beginning and ending balances for assets measured at fair value on a recurring basis using significant unobservable inputs (Level 3) during the period ended December 31, 2008:

	Investment in Limited Partnerships
Beginning balance	$ 2,042,665
Total realized and unrealized gains or (losses)	(498,746)
Purchases, issuances and settlements, net	-
Transfers, net	-
Ending balance	$ 1,543,919

NOTE 11 - COMMITMENTS

Operating Leases

The Foundation leases facilities under non-cancelable operating leases expiring between January, 2012 and December, 2012 which call for both base rent payments and operating expenses. Rent and operating expenses under these leases for the years ended December 31, 2008 and 2007 was $104,045 and $104,784, respectively.

Future minimum lease payments under these leases are as follows:

Year Ending December 31,	
2009	$ 111,715
2010	112,022
2011	105,415
2012	104,796
	$ 433,948

NOTE 12 - RESTATEMENT

The Foundation's December 31, 2007 financial statements have been restated to correct the effects of overstating fiscal year 2007 depreciation expense related to 2006 write-downs of certain leasehold improvements. The following financial statement line items for fiscal year 2007 were affected by the restatement:

	As Previously Reported	As Stated	Effect of Restatement
Assets			
Property and equipment, net	$ 484,730	$ 543,913	$ 59,183
Net assets			
Total net assets	$ 5,903,292	$ 5,962,475	$ 59,183
Functional expenses			
Depreciation and amortization	$ 184,578	$ 125,395	$ (59,183)
Change in net assets	$ 568,306	$ 627,489	$ 59,183

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