Steadman◆Hawkins

Sports Medicine Foundation

ANNUAL REPORT 2003

15

YEARS OF

EXCELLENCE

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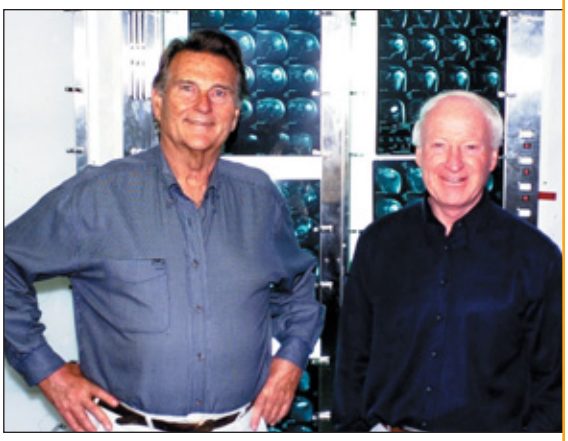
The Steadman◆Hawkins Sports Medicine Foundation wishes to express deep appreciation to John P. Kelly, who donated many of the stock photos in this year's Annual Report and contributed his time to photograph the many Foundation and operating room subjects.

Kelly is a renowned sports and stock photographer who approaches every photo shoot like a commando. His sense of motion combines with his obvious love of natural light to produce vibrant graphic images. He shoots extensively for a variety of prominent manufacturers in the sports and recreation industry; and his experience includes numerous assignments at the Olympics, Wimbledon, U.S. Open Golf, and World Cup Skiing. When Robert Redford needed a poster that reflected the spirit of his movie "A River Runs Through It," he called Kelly. More recently, Redford employed Kelly's photographic talents during the making of the "Horse Whisperer." Whether covering the Olympics or trekking in the Himalayas, Kelly is always ready for his next photographic adventure.

The Year in Review

Dear Friends:



In 2003, we celebrated the 15th anniversary of the Steadman◆Hawkins Sports Medicine Foundation! It is hard to believe that 15 years have passed. During this period, new surgical procedures and non-operative treatments to combat arthritis have been pioneered and developed. Our Fellowship Program has trained a new generation of orthopaedic surgeons who are now practicing throughout the world. We are indebted to the many individual and corporate supporters who have made these achievements possible. Since our founding in 1988, 2,100 individuals, foundations, and corporate sponsors have made more than 7,200 gifts to the Foundation. In this Annual Report, you will read about some of the noteworthy achievements and the progress we are making every day.

For example, microfracture, pioneered and developed by the Foundation, is now accepted as a treatment that may make it possible to postpone or even eliminate the need for knee replacement surgery. Just ten years ago, only a small percentage of the world's orthopaedic surgeons performed microfracture. Today, it is the treatment of choice among surgeons all over the world to relieve pain and slow the progression of arthritis in the knee.

Once again employing the body's own recuperative power, the Healing Response technique was another product of the Foundation's research and development environment. This alternative to anterior cruciate ligament (ACL) reconstruction in the knee provides treatment for certain types of ACL injuries.

The shoulder presents another area where injuries often lead to arthritis. In this complex joint, our researchers have been improving arthroscopic techniques that are far less invasive than open surgical procedures.

Increasing in size every year, the clinical research database developed by the Foundation offers researchers access to information on thousands of cases on injured or arthritic joints. Numerous peer-reviewed publications based on the information stored here have been produced by the Foundation. One of the many applications of the patient database was its use by researchers to identify risk factors that lead to arthritis.

Our biomechanics research group has become a leader in the development of computer modeling technology. Being able to see how a moving joint's different components interact is immensely valuable to doctors and therapists. Armed with this information, they can design therapies uniquely suited to each injured or diseased joint.

To reach professionals who are unable to come to us, Foundation scientists and physicians have reported their research worldwide through peer-reviewed publications and presentations. During the past decade and a half, we have produced more than 400 papers, 1,000 presentations, and 60 teaching videos—many award winning—that have been accepted by medical and scientific journals and organizations worldwide.

In fulfillment of our mission to educate and disseminate the results of our research, the Foundation in 2003 hosted the webcast *Overcoming the Challenge of Degenerative Joint Disease: Innovative Surgical and Pain Management Techniques.* The four-hour roundtable discussion sponsored by Pfizer was made available to orthopaedic surgeons throughout the world on the World Wide Web for continuing medical education credit.

As evidence that the quality of our research has attained a level of excellence recognized throughout the medical and scientific community, the prestigious American Academy of Orthopaedic Surgeons selected the poster presentation *Factors Associated with Disability and Activity in Patients Seeking Care for Osteoarthritis* as one of 12 award winners.

The Foundation owes a special thanks to our staff, scientists, and physicians. They dedicate their time and effort to conduct research that is meeting the highest and most rigorous standards of excellence and educational programs that will help all of us lead healthy and active lives for years to come.

As we look forward to the future, the legacy of the Steadman◆Hawkins Sports Medicine Foundation is constantly expanding as we continue to develop innovative treatments to heal the body. The Foundation has already set definitive goals that, when reached in the coming decades, will restore quality, activity, and health to countless lives.

Sincerely yours,

J. Richard Steadman, M.D.
Chairman of the Board

Richard J. Hawkins, M.D.
Vice President

Mission

THE STEADMAN◆HAWKINS SPORTS MEDICINE 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 PREVENTION.

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 Steadman◆Hawkins Sports Medicine Foundation is committed to solving orthopaedic problems that limit an individual's ability to maintain an active life. In 1990, he was joined by renowned shoulder surgeon Dr. Richard J. Hawkins. Together, they brought the Foundation's research production in knee and shoulder studies to a new level.

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 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 that may make it possible to postpone or even eliminate the need for knee replacement surgery.

One of the largest independent orthopaedic research institutes in the world, the Steadman◆Hawkins Sports Medicine Foundation has become one of the most productive and innovative foundations in orthopaedic research and education.

Philanthropic gifts are used to advance scientific research and to support scholarly academic programs that train physicians for the future. Through its Fellowship program, the Foundation has now built a network of 130 Fellows and associates worldwide who share the advanced ideas and communicate the concepts they learned in Vail.

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

- Basic Science Research – Undertakes studies to investigate the mysteries of degenerative arthritis, cartilage regeneration, and arthritic changes in the knee and shoulder.
- Clinical Research – Conducts "process" and "outcomes" research in orthopaedic sports medicine that aids both physicians and patients in making better-informed treatment decisions.
- Biomechanics Research Laboratory – Performs knee and shoulder computer modeling and related studies in an effort to reduce the need for surgical repair.
- Education and Fellowship Program – Administers and coordinates the physicians-in-residence fellowship program, hosts conferences and international medical meetings, and produces and distributes publications and videotapes.

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

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

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Savio Lau-Yuen Woo, Ph.D., D. Sc. (Hon.)
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Earl Graves: An Enterprising Touch

Editor's Note: The following profile is based on an interview by Richard Needham. Mr. Needham is editor of *Skiing Heritage* magazine and the health newsletter *Arthritis Advisor*.

If ever there were a role model for the self-made entrepreneur—the kind of individual business school students study to emulate when they finally step into the real world—it might be Earl Graves. The charismatic founder of *Black Enterprise* magazine, Graves is an African American who started his spiraling success story by selling Christmas cards door-to-door at age seven ("I was not in a community [Brooklyn, N.Y.] where you could cut grass."), and 27 years later, in 1970, launched the nation's first publication devoted to black entrepreneurs and business executives. Last year, Graves' *Black Enterprise*-driven media empire generated $53 million in revenues.

Years before launching his magazine, Graves, like many of the '60s' brightest, served in the political arena as an aide to the late Sen. Robert Kennedy. He was with the presidential candidate, in fact, on June 5, 1968, the night Kennedy was assassinated in Los Angeles.

It was a dark moment for Graves, but it was also a turning point. Offered a high-paying job with IBM, he turned that down to sign on for a Ford Foundation fellowship. It was an opportunity to study entrepreneurship and economic development, studies that would serve him well in pursuit of his goal, which was to advise American businesses on tapping into the emerging African-American market and, his ultimate goal, to put "black" and "capitalism" in the same sentence. After 33 years of publishing, and with the help of his three sons, the *Black Enterprise* empire based in New York City shows no signs of slowing.

Through it all, Graves also took his lumps. Jumping out of airplanes as a member of the U.S. Army Special Forces after college took its toll on his back. Recently diagnosed with stenosis of the spine, he underwent spinal fusion in July at New York City's Hospital for Special Surgery. The operation was recommended by Steadman-Hawkins Fellow Dr. David Johnson, who had interned at the hospital. The rehabilitation is proceeding well, although, as Graves puts it, "Sitting around the house isn't me." So he cheats a bit by pushing his recovery regimen, taking longer walks than he should, and trimming back on medications sooner than he should. "What really bothers me," he says, "is that it's going to knock out skiing this winter, and for me that's tragic." An active outdoorsman—hiking, swimming, golf, in addition to skiing—Graves bought a home 20 years ago in Beaver Creek, Colorado, where he and his family spend most of their winters. It was in Beaver Creek in 1997 that he found himself riding a chairlift with former HUD secretary and 1996 Vice Presidential candidate Jack Kemp. Graves asked Kemp what brought him to Beaver Creek. When Kemp told him he was attending a Steadman◆Hawkins Foundation meeting, Graves asked, incredulously, "Let me understand this. You mean you came all the way out here just for a meeting?"

Fast forward. Earl Graves, six years later, is now the Foundation's Development Committee chairman, a key position in which he has been able to attract much-needed funding for the Foundation's work, including $150,000 for the Foundation's 15th anniversary event held last summer.

Why does he do it? "The reason I volunteered for the Steadman◆Hawkins Foundation is because of Dr. Steadman and Dr. Hawkins. These are two unique individuals. They, and their staff, really care—and not during just pre-care and operative care. Most significant is the concern and interest that the Steadman-Hawkins staff have in how well and quickly you recover. And the Board is a totally committed group of people who very much care about what the Foundation is doing and what it's capable of doing."

Graves should know. An expert skier ("When you've spent as much money as I have on lessons, you're bound to get good."), he's suffered his share of knee problems during his 68 years. Dr. Steadman has scoped his knee twice, advising Graves to think of it as getting a tune-up on his legs every two to three years. "Eventually," he says, "I'll have to have a knee replacement. Nonetheless, I consider any of my infirmities incidental to the times I've enjoyed skiing—you gotta pay to play."

And *Black Enterprise*? Graves grins broadly. "My sons have pretty much taken over the business. I'm honest enough to admit that I'm working for them these days."

Friends of the Foundation

In 2003, we received contributions and grants from 807 individuals and foundations. This combined support, including special events, amounted to more than $1.6 million.

The Steadman◆Hawkins Sports Medicine 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.

In Memory of

During 2003 the following gifts were received in memory of Colonel Beverly Steadman:

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Mr. and Mrs. Harry Turvey
Dr. and Mrs. Wayne Wenzel
Dr. and Mrs. Savio Woo

HALL OF FAME

The Steadman◆Hawkins Sports Medicine Foundation is grateful to the following individuals, corporations, and Foundations for their support of the Foundation in 2003 at a level of $50,000 or more. Their vision ensures the advancement of 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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The Cliffs Communities
EBI Medical Systems, Inc.
Mr. and Mrs. Earl G. Graves
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HealthONE
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Center Pulse
Vail Valley Medical Center

GOLD MEDAL CONTRIBUTORS

We are grateful to the following individuals, foundations, and corporations who contributed $20,000-$49,999 to the Foundation in 2003. Their continued generosity and commitment helps fund research in degenerative arthritis and train physicians for the future.

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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 develop new rehabilitation protocols for patients with ACL-reconstructed knees, to improve the effectiveness of knee braces, and to support the basic science studies of healing factors and gene therapy. We extend our deep appreciation to these following individuals for their generous support in 2003:

Mr. and Mrs. Don Ackerman
Mr. and Mrs. Paul Baker
Mr. and Mrs. Erik Borgen
Mr. and Mrs. Robert A. Bourne
Mr. and Mrs. Harry B. Clow III
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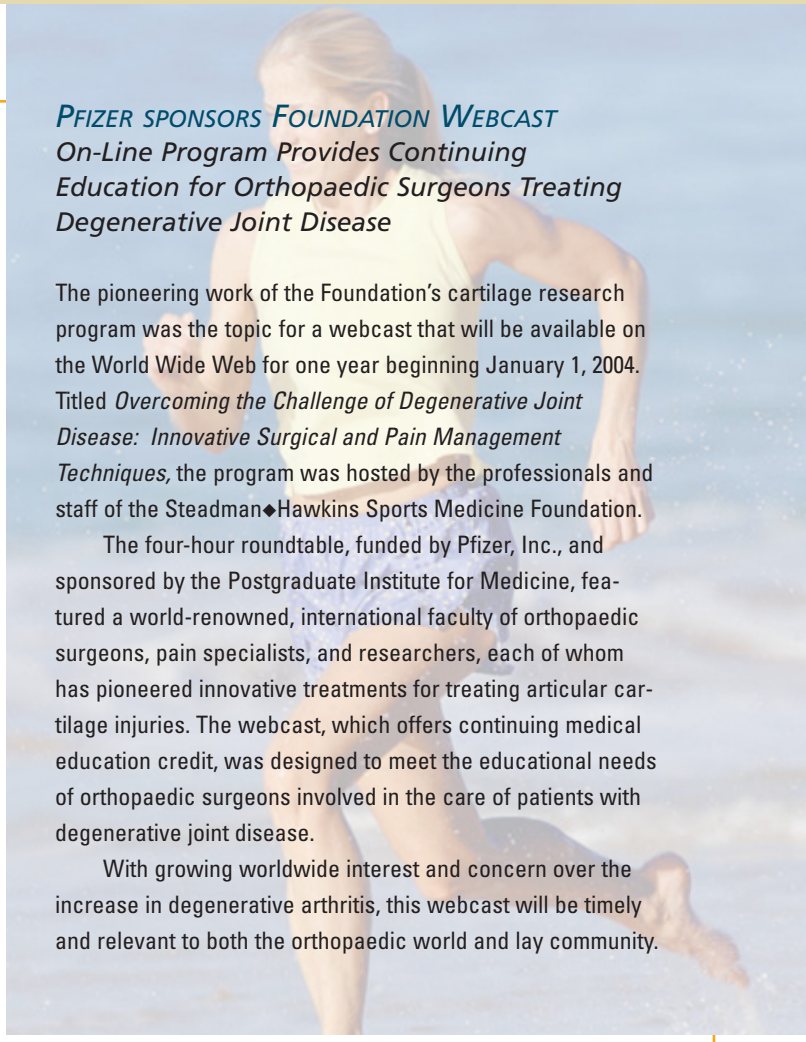

Pfizer sponsors Foundation Webcast

On-Line Program Provides Continuing Education for Orthopaedic Surgeons Treating Degenerative Joint Disease

The pioneering work of the Foundation's cartilage research program was the topic for a webcast that will be available on the World Wide Web for one year beginning January 1, 2004. Titled *Overcoming the Challenge of Degenerative Joint Disease: Innovative Surgical and Pain Management Techniques,* the program was hosted by the professionals and staff of the Steadman◆Hawkins Sports Medicine Foundation.

The four-hour roundtable, funded by Pfizer, Inc., and sponsored by the Postgraduate Institute for Medicine, featured a world-renowned, international faculty of orthopaedic surgeons, pain specialists, and researchers, each of whom has pioneered innovative treatments for treating articular cartilage injuries. The webcast, which offers continuing medical education credit, was designed to meet the educational needs of orthopaedic surgeons involved in the care of patients with degenerative joint disease.

With growing worldwide interest and concern over the increase in degenerative arthritis, this webcast will be timely and relevant to both the orthopaedic world and lay community.

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Medical research and education programs are supported by gifts to the Steadman◆Hawkins Sports Medicine 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 in degenerative arthritis and the development of gait retraining protocols for patients with ACL-reconstructed knees. We thank the following for their support in 2003:

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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 work. We extend our gratitude to the following individuals for their generous support:

Mr. and Mrs. Mitch Hart
The Fred and Elli Iselin Foundation
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Mr. S. Robert Levine
Mr. and Mrs. Kent Logan
Mr. Charles McAdam
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Chairs Support Foundation Work

The education of orthopaedic surgeons is a critically important mission of the Steadman◆Hawkins Sports Medicine 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 130 Steadman-Hawkins 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 2003, five chairs provided important funding for the Foundation's research and educational mission. We are most grateful for the support from the following:

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Over the years, the Steadman◆Hawkins Sports Medicine 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 high-quality health care, treatment, and rehabilitation, and to providing education and training programs—is assured 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.

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Genzyme Biosurgery/Wyeth New Corporate Sponsors to the Steadman◆Hawkins Sports Medicine Foundation

Genzyme Biosurgery and Wyeth joined forces in 2003 to become corporate sponsors of the Steadman◆Hawkins Sports Medicine Foundation. Genzyme Biosurgery is a division of Genzyme Corporation and a leading business in the rapidly emerging market for sophisticated biotechnology products. Wyeth is one of the world's largest research-driven pharmaceutical and health care products companies. It is considered a leader in the discovery, development, manufacturing, and marketing of pharmaceuticals, vaccines, biotechnology products, and nonprescription medicines that improve the quality of life for people worldwide.

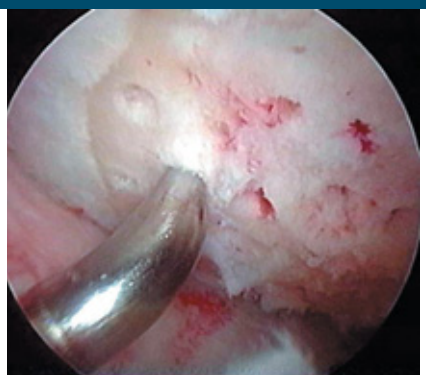
"We are excited about the relationship between Wyeth and the Foundation with regard to our mutual involvement with such beneficial activities as the annual Fellows Conference, a Public Education Speaker Series, and the shared goal of providing beneficial health care through research and education," said John Johlfs, Wyeth Musculoskeletal Specialty District Manager. "Being involved with continuing efforts investigating the causes, prevention, and medical intervention of osteoarthritis is a worthy and lofty goal in which we are very proud to be a part."

Genzyme Biosurgery has two products on the market that provide solutions for treating damaged knee joints. They are Synvisc-(hylan G-F 20) and Carticel (autologous cultured chondrocytes). These products have made a significant contribution to clinical orthopaedics. Synvisc is a biomaterial used in the treatment of pain caused by osteoarthritis of the knee. Carticel uses a patient's own cartilage cells to treat knee cartilage defects.

Basic Science Research:
Understanding Joint Disease

The purpose of our Basic Science Research is to gain a better understanding of factors that lead to degenerative joint disease and osteoarthritis. Our focus is to develop new surgical techniques, innovative therapies, rehabilitative treatments, and related programs that will either help prevent the development of degenerative joint disease or lessen its effects. In 2003, we collaborated with Colorado State University and other educational institutions. We believe that our combined efforts will lead directly to slowing the degenerative processes, as well as finding new ways to enhance regeneration of injured tissues.

William G. Rodkey, D.V.M., Director



Microfracture

The area of regenerative medicine is an exciting one. There are many new and innovative techniques under investigation by scientists around the world. In 2003, we focused our efforts almost exclusively on regeneration of an improved tissue for resurfacing of articular cartilage defects that typically lead to degenerative osteoarthritis. We have been working in the promising area of gene therapy in collaboration with Drs. Wayne McIlwraith and David Frisbie at Colorado State University. Following is 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 is a debilitating, progressive disease characterized by the deterioration of articular cartilage and accompanied by changes in the bone and soft tissues of the joint. Traumatic injury to joints is also often associated with acute damage to the articular cartilage. Unfortunately, joint cartilage is a tissue with poor healing potential. Once damaged, cartilage typically does not heal, or it may heal with fibrous tissue that does not function as it should. 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 function are compromised. The result often is osteoarthritis.

Several of our earlier studies have shown that a technique called microfracture is a successful method to promote adequate cartilage healing. Microfracture consists of making small perforations in the bone plate to gain access to the cells and growth factors present in the underlying bone marrow. The technique relies on the cells and proteins present in the marrow to promote healing, thus avoiding concerns of immune reactions to transplanted tissues, the need for a second surgical site, or a second surgery to collect grafts or cells.

When we evaluated the healing of full-thickness defects in horses, we were able to show that the use of microfracture increased the amount of repair tissue present in the defect and improved the quality of cartilage repair by increasing the amount of type II collagen present in that repair tissue. It is the basic building block protein of articular cartilage. Although microfracture was able to increase the major component of articular cartilage outside the cells, it did not enhance the production of proteoglycans, the other major component of cartilage thought to be necessary for long-term joint health.

The imbalance between the building up and tearing down of components may be responsible for the inability of cartilage to heal itself. Interleukin-1, an inflammatory molecule, is considered the predominant substance involved in the process of cartilage breakdown. Blocking Interleukin-1's inflammatory effects to improve cartilage health and simultaneously using it to counteract negative effects seemed like an attractive approach. In addition, insulin-like growth factor-1, which plays a pivotal role in cartilage growth and repair, has been shown to enhance cartilage healing and appeared to be another logical candidate to promote cartilage healing. Unfortunately, the use

of these molecules has been limited by a lack of an effective delivery system to the joint. Even with direct injections, they are rapidly cleared from the joint, creating the need for costly, repeated injections and increasing the risk of complications.

An alternative therapeutic method is the use of gene therapy. A virus carrying genes can be injected into the diseased joint after damaged tissue has been removed and microfracture performed. The modified virus infects the cells of the membrane and produces large amounts of an antagonist protein and growth factor in hopes of improving cartilage healing. The advantage of this technique is the relative long life of the molecules (3 to 4 weeks), which would eliminate the need for repeated injections. We undertook the task to evaluate the effect of the one-time injection on the healing of cartilage defects treated by microfracture. Our working hypothesis was that the combined anti-inflammatory effects of the antagonist protein and growth factor delivered to the joints by gene transfer would significantly improve the quality of the repair tissue.

Our first gene therapy project evaluated the healing of cartilage defects in horses. We compared the quantity and quality of the repair tissue in defects that received an injection containing the genes to that of horses receiving a placebo and to another group that was never in contact with the viral preparations. The study also looked at the effects of gene therapy by evaluating lameness, the escape of fluid from the area, and the composition of fluid. The investigation confirmed that joints receiving gene therapy produced significantly more protein than the joints that were not treated. The results indicate that the carriers of the virus were able to infect the cells of the joint and use the cells to produce the proteins for a period of three weeks.

Overall, gene therapy did not affect the composition or the amount of repair tissue found in the defects and had no effects on the porous nature of the bone. However, we concluded that gene therapy increased the amount of protein present in the repair tissue of the treated joints as well as in non-treated joints. We speculate that the growth-enhancing properties were able to increase the development of protein-like substances by the cells present in the repair tissue. The effect on the composition outside the cells might also have been due to its effect on cell growth and the development of different kinds of cells. By increasing cellular production and facilitating development of cells recruited into the defective area from the bone marrow, insulin-like growth factor might have increased the number of cells capable of producing proteins.

This study confirmed that it is possible to use gene therapy to enhance healing of cartilage defects. The use of the combined carriers of antagonist protein and insulin-like growth factor was associated with an increased production of substances needed for repair. This was a critically significant finding. Improving the quality of the repair tissue is an essential step in cartilage resurfacing. Going forward with this new and promising information, our challenge in future studies is to further increase protein production and to obtain repair tissue that most closely resembles normal cartilage in the way it is composed and in the way it functions.

Cindy Nelson: Skiing or Golf, Staying the Course

Editor's Note: The following profile is based on an interview by Richard Needham. Mr. Needham is editor of *Skiing Heritage* magazine and the health newsletter *Arthritis Advisor*.

Not many skiers would equate a world-class downhill with a leisurely stroll on the links. And not many golfers would consider the act of putting an exercise in reading mountain terrain. Cindy Nelson sees things differently.

"For me, there are a lot of similarities between golf and skiing," says the former ski Olympian and eight-handicap golfer. "I read a putt the same way I read a line in a downhill course. There's the pitch, the break, the grain, and all those things I used to do at 60 miles an hour and now do in putting. But things are a lot safer on the green."

It's a unique way of looking at things. But then, Cindy Nelson is unique. She was the first American—woman or man—to win a World Cup downhill; she is a seven-time national champion; she was a member of four Winter Olympic teams and four World Championships teams (and medaled three times in those events); she is the first skier to win a World Cup Super G; and she is the first woman to serve as Chief of Course for a major alpine ski competition (1989 World Alpine Championships). But one of her most memorable firsts, she'll tell you, was being the first elite athlete to come under the care of Dr. Richard Steadman. That was in 1973 at Dr. Steadman's clinic at Lake Tahoe, California, and the two have been close friends and mutual admirers ever since. Eleven surgeries later (nine knees, two ankles), Cindy is now a member of the board of the Steadman◆Hawkins Sports Medicine Foundation.

"That," says Cindy, "means a lot to me, because I've come to understand what it takes to get people back on their feet. The work that I've been privy to at the Foundation—the treatment as well as the prevention of injuries—has been enormously rewarding. And for me, as a board member, to be able to bring to the Foundation some of my experience as an athlete, as well as my knowledge of Dr. Steadman's genius, has been equally rewarding.

"Dr. Steadman has pioneered so many procedures and affected so many lives so positively. Creating the Foundation was a huge step and an important part of his dream. The Foundation has become an educational tool by which Dr. Steadman's genius can be passed on to orthopaedists all over the world."

A lot of what the Foundation has passed on to others has also been responsible for keeping Cindy Nelson in the game. Fourteen years with the U.S. Ski Team (she was named to the team at the age of 15), hers has been a remarkable career, which really took off after her defeat of Austrian downhill powerhouse Annemarie Moser-Proell in 1974. No American had ever won a World Cup downhill, and it proved to Cindy that she could compete with, and win against, the world's best.

Cindy retired from racing in 1985 to become Ambassador of Skiing at Vail, Colorado. Soon after, she was promoted to Director of Skiing for Vail and Beaver Creek. She enjoyed the do-everything nature of the position, working with the resorts' marketing, real estate, ski school, and mountain operations departments. It also provided her with an opportunity to take up something new in her life—the game of golf, an endeavor she calls "the most humbling, most frustrating, most rewarding game I've ever played."

Today, Cindy has her own consulting business. She'll also tell you that just as important as her downhill win was to her in 1974, the day she shot one under par on her home course at Eagle-Vail was equally a high point in her life. In fact, her fanatic devotion to golf sometimes worries her. Last year, she played 85 rounds of golf and logged 50 days of skiing. "I wasn't skiing enough," says Cindy, "so I made an agreement with a couple of the girls who play in the same league that we adopt a 'powder day' rule to get out on skis more often. This past season I skied 78 days, so things are improving. I'm determined not to let either sport get out of balance."

Keeping things in balance, of course, means being able to summon up those images of golf as skiing and skiing as golf that Cindy easily sees but others often don't. "It's more than being out in the elements," she says. "In skiing, if you don't think you can make a pre-jump, you take a different line. In golf, if you can't make it to the green in one shot, you use different clubs. In both, you play for your strengths and protect against your weaknesses. Your strategy for how you go down the mountain should be the same as how you play the game of golf. You take into consideration sun, temperature, wind, your moods, and all the distractions you have around you. In skiing, it's tough to control the distractions. In golf, there's an etiquette that takes care of that, but otherwise, the sports are a lot alike."

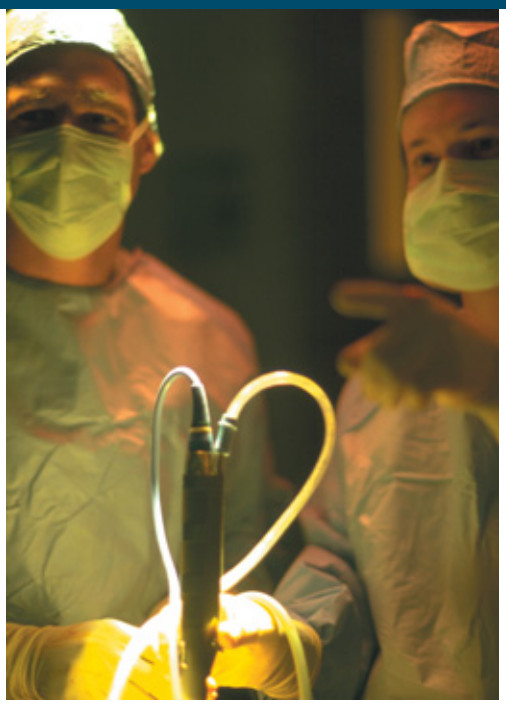
Clinical Research

"Outcomes" and "Process" Research

Outcomes Research is an expression used to describe clinical research that focuses on patient-oriented results and uses methodologies that improve the quality and comparability of reports. Our outcomes research is based on physician/patient assessment of improvement in function and quality of life. Our goal is to learn from patients and to validate treatment protocols in an effort to improve the quality of health care. This information is becoming more important as patients are interested in participating in decisions regarding their health care.

Karen K. Briggs, M.P.H., M.B.A., Director; Marilee Horan, Research Associate; Elizabeth Barry, Research Associate; Amanda Ciotti, Research Associate; Catey Bradford, Intern; Mindy Fein, Intern; Brian Maxwell, Intern.

Clinical Research at the Steadman◆ Hawkins Sports Medicine Foundation is dedicated to gathering data to educate physicians and patients in an effort to improve health care. Data are collected on all knee and shoulder patients and stored in a database. This information is the key to our research. The future of Clinical Research will be based on learning from the patient. Our research will focus on predictors of success, predictors of satisfaction, patient expectations, and patient outcomes from surgical procedures. The goal of Clinical Research is to carry out clinical outcomes research in the area of orthopaedic sports medicine that will aid both physicians and patients in making better-informed decisions regarding medical treatment.



OSTEOARTHRITIS

Osteoarthritis is a chronic disease causing deterioration of the joint cartilage (the softer parts of bones, which cushion their connections to each other) and the formation of new bone (bone spurs) at the margins of the joints. According to the Centers for Disease Control and Prevention (www.cdc.gov/nccdphp/arthritis), arthritis and chronic joint symptoms currently affect one of every three adults in the U.S. This makes arthritis one of the prevalent diseases in the U.S. and the leading cause of disability. As the population continues to age, the prevalence of osteoarthritis will increase. With increased numbers come increased health-care expenditures. The CDC estimates that arthritis, the source of at least 44 million visits to health-care providers, will result in $51 billion in health-care costs and $86 billion in total costs.

DEVELOPMENT OF A TREATMENT ALGORITHM FOR PATIENTS WITH OSTEOARTHRITIS OF THE KNEE PRIOR TO TOTAL KNEE REPLACEMENT

Surgical management of the arthritic knee in an active patient presents a challenge to the orthopaedic surgeon. Treatment options range from activity modification plus anti-inflammatory medication to arthroscopic procedures to total knee arthroplasty. Quadriceps and hamstring strengthening allows the knee to rely as much as possible on the musculature rather than the bony architecture for support. Providing a well-cushioned insole transfers some of that cushion at foot strike into the knee. Nutritional supplements are becoming increasingly popular and seem to help a percentage of the population. Many surgical procedures have been developed to treat articular cartilage lesions of the knee, but few have been shown to be successful in the degenerative knee. The purpose of this study was to determine which patients benefit from different kinds of treatment. As this research continues we hope to aid patients in making decisions regarding management of osteoarthritis of the knee prior to total knee replacement.

MICROFRACTURE OF THE DEGENERATIVE KNEE

Studies have demonstrated the efficacy of microfracture in elite athletes, in traumatic cartilage lesions, and with this publication, in the degenerative knee. The microfracture technique, in combination with other therapies, is used to treat early to late osteoarthrosis in the knee. The goals of this procedure are to alleviate pain, maximize function, and prevent further degenerative changes.

Medial opening wedge high tibial osteotomy

This study followed 81 patients between the ages of 40 and 70 who had microfracture. Patients' symptoms significantly improved over preoperative status. Lysholm scores (a measure of patient function) improved by 20 points and the mean Tegner Activity Scale score improved from 2.9 to 4.5. Patients showed high satisfaction with outcome. Repeat arthroscopy was reported in 15.5 percent of these patients. Failures, as defined by an additional microfracture procedure or total knee replacement, were documented in 6 percent of the patients.

This study established the microfracture technique as a viable surgical option, with proper patient selection, for the treatment of degenerative cartilage lesions of the knee. Patient satisfaction scores as well as significant improvement in subjective and functional outcome scores demonstrated the efficacy of this procedure in the degenerative knee. This study will be published in the *Journal of Knee Surgery* in 2004.

HIGH TIBIAL OSTEOTOMY

Medial opening wedge high tibial osteotomy (HTO) has gained popularity as a means of decreasing pain and correcting malalignment in patients with medial compartment arthrosis (degeneration) and varus (bow-leggedness) malalignment. This procedure may provide years of relief prior to a knee replacement.

In 1995, Dr. Sterett began performing an opening wedge osteotomy on the medial side (inside) of the proximal tibia (the large bone in the lower leg) in conjunction with the microfracture procedure in the affected knee. In a paper that is expected to be published in *American Journal of Sports Medicine* in 2004, we reported on 39 patients who underwent an open HTO with a microfracture. Patients showed improvement in function and activity level, as well as reduction in symptoms. The study concluded that, at a minimum of two years following surgery, patients with varus alignment and chondral surface lesions of the knee can be effectively treated with the HTO and microfracture.

CHONDRAL DAMAGE IN THE ACL DEFICIENT KNEE

The natural history of the ACL deficient knee is the topic of much debate. Previous studies have shown radiographic evidence of arthritis 8-15 years after ACL rupture in 50 percent to 80 percent of patients. The progression of chondral (cartilage) damage in the ACL deficient knee is unknown. The purpose of this study was to determine the prevalence of chondral lesions in patients with ACL deficiency and identify risk factors associated with the development of severe chondral damage.

From our patient database, 3,030 patients (with no history of previous knee surgery and who were diagnosed with a torn ACL during knee arthroscopy) were identified. For this study, severe chondral damage was defined as grade III or grade IV chondral damage. In this patient group, there was a 36 percent prevalence of chondral damage and a 22 percent prevalence of severe chondral damage. There was a significant association between time from injury and the presence of chondral damage and the presence of severe chondral damage. Patients with chronic injuries (longer than three months from injury) had a prevalence of severe chondral damage in 33 percent of the cases. The average age for the group with arthritis was 40.4 years and the average age for the group without arthritis was 32.9 years. Patients with a severe instability had a 1.6 times increased risk of severe chondral damage compared to those with a mild instability.

Information regarding chondral damage in the ACL deficient knee can help guide decision-making. In this study of a large series of patients, the chronic nature of ACL injuries, age, and increased instability were associated with severe damage in the knee. These data suggest that treatment of ACL injuries should not be delayed longer than necessary and stabilization is critical in more unstable knees with regard to risk of severe chondral damage.

PREDICTORS OF DECREASED FUNCTION AND ACTIVITY LEVEL IN PATIENTS SEEKING TREATMENT FOR OSTEOARTHRITIS OF THE KNEE

Increased prevalence of arthritis is also associated with decreased activity. Identifying factors associated with decreased function and decreased activity may help develop early treatment programs that can decrease the impact of arthritis. The purpose of this study was to identify the causes of decreased function, as determined by Lysholm score, and patient activity level, as determined by Tegner Activity Level, in patients who were evaluated for osteoarthritis of the knee.

A group of 242 patients who were diagnosed with osteoarthritis of the knee on initial examination was studied. Prior surgeries were reported in 58 percent of the knees, and 80 percent had joint space narrowing. Activity level was significantly associated with age and gender. It was also associated with number of prior surgeries, with knees operated on two or more times having significantly lower scores. There was a significant difference in the presence of joint space narrowing, as well as the ability to extend and flex the knee joint. Tegner Activity Level was associated with extension and flexion deficits. Patients with knee stiffness had significantly lower Lysholm (function) scores. Patients reporting severe stiffness had an average Lysholm score of 24 points less than those with no stiffness. The causes of decreased function and decreased activity level in patients seeking treatment for osteoarthritis of the knee were established. Stiffness

and range-of-motion deficits were found to be associated with both decreased activity level and a decreased function score. These factors may be important in developing early treatment programs aimed at improving function and maintaining activity level in patients with osteoarthritis.

GLENOHUMERAL OSTEOARTHRITIS

Osteoarthritis of the glenohumeral joint is a common cause of shoulder pain. It can result in restricted range of motion and loss of function. In the osteoarthritic shoulder the articular surface may be damaged, leading to pain and loss of function. Arthritis in the shoulder can develop following trauma, shoulder surgery, or an inflammatory joint condition.

GLENOHUMERAL ARTHRITIS IN PATIENTS WITH ROTATOR CUFF TEARS

A recent study found a statistically significant correlation between degenerative articular changes and tears of the rotator cuff in 33 shoulders. The purpose of this study was to determine the prevalence of cartilage damage in patients with rotator cuff tears without other significant injuries.

A group of 281 patients from our clinical database who had undergone shoulder arthroscopy was identified. Patients with previous surgery, instability, or other significant shoulder problems were excluded. The average age was 56 years and the average time from injury to surgery was 2.83 years. Arthroscopic examination showed 32 percent of the shoulders in the study had cartilage damage and 15 percent had osteoarthritis. Osteoarthritis was found in 43 percent of the shoulders with tendinitis, 20 percent of the shoulders with partial tears, and 14 percent of the shoulders with complete tears. The average age of patients with osteoarthritis was 62, compared to 55 for patients without osteoarthritis. The average time from onset of symptoms to surgery for patients with osteoarthritis was 4.38 years, compared to 2.56 years for patients without osteoarthritis. These findings showed the two most reliable predictors of osteoarthritis in patients with rotator cuff injuries or conditions were age and time from onset of symptoms to surgery.

NEW GENERATION OF TOTAL SHOULDER REPLACEMENTS

In 2003, the Steadman-Hawkins Clinic in Vail was one of 15 FDA-approved sites chosen to participate in a study to investigate a shoulder prosthetic newly designed by ENCORE medical. This prosthetic is specifically designed to function in patients who do not have a functioning rotator cuff. Patients who qualify for the new prosthetic can have arthritis of the shoulder with an irreparable, massive, rotator cuff tear, a failed rotator cuff tear with secondary degenerative arthritis, or failed shoulder replacement with an irreparable rotator cuff tear. These conditions can exclude patients from standard shoulder replacements. If the rotator cuff is not intact, normal shoulder function is severely altered. The rotator cuff compensates for the lack of bony stability in the shoulder by providing static and dynamic stability.

In a traditional shoulder replacement the prosthetic mimics the shoulder structure with the humeral head being ball shaped and fitting into the socket that is shaped like a golf tee. In the new shoulder prosthetic by ENCORE the traditional structures are reversed, with the socket of the shoulder being fitted with a ball-shaped head and the top of the shoulder being replaced with a socket that rotates around the ball. This semi-constrained head/baseplate combination optimizes the function of the deltoid muscle to allow arm elevation.

Dr. Hawkins has implanted eight of these new shoulder prosthetics. While the follow-up time frame is short, patients report a vast improvement in function and a decrease in the severity of pain. We are eager to see if this pattern holds steady after one year and beyond.

RUPTURE OF THE SUBSCAPULARIS TENDON AFTER SHOULDER JOINT REPLACEMENT: DIAGNOSIS, TREATMENT, AND OUTCOMES.

Rupture of the subscapularis (one of the four rotator cuff muscles) rotator cuff tendon following shoulder replacement surgery is an infrequent complication that may result in pain, weakness, and instability. Proposed risk factors for postoperative subscapularis rupture have included multiple operations, overzealous activity or therapy during the early postoperative period, and compromise of the tendon repair due to various subscapularis lengthening techniques. When symptomatic, early repair has been advocated because

increased difficulty has been encountered with attempts at delayed repair. Data were collected on seven patients with symptomatic rupture of the subscapularis tendon following shoulder replacement. Patients' symptoms included pain, weakness in internal rotation, increased external rotation, and anterior instability. All patients were treated with surgical repair of the ruptured tendon. Following repair, two patients continued to experience anterior instability and required an additional operation to address instability. At an average follow-up of 2.3 years, the average American Shoulder and Elbow Surgeons shoulder score in this study group was 63 points out of 100. The average patient satisfaction rating on a 10-point scale was 6.2.

Risk factors for post subscapularis joint-replacement ruptures included subscapularis lengthening techniques used to address internal rotation and previous surgery that violated the subscapularis tendon. Symptomatic subscapularis rupture following shoulder replacement introduces the need for additional surgery and a period of protected or delayed rehabilitation following replacement surgery. Although symptoms were adequately addressed with appropriate surgical treatment, decreased functional outcomes were observed. Because subscapularis rupture can compromise the outcome of shoulder replacement, a technically sound repair of the subscapularis and a guarded, controlled rehabilitation program are critical components of replacement surgery.

INJURY TREATMENT TO MAINTAIN FUNCTION AND ACTIVITY

Microfracture

Full-thickness chondral defects in the knee are common after injury in the young person. They rarely heal spontaneously and most patients eventually develop degenerative changes that can be debilitating.

To treat full-thickness chondral defects, the ideal technique would be relatively simple to perform, have a low patient risk for complications, be cost-effective, and have a high long-term clinical success rate without jeopardizing the ability to perform future procedures. More than 20 years ago, Dr. Steadman began performing the microfracture technique for the treatment of cartilage defects. The technique was developed to enhance chondral resurfacing by providing a suitable environment for new tissue formation and take advantage of the body's own healing potential. The rehabilitation program following treatment of chondral (cartilage) defects of the knee by microfracture is also crucial to optimizing results of surgery.

In 2003, the first long-term outcomes paper was published on the microfracture technique. This study included follow-up on patients an average of 11 years following microfracture, with the longest follow-up being 17 years. The study found that microfracture for isolated full-thickness chondral defects in patients under 45 years of age led to significant improvement in function and symptoms. This improvement was maintained a minimum of seven years and up to final follow-up. The study showed that the microfracture technique accompanied by the prescribed rehabilitation decreased pain and improved function in 95 percent of the study population up to 17 years follow-up.

The Use of MRI to Assess Knee Cartilage Repair Tissue after Microfracture of Chondral Defects

Magnetic resonance imaging (MRI) has been shown to be both sensitive and specific in detecting chondral injuries. MRI has also been used to evaluate the success of cartilage resurfacing procedures. However, these studies have not correlated MRI assessment of chondral resurfacing procedures with arthroscopic evaluation of treated chondral defects. The objective of this study was to determine the diagnostic accuracy of MRI to evaluate repair tissue of traumatic knee articular cartilage defects treated by microfracture.

Nineteen recreational or high-level athletes underwent standard microfracture technique for traumatic full-thickness chondral defects. Patients subsequently underwent repeat arthroscopy for unrelated knee conditions. MRI studies were obtained prior to the second-look arthroscopies. MRI images were evaluated for the presence of full-thickness articular cartilage defects and for the quality of the repair tissue. During the arthroscopy procedure, the quality and quantity of the repair tissue was assessed.

During a second arthroscopy, 21 defects had 100 percent coverage with repair tissue, while one defect continued to have areas with full-thickness cartilage loss. MRI was 100 percent accurate in detecting a full-thickness lesion and in predicting the presence of a full-thickness lesion after microfracture. In determining whether the repair tissue after microfracture was of good or poor quality, MRI had a sensitivity of 80 percent and specificity of 82 percent.

MRI using specialized sequences proved to be a satisfactory technique for evaluating repair tissue in full-thickness traumatic defects treated by microfracture. The study also reiterated that microfracture is successful in treating traumatic chondral lesions of the knee. Twenty-one of 22 (95 percent) chondral lesions treated by this technique were fully covered by repair tissue. Furthermore, the quality of repair tissue was high in 17 of 22 lesions (77 percent).

Healing Response

Previous studies have shown that the non-treated injured anterior cruciate ligament (ACL) can result in poor results. When injured, the anterior cruciate ligament can tear in many different locations with many different types of tears. It is believed that proximal tears (those closest to the point of attachment) heal better than mid-substance tears because of increased blood supply and proximity to the femur. More than 20 years ago, Dr. Steadman developed the "healing response" technique to promote healing of proximal ACL tears. This technique was meant to enhance ACL stability and minimize joint disease. Indications for this procedure include partial ACL tears and proximal tears, and the patient must agree to the rehabilitation protocol.

Injuries to the ACL in children and adolescents were once felt to be infrequent. The increase in reports of ACL tears in the pediatric population may be related to increased participation in competitive athletics at younger ages, improved clinical examination, awareness by orthopaedic surgeons, and improved diagnostic methods such as arthroscopy and magnetic resonance imaging. ACL deficiency in the skeletally immature athlete is challenging for several reasons. Conservative treatment with activity modification and bracing is often unsuccessful because these children often do not comply with activity restrictions and brace wearing. Reconstruction of the ACL using standard techniques is a concern because of the potential for growth disturbances secondary to drilling through an open physis. Finally, functional instability at this age places the young child at high risk for meniscal tears and very early degenerative arthritis.

The purpose of this study, accepted for presentation at the annual meeting of the 2004 American Academy of Orthopaedic Surgeons and the 2004 American Orthopaedic Society for Sports Medicine, was to report our results of the "healing response" for proximal ACL tears in the skeletally immature knee. In this active and

Scapulothoracic Arthrodesis: Indications, Technique, and Outcomes

(Editor's Note: Arthrodesis is the surgical immobilization of a joint so that the bones grow solidly together.)

The shoulder blade (scapula) has an important job of stabilizing the shoulder when the arm is lifted. Scapula motion is also a potential source of debilitating pain in the shoulder girdle. Several authors have documented the incidence of painful scapulothoracic crepitus (snapping scapula syndrome) and/or bursitis. In addition, recent authors have reported a significant incidence of the scapular winging (in which the inside edge of the scapula protrudes away from the center of the back) secondary to glenohumeral joint lesions such as rotator cuff tears and glenohumeral instability.

The vast majority of patients who have symptomatic scapular winging, scapulothoracic pain, and/or crepitance respond to nonoperative measures. Therapeutic methods involve supervised stretching and strengthening, the use of oral anti-inflammatory medications, and selective cortisone injections. Nevertheless, there exists a group of patients who experience complex scapulothoracic dysfunction and/or pain and who do not respond to conservative measures.

Between 1984 and 2000, scapulothoracic arthrodesis was performed in 24 shoulders in 23 patients. All patients were extremely disabled with pain and loss of function due to the symptoms of scapular winging, and many of the patients underwent multiple previous procedures on their shoulders prior to the arthrodesis. Surgical technique utilized a semi-tubular plate and wire construct along the inside border of the scapula with the use of autograft (iliac crest) and/or allograft bone between the scapula and the rib cage. Complications occurred in over half of the patients. After the surgery, 91 percent of the patients felt that the pain in their shoulder complex was significantly reduced and they were satisfied with their functional outcome. In summary, scapulothoracic arthrodesis does have a high complication rate but can improve function and reduce pain in the shoulder complex in patients with this condition.

Accuracy of Rotator Cuff Diagnoses on the Basis of Physical Examination with and without MRI.

Because of the shared symptoms and signs of the different types of rotator cuff injury, differentiating the specific disease is often difficult. While the physical examination and history is very good at determining the pathological condition, error still remains. Thus, other objective measures, such as MRI, have been used to help secure a proper diagnosis. The purpose of this study was to determine the accuracy of diagnosing rotator cuff pathology by physical examination alone versus physical examination with MRI.

Data were collected on 299 shoulders in 281 patients. Approximately one half had MRI data available prior to surgery. Sensitivity, specificity, and positive and negative predictive values were determined for physical examination alone versus physical examination with MRI for full-thickness rotator cuff tear, partial-thickness tear, and tendinitis.

The positive predictive values for the diagnosis of full-thickness tear for physical examination with and without MRI were 0.88 and 0.89, respectively. The positive predictive values for the diagnosis of partial-thickness tear were relatively low. MRI provided a slightly better prediction. For tendinitis, MRI provided an increase in positive predictive value.

MRI does not aid in the diagnosis of partial-thickness tears. The most striking advantage of MRI in the diagnosis of rotator cuff conditions is the ability to rule out a full-thickness tear. MRI only gives additional information in some cases.

skeletally immature patient group, the healing response procedure restored stability and knee function. Four patients sustained a re-injury but had a normal functioning knee prior to re-injury. Patients were very satisfied with the procedure and returned to a high level of sports and activities.

The Role of MRI in the Evaluation of Tibial Eminence Fractures in Adults

Few studies have documented injuries associated with tibial eminence fractures in adults. The purpose of this study was to integrate MRI sequencing into the routine evaluation of adult tibial eminence fractures and determine the frequency and severity of other existing injuries.

MRI sequences were obtained in 21 adults with 22 tibial fractures. The average patient age was 43. There were ten men and 11 women in the study. Tibial eminence fractures were classified using a modification of the Meyers and McKeever classification system. In this scheme, type I represents nondisplaced fractures; type II, those displaced less than 3 mm; type III, those displaced from 3 to10 mm; and type IV, those with severe displacement greater than 10 mm or significant damage.

There were 3 type I, 3 type II, 12 type III, and 4 type IV fractures. The average fracture fragment size was 21 x 23 mm, and the average displacement was 5.5 mm. In the 22 fractures, MRI disclosed ACL insertional avulsions (separations) in 20, distal PCL avulsions in 4, intrasubstance ACL damage in 9, intrasubstance PCL injury in 3, MCL tears in 9, medial meniscal tears in 5, and 4 lateral meniscal tears. Occult subchondral osseous injuries were seen in the posterolateral tibial plateau in 13 cases..

Significant osseous (bony), cartilaginous, meniscal, and ligamentous damage was discovered in all patients. Based on these findings, we recommend MRI evaluation of all tibial eminence fractures to detect accurately all damage in the knee.

Effect of Functional Bracing on Knee Injury in ACL-Reconstructed Professional Skiers

The role of knee bracing in anterior cruciate ligament (ACL) injury is controversial. Clinical evidence of efficacy for functional bracing in the ACL-reconstructed (ACLr) knee is lacking. The purpose of this study was to determine the effect of functional bracing on subsequent knee injury in ACLr professional skiers.

A total of 11,606 professional skiers at a major destination ski resort underwent preseason knee screening from 1991 to1997. The ACLr group was defined as any skier who had an ACL reconstruction and was a minimum of two years postoperative before the knee screening. ACLr skiers selected the use of a functional knee brace during skiing through a shared decision-making process.

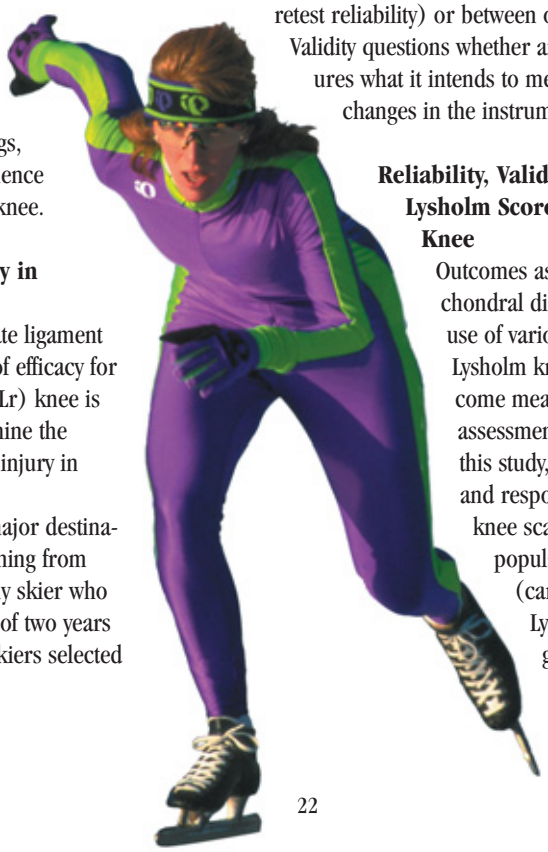
In this study, 257 braced ACLr skiers were identified and compared to 563 non-braced ACLr skiers. A total of 61 subsequent knee injuries were identified, 51 (8.9 injuries/100 knees/ski season) in the non-braced group and 10 (4.0 injuries/100 knees/ski season) in the braced group. No difference in Lachman, pivot shift, or age was noted between the injured braced and non-braced skiers. Non-braced ACLr skiers were 2.74 times more likely to suffer subsequent injury than braced skiers.

Because of the increased risk of subsequent knee injury in non-braced skiers, we recommend functional bracing for ACLr skiers with increased instability. Whether the protective effect of functional bracing can be extrapolated to other high-demand patients is yet to be determined.

OUTCOME SCORE VALIDATION

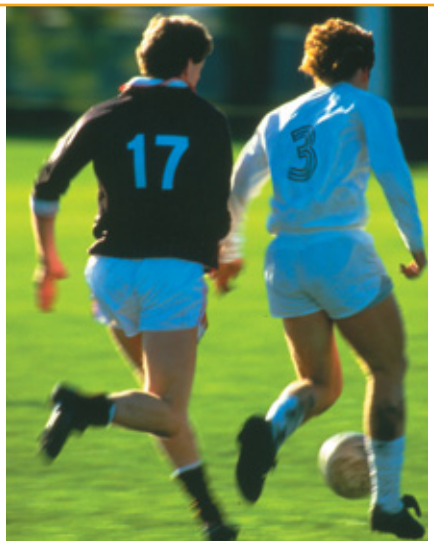
Recently, there has been an increased emphasis on the use of validated outcome measures in orthopaedics. In an effort to maintain the quality of outcomes studies by the Department of Clinical Research, we have recently undertaken studies to measure the validity of the common scoring systems we use.

Reliability, validity, and responsiveness are the important psychometric properties of an outcome instrument. Reliability refers to the reproducibility of an outcome measure, either between subjects (test-retest reliability) or between observers (interobserver reliability). Validity questions whether an outcome instrument actually measures what it intends to measure. Responsiveness assesses changes in the instrument value over time or treatment.



Reliability, Validity, and Responsiveness of the Lysholm Score for Chondral Disorders of the Knee

Outcomes assessment after the treatment of chondral disorders of the knee has involved the use of various knee outcome instruments. The Lysholm knee scale is a condition-specific outcome measure that was originally designed for assessment of ligament injuries of the knee. In this study, we determined reliability, validity, and responsiveness to change for the Lysholm knee scale within subsets of an overall study population of 1,657 patients with chondral (cartilage) disorders of the knee. The Lysholm knee scale demonstrated, in general, acceptable psychometric parameters (test-retest reliability,



internal consistency, floor-ceiling effects, criterion validity, construct validity, and responsiveness) to justify its use in outcomes assessment for chondral disorders of the knee. This study is scheduled to be published in the *Journal of Bone and Joint Surgery* in 2004.

Reliability, Validity, and Responsiveness of the Lysholm Score for Meniscus Injuries

The Lysholm score has been validated for use with ACL injuries and recently for cartilage injuries. Few scores have been validated for the treatment of meniscus injuries of the knee. In this study, we determined the psychometric properties of the Lysholm score for meniscus injuries of the knee.

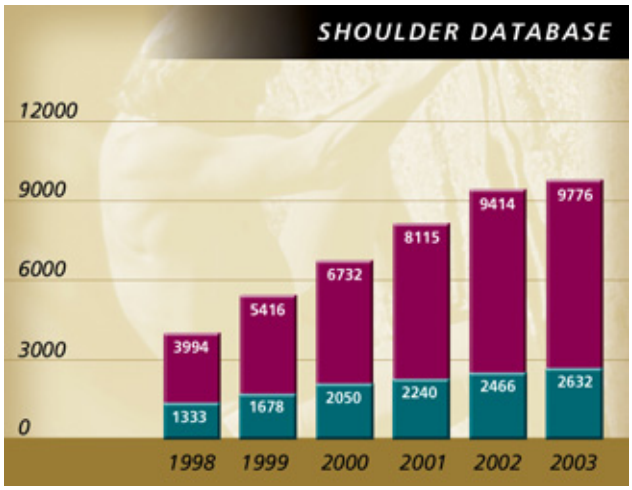
Using two groups of patients, one group with only menisci pathology and one group with menisci and other pathology, we determined the content validity, criterion validity, construct validity, and responsiveness of the Lysholm score. Test-retest reliability was determined in a group of patients who completed an original questionnaire and a second questionnaire within four weeks of the original questionnaire. There were acceptable floor (0 percent) and ceiling (0.4 percent) effects for the overall Lysholm score. There was acceptable criterion validity, with significant correlations between the overall Lysholm scale and the physical score of the SF12. There was acceptable construct validity, with all hypotheses demonstrating significance. There was acceptable responsiveness to change. There was acceptable test-retest reliability for the overall Lysholm scale and seven of the eight domains.

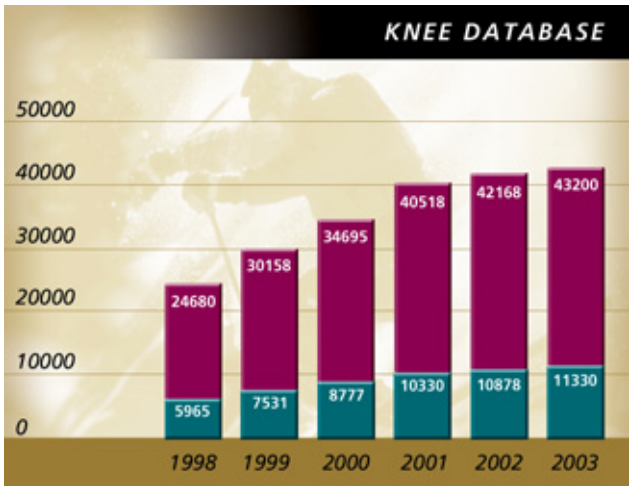
To document the outcome of treatment of meniscus pathologies of the knee, scores with established psychometric properties should be used. The Lysholm score demonstrated overall acceptable psychometric performance for outcomes assessment of meniscus injuries of the knee.

Clinical Database

It has been the goal of the Department of Clinical Research at the Steadman◆Hawkins Sports Medicine Foundation to assess patient outcome following treatment. For this to be accomplished, data must be collected on every patient. The key to successful analysis of outcomes is effective management of patient information. At the Steadman◆Hawkins Sports Medicine Foundation, we have developed a method of managing a patient's outcome information. This method consists of data collection, data entry, data storage, and data analysis. This process has led to the development of the Steadman-Hawkins Clinical Research Database. These data consist of both patient and physician assessment.

Currently, the knee subjective database has 67 data fields and 45,611 records, totaling 3,055,937 data points. In the knee surgery database there are 247 fields and 12,184 surgical records, or 3,009,448 data points. This system is special for several reasons. The same data have been collected on every patient since 1993 and the data collection process has been developed entirely "in-house" by SHSMF Clinical Research staff. These data have been used to validate the microfracture technique and have resulted in 24 publications to major orthopaedic journals in the last three years. The goal is to measure the impact of surgical intervention on patient symptoms, function, and satisfaction.





Surgery Subjective

Biomechanics Research Laboratory

Mission and Goals

The mission of the Biomechanics Research Laboratory (BRL) is to further the scientific understanding of basic biological processes and to develop innovative approaches for the understanding, prevention, diagnosis, and treatment of musculoskeletal disease.

Michael R. Torry, Ph.D., Director; Takashi Yanagawa, M.A., Staff Scientist; Michael J. Decker, M.S., Staff Scientist; Michelle Sabick, Ph.D., Senior Staff Scientist; Kevin Shelburne, Ph.D., Senior Staff Scientist

BIOMECHANICS RESEARCH LABORATORY (BRL)

The Foundation's Biomechanics Research Laboratory (BRL) is a multi-disciplinary laboratory in which the principles of mathematics and engineering are applied to solving complex problems in orthopaedic medicine. A main objective of the BRL is to explain (empirically) the how and why treatments, and surgeries, work for some individuals and not for others.

It applies quantitative, analytical, and integrative methods to the field of orthopaedic medicine. The staff of kinesiologists, biomechanists, mechanical and biomedical engineers 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 BRL are unique, diverse, and encompass a complete range of services for the physically active or those wishing to return to an active lifestyle after injury.

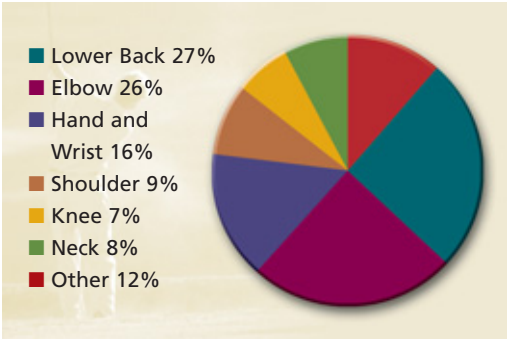
With the statement "helping physicians to make clinical decisions" as its doctrine, the BRL also seeks to enhance the medical fellowship program by providing quality research education, guidance, support, and consultation to the partners and medical Fellows of the Steadman-Hawkins Clinic.

The work output for the BRL for the year 2003 has been exemplary with eight refereed abstracts presented at five national and international conferences. The group has also produced ten original full-length research papers (three currently in review with seven accepted for publication or already in press). Notwithstanding, the quantity of the work is backed by substantial quality.

"Each year our research gets stronger and stronger and we are receiving recognition from our peers for the quality of our work," states Dr. Mike Torry. Some of the research that the BRL has initiated and/or completed in the year 2003 is described below.

DETERMINATION OF HOW THE KNEE CARRIES LOAD DURING ACTIVITIES

Many individuals suffer from degenerative arthritis of the knee. The degeneration of the knee joint often becomes more painful during activities of daily living such as walking or hiking. Joint degeneration often begins with an injury or mild malalignment at the knee that alters its normal load bearing. Many conservative and surgical treatments for osteoarthritis are based on the theory that restoring the normal load-bearing capability of the knee will delay the onset and progression of the disease. However, until recently, it was not known what types of mechanical loads are distributed throughout the knee. Dr. Kevin Shelburne, Assistant Director, and Dr. Marcus Pandy, of the University of Texas, have developed a computer model of the knee and lower extremity that can determine loads inside the knee joint during walking.



Distributions of injuries in amateur golfers. Adapted from J.R. McCarroll, A.C. Rettig and K.D. Shellbourne

Dr. Shelburne recently submitted an abstract to the Orthopaedic Research Society that details where and how loads in the knee joint are distributed during a walking cycle. The model has shown that most of the load-bearing area arises on the medial (inside) side of the knee. This is not surprising, as clinically, our doctors often observe more severe arthritic conditions on the medial side of the knee rather than on the lateral side. What is a unique finding of this research is that the total loads in the knee can reach upwards of 449 pounds during simple walking, with nearly 334 pounds distributed on the medial side of the knee. Furthermore, the distribution of force at the knee is largely determined by the alignment of the leg. Malalignments of the lower limb such as knee varus (bow-leggedness) and knee valgus (knock-knees) can shift more or less load to the medial or lateral side of the knee joint and the force in the muscles spanning the knee. Ligaments have a role as well, but it is the muscles and bony geometry that keep the knee stable during activity. This study only investigated loads in a knee that is considered to have normal alignment. However, future and ongoing work is focused on how ligament injuries and knee malalignment affect knee loads during a variety of activities.

Dr. Shelburne's research helps physicians understand how and why conservative and surgical treatments are effective in restoring normal load bearing at the knee. This research also provides a basic understanding of the loads that a knee must be able to withstand, which allows physicians to select surgical procedures most appropriate to meet those demands in the active individual.

DETERMINING HOW LATERAL HEEL WEDGES (FOOT ORTHOTICS) REDUCE KNEE LOADS

People who suffer from knee joint arthritis as well as physicians who treat these individuals are often searching for conservative, inexpensive, yet effective options to alleviate knee pain during athletic activities.

The use of foot orthotics has long been utilized in this endeavor. However, while testimonials support their use, little empirical evidence has been able to identify the mechanics by which orthotics can alleviate knee pain. The Biomechanics Research Lab has embarked on an ambitious project to better understand how and why orthotics reduce knee loads in osteoarthritic patients.

Headed by Dr. Michael Torry, the Biomechanics group will test numerous individuals who fit the criteria of knee arthritis and lower extremity varus alignment. The researchers will outfit each individual with orthotics of varying heights and consisting primarily of a lateral heel wedge. The patients will walk wearing the orthotics while the Biomechanics group collects motion and force data. Once completed, the analysis will yield the degree by which each orthotic helped (or did not help) to reduce the loading in the knee of each patient. With this information the researchers will be able to make recommendations regarding the proper use, fitting, and degree of knee arthritis and lower extremity alignment that might or may not benefit from orthotic/heel wedge use, as well as determine how and why orthotics work.

ANALYSIS OF THE GOLF SWING MECHANICS IN THE AMATEUR GOLFER AGED 60 AND OVER

In amateur golfers, back injuries and back pain constitute 27 percent of golf injuries requiring loss of playing time and medical treatment. Epidemiologically, the incidence of back injury is followed closely by elbow injury and to a lesser extent, hand, wrist, shoulder, and knee maladies.

Golf is one of the most popular sports in men and women over 50 years of age. Unfortunately, golf also requires excessive and repetitive rotary motion about the spine. This motion frequently develops into low back pain that is often exacerbated by the presence of spine arthritis in this age group. Although some clinicians believe the rotary motion may cause spine-related arthritis, this has not been proven.

Little information exists to describe the motion of the body in the aging golfer. The Biomechanics group is spearheading a large project to investigate the golf swing mechanics in the golfer 60 years and older. The study includes building an indoor swing center that allows for unrestricted swing analysis using high-speed video capture. With this instrumentation, you can actually see if the golfer keeps his or her lead arm straight and when he breaks his hips. A measurement

Takashi Yanagawa, M.A., Staff Scientist, Biomechanics Research Laboratory

Born in Osaka, Japan, Takashi joined the Foundation in August 2001 as Staff Scientist in the Biomechanics Research Laboratory. While playing basketball during his high school years, he became interested in sports science. After watching the televising of a motion capture system, his interest in sports biomechanics grew. He then started thinking about the utilization of computers to study injury prevention and optimal motion in athletic activities. That led him to leave his native Japan in 1993 to study biomechanics in the U.S. After completing his bachelor's degree in Computer Science from the University of Texas at Tyler, he received his master's degree in kinesiology, specializing in biomechanics, from the University of Texas at Austin in 2001. Takashi's research is centered in computational modeling and simulation of the musculoskeletal system. He has published reports on the effects of hamstring co-contraction on knee joint stability during isokinetic exercises.

Currently, Takashi is involved in a project of upper extremity computer modeling and simulation, through which muscle and joint contact forces are estimated in various exercises. The information gained from this research will aid in the design of more effective and safe rehabilitation protocols and help physicians develop a better understanding of beneficial and harmful joint forces that occur during movement. Ultimately, this new knowledge will aid in getting patients back from injury or surgery sooner and more effectively. Takashi enjoys cycling and skiing, sports in which he continually develops his thinking about biomechanics.

can be taken of the popular X-factor, a leading variable the golf pros use to define trunk rotation. The study was initiated in August 2003, and any interested golfers (over age 55) can call Dr. Torry for more details if they wish to have their golf swing analyzed. "Once we understand more about what happens to the knees, hips, shoulder, and back in the 60+ golfer, we will be able to focus on specific injuries that often plague this age group at each joint," states Dr. Torry. "If you want to participate in our golf program, I can't promise I'll make you a better golfer, but I'll promise a good time trying!"

More recently, and with financial assistance from Pfizer, Inc., the golf study is now enrolling individuals with low back pain. Patients with low back osteoarthritis are being tested before and after taking a pharmacological aid (Bextra, a COX-2 inhibitor marketed by Pfizer, Inc.) in order to determine the drug's effectiveness on improving the golf swing by reducing acute pain.

DETERMINING HOW ACL INJURIES OCCUR DURING LANDING FROM A JUMP AND WHY FEMALES TEAR THEIR ACL MORE THAN MALES

Since the inception of Title IX in 1979, the incidence of females tearing their ACL in non-contact sports (such as soccer) has been alarming. Some reports estimate women to be four to eight times more likely to tear their ACL compared to their male counterparts in comparable sports. Understanding how and why this gender disparity occurs has been a three-year endeavor for the Biomechanics group. Most recently, the BRL published a paper that detailed specific landing-from-a-jump differences that exist between age and activity level matched male and female athletes.

Women land in a more erect position (less knee flexion), which tends to create higher loads on the ACL. However, measuring a person's performance in the laboratory has disadvantages because the landings cannot be harmful in any way and this only answers part of the questions. To further understand how and why the ACL is sometimes injured (in both men and women) Kevin Shelburne, Ph.D., and Mike Torry, Ph.D., in conjunction with Dr. Marcus Pandy at the University of Texas-Austin, have conducted a study in which the landing data measured on subjects in the laboratory was used to guide a computer model of the landing motion.

With the computer model, the scientists are able to determine what is happening inside the knee during the motion, what tissues are being loaded and what factors are contributing most to the ACL injury. Unlike testing human subjects, the model can be made to perform in a manner that actually tears its ACL. "How people tear their ACL when landing from a jump is a hot topic in sports medicine right now. This study represents a tremendous leap forward in technology and in the understanding of just how this injury may occur," remarked Dr. Torry.

DETERMINING HOW AND WHY LITTLE LEAGUE BASEBALL PITCHERS GET INJURED

After four years of investigating major league baseball pitching mechanics and injuries, Dr. Torry and the BRL team have focused their efforts to understanding the mechanics behind 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 different as well.

Biomechanics Research Laboratory interns, left to right: Michael Torry, Ph.D., director; Natalie Danaher; Amy Engle; Nick Kreutzer; Tom Shannon; Jeff Jockel; and Viral Patel.

The BRL has recently 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, Little Leaguers only throw about 50 to 65 mph fastballs. Given the shorter distance from home plate to the pitcher's mound, this translates into a professional pitch velocity equivalent of 80 to 95 mph to the batter. Our research has also shown that Little League pitchers actually 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 injuries 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 athletes are already developing pitching mechanics that they will carry into adolescence.

A COMPARISON OF SUPINATION AND ELBOW FLEXION STRENGTH IN PATIENTS WITH EITHER PROXIMAL BICEPS RELEASE OR BICEPS TENODESIS

Proximal biceps release and biceps tenodesis (suturing tendon to bone) are both surgical procedures used to treat symptomatic patients suffering from biceps injury. Arthroscopic biceps release has been shown by several investigators to provide substantial improvement in certain patients with a variety of biceps injuries (massive rotator cuff tears, SLAP lesions, primary bicipital tendinitis). However, it has been reported that the release of the biceps can result in a cosmetic deformity (often called a Popeye deformity), loss of shoulder-arm stability, and loss of upper extremity strength. Given these deficiencies, some investigators have advocated proximal biceps tenodesis after a biceps release, and a number of fixation techniques (staples, suture anchors, keyhole, screw and washer).

Two of the principal functions of the biceps muscle are elbow flexion and forearm supination. Several investigators have looked at elbow flexion and supination strength in patients who have had a biceps tenodesis, but few comparisons have been made with patients who have sustained a proximal biceps rupture. Dr. Torry and Dr. Hawkins are leading a study in which individuals with either the release or the tenodesis are brought in to have their upper arm strength tested. The preliminary results suggest that very little strength differences occur between these two surgical procedures. "This is very important to know," claims Dr. Torry, "as simply releasing the biceps without trying to tenodese it down is surgically a much easier, safer, quicker (and thus cheaper) way to go. The results to date suggest little strength difference as long as one can live with the Popeye deformity in the end."

UNDERSTANDING 3D MOTION OF THE SHOULDER COMPLEX

The first step in preventing and determining how shoulder pathologies occur is to understand and quantify normal motion of the shoulder complex: the clavicle, scapula, and humerus. However, conventional biomechanics research methods are ineffective, primarily because the scapula and clavicle motions are three-dimensional and are obscured by the surrounding muscle and tissue.

A STEP INTO THE FUTURE

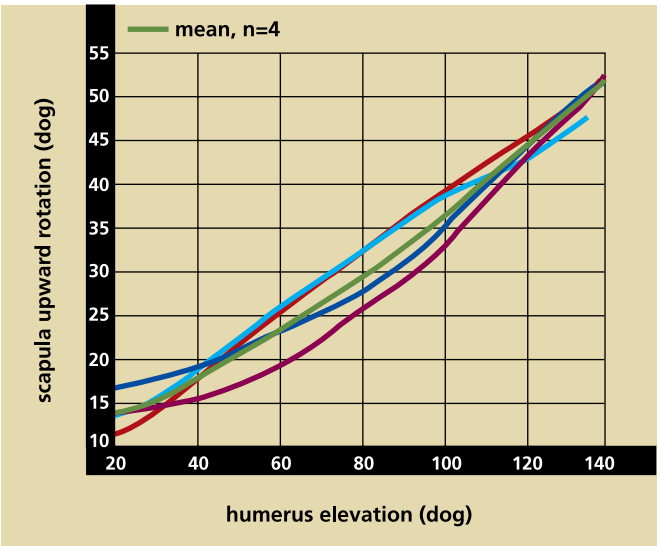
Nearly everyone reading this annual report has experienced a trip to an orthopaedic surgeon's office. This trip is most often associated with an additional trip to the MRI station and/or the radiology station so the doctors can get a "view" of what is inside the joint. While taking the MRI or radiographic scan, the imaging technician tells us to remain perfectly still. This is a major problem and is in stark contrast to the doctor's assessment where the clinician often requires the patient to bend or flex the joint in an attempt to reproduce and localize the pain. Thus, most often the pain a patient feels in a joint actually occurs while moving, not lying still as imaged by the MRI or radiology.

The fundamental basis for this future research is quite simple— to combine the MRI and radiographic data with patient's motion and to report the movements of the bones while the person is actually moving, thus creating a set of 3-D Dynamic Motion Images that can be viewed from any perspective. The potential for this information in its practical application to orthopaedic surgery is limitless. "We will start with simple motion such as walking, hence the title 'A Step into the Future,' and then progress into more dynamic motions. But this project offers a unique opportunity to investigate numerous research questions that are persistently plaguing the orthopaedic practice," remarks Dr. Torry.

The BRL has overcome these obstacles by performing a unique set of experiments. Rather than the traditional method of attaching reflective markers to the skin, markers are attached to a pin drilled into the clavicle, scapula, and humerus. High-speed cameras then record the motion of the markers, which are duplicating the exact motion of the shoulder bones. This method allows the investigators to identify how each bone is moving relative to each other during basic movements such as raising the arm, as well as during skilled activities like throwing a football or hitting a golf ball.

Data from one subject have already been collected and analyzed. For example, as the arm was elevated from 20° to 135°, the scapula rotated upward a total of 35 degrees (see graph on this page) and tilted back 12 degrees. Five more subjects have volunteered and will be tested within the next several months.

These motion data are important. Numerous research centers around the world are anxiously awaiting our results. Furthermore, these data will be instrumental in helping advance our theoretical model of the shoulder.



Scapula upward rotation for four trials during humerus elevation
(0° = arm straight down, 180° = arm above head)

THE VIRTUAL SHOULDER

Like the virtual knee model, the BRL (under Dr. Kevin Shelburne and Takashi Yanagawa, in association with Dr. Marcus Pandy at the University of Texas at Austin) is leading the way in the development of a revolutionary virtual shoulder model. Next to a knee joint, a shoulder joint is more prone to injury because of its complexity than other joints in the body. The shoulder has four joints and involves four bones and many muscles that surround it. Many other structures also contribute to the joint stability of the shoulder. Determining just how each of these structures contributes or fails to contribute to the shoulder joint stability is paramount to being able to surgically treat the shoulder more successfully.

The virtual shoulder model allows for many individualized research questions to be asked and investigated. For instance, we may ask how much force is applied to the glenohumeral joint if one of the rotator cuff (or any combination of) muscles is weak or injured. Thus, the shoulder model can be applied to nearly any "what if" scenario that an orthopaedic surgeon could ask. Engaging in this type of research would be financially impractical using conventional methods with cadavers.

As with any virtual model, prior to being applied clinically, it must be validated. "Takashi Yanagawa has been working very hard in validating our current model," states Dr. Torry, "and this validation process is no small endeavor, as it is very tedious. We are very close to applying the model in a very useful and clinically relevant manner. I have no doubt that this model will revolutionize our basic understanding of how the shoulder really moves and what muscles and ligaments are involved."

Inside the Steadman◆Hawkins Foundation: A Fellow's Perspective

When Arun Ramappa was twelve years old, a pediatrician saved his best friend's life by diagnosing a potentially fatal condition. The pediatrician was Arun's father, Dr. G. M. Ramappa. "That was the first time I remember thinking that becoming a doctor might be something I wanted to do," remembers Arun. His mother, Renuka, is also a physician, so the decision to go into the family profession was not that difficult or unusual.

Although Arun was valedictorian at Hudson High School in Florida, he didn't have his sights set on an Ivy League education. "I knew places like Yale and Harvard had good academic reputations, but I wasn't even sure where Harvard was." Now he knows. Dr. Ramappa graduated magna cum laude from Harvard in 1991 with a degree in chemistry. In 1996, he graduated cum laude from Harvard Medical School and has since completed the Harvard Combined Orthopaedic Residency Program.

Why did he specialize in orthopaedic surgery? "Everyone in medical school tries to figure out what kind of specialty would be a good fit. For me it became pretty clear that I was surgically oriented," he answers. "Orthopaedic surgery involves problems that you can get your hands on. Typically, after assessing the situation, you can define a problem, find a solution, implement the solution, and make a tangible difference in the lives of people who are in pain, disabled, or have a loss of function. That process was and still is attractive to me."

Why Steadman-Hawkins?

"The first time I heard about the Steadman◆Hawkins Sports Medicine Foundation was during medical school. Some of my mentors who had been Fellows there told me that its clinical and research programs were unparalleled. The research reputation, combined with the fact that people senior to me recommended it, helped push me in that direction. I had to apply two years ahead of time, was accepted, and was part of the 2003-2004 class."

The Steadman◆Hawkins Sports Medicine Foundation Fellowship Program is considered one of the top post-residency sports medicine fellowship programs in the world. Each year, six young orthopaedic surgeons are selected from a pool of more than 150 candidates. The Fellows participate in a 12-month training period to refine their skills in orthopaedic surgery and investigate the causes and prevention for sports-related injuries. The staff and Fellows are also dedicated to finding the cause and cure of degenerative arthritis. For four months, the Fellows work in clinics and surgery alongside Dr. Richard Steadman, whose specialty is the knee. They serve another four months working with shoulder specialist Dr. Richard Hawkins, and two months with Dr. William Sterett in the care of fractures. Two months are devoted to research, although some clinical and research projects are conducted simultaneously.

The work conducted in the Steadman-Hawkins Fellowship Program reaches the public in three ways:

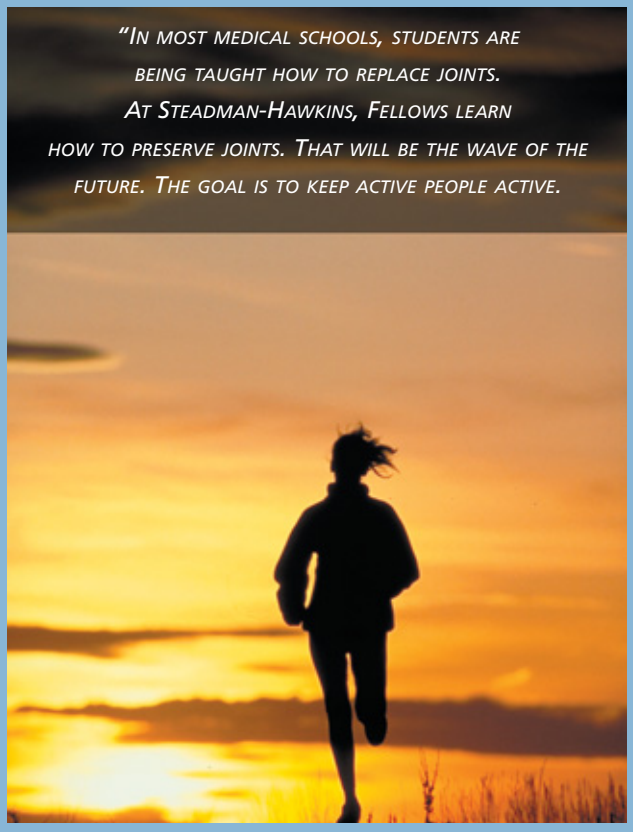
- Results are disseminated through Fellows to orthopaedic centers throughout the world.
- Thousands of patients benefit from Foundation research as each graduate joins the network of Steadman-Hawkins Fellows.
- Fellows learn new techniques that will improve health care and reduce medical costs worldwide.

Dr. Ramappa describes a typical clinical workday like this: Get to work between 7 and 8 a.m. Participate in an hour-and-a-half academic conference to discuss sports medicine literature and current practices. Begin seeing patients later in the morning and continue until 6 or 7 p.m. A typical day in the operating room starts around 7 a.m. and continues until all the cases are done. That could be as late as 11 p.m. "During the two months dedicated to research," says Dr. Ramappa, "Fellows design projects and carry out the necessary research to complete them. Steadman-Hawkins has assembled a star-studded scientific advisory board, and

(CONT. ON PG 30)

Fellows have access to them for advice and opinions about biomechanical, clinical, and basic science research."

In addition to responsibilities in Vail, Fellows work with athletes at the high school, college, and professional levels. Dr. Ramappa attended the National Football League combine in Indianapolis to examine players prior to the draft. He also spent time during Major League Baseball spring training examining and treating players in the Colorado Rockies system.



What Sets Steadman-Hawkins Apart From Other Programs?

"There are at least two things that set Steadman-Hawkins apart from other fellowship programs," explains Dr. Ramappa. "In most medical schools, students are being taught how to replace joints. At Steadman-Hawkins, Fellows learn how to preserve joints. That will be the wave of the future. The goal is to keep active people active. This emphasis has made an indelible mark on my approach to patient care. It is particularly timely because people are living longer and they want to remain youthful and vigorous. The work being done by Steadman-Hawkins physicians and Fellows—sponsored by the Foundation—is allowing people to perform at the highest level possible."

"The second distinguishing characteristic of Steadman-Hawkins," continues Dr. Ramappa, "is the atmosphere created by Drs. Steadman and Hawkins. "I came from a large program where everyone was a small part of the big picture. I was looking for a situation where I could establish meaningful relationships with my mentors and co-workers. I can say unequivocally that the program surpassed all my expectations. The mentorship of Drs. Steadman, Hawkins, and Sterett has been invaluable. The staff is happy to be there, they are very talented, and they make you feel like you are part of a family. That was something I had not experienced in my previous training."

What would Dr. Ramappa tell potential Foundation donors about Steadman-Hawkins? "People who support the Foundation financially should know that the quality of work and research performed at the Foundation is allowing people to live active, productive lives. For that to continue, we have to develop better and better therapies. The Foundation is making that research possible."

Today, Arun Ramappa, M.D., is back in Boston, a member of the faculty at Harvard, an orthopaedic surgeon, and a sports medicine physician at Beth Israel Deaconess Medical Center. "I'll return to Colorado every year to attend the meeting of Steadman-Hawkins Fellows. It's a unique opportunity to participate in lively discussions with some of the best sports medicine doctors in the world. I'll also continue to work in research, perhaps doing something here in Boston in conjunction with the Foundation. Whatever the project, I look forward to being involved with Steadman◆Hawkins Sports Medicine Foundation for a long time."

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, 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.

Richard J. Hawkins, M.D.; Greta Campanale, Coordinator

FELLOWSHIP PROGRAM: Learning As We Teach

Considered one of the top sports medicine fellowship programs in the world, the Steadman-Hawkins Fellowship is at the core of the Foundation's educational effort. Each year, six young orthopaedic surgeons are chosen from more than 150 candidates to become Steadman-Hawkins 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 the leaders in the field of orthopaedic sports medicine for the remainder of their careers.

The Foundation currently maintains a network of more than 130 Fellows who share advanced ideas and inspire each other to higher levels. This year we held the Eleventh Annual Fellows Meeting. We are fortunate in Vail to work with the best and the brightest 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.

Dr. Hawkins (right) with former Fellow Steve Singleton, M.D.

2003-2004 FELLOWS

Timothy S. Bollom, M.D.

Dr. Bollom graduated summa cum laude from the University of Saint Thomas (St. Paul, Minn.) with a degree in biology and then studied medicine at the University of Minnesota Medical School, where he was named to the Alpha Omega Alpha National Honor Medical Society. He completed his residency in orthopaedic surgery at the University of Florida at Gainesville. Dr. Bollom has been published in *The American Journal of Sports Medicine*, has authored several book chapters, and has received an award for outstanding resident/student research paper presentation. Dr. Bollum was an All-American track and cross-country runner.

Andrew L. Chen, M.D.

Dr. Chen earned an undergraduate degree in biology and a master of science degree in materials science and engineering at Johns Hopkins University. He continued his studies at the Johns Hopkins School of Medicine. He completed his residency in orthopaedics at New York University's Hospital for Joint Diseases, where he also completed a research fellowship at the Musculoskeletal Research Center. Dr. Chen has received numerous awards for his

work in basic science and clinical research and has been published in *Arthroscopy, Journal of Arthroplasty, Journal of the American Academy of Orthopaedic Surgeons*, and *Journal of Trauma*.

Douglas J. Lowery, M.D.

Dr. Lowery graduated from DePauw University with a degree in biology. He then pursued a master's program in physiology and biophysics at Indiana University. He continued his studies at Indiana University to earn his medical degree and was named to the Alpha Omega Alpha National Honor Medical Society. Dr. Lowery performed his orthopaedic residency at the Summa Health System in Akron, Ohio. Dr. Lowery was an accomplished collegiate football player and played with the Indianapolis Colts.

Charles B. May, Jr., M.D.

Dr. May attended the University of Georgia at Athens as an undergraduate student of zoology. He then graduated cum laude from Emory University School of Medicine and completed his residency in orthopaedic surgery at the University of Texas Southwestern Medical Center. During medical school and his residency, Dr. May was published in *Foot and Ankle International* and *Biomechanics*, and was involved in researching supracondylar femoral osteotomies for lateral compartment degenerative arthritis.

Arun J. Ramappa, M.D.

Dr. Ramappa graduated magna cum laude with a degree in chemistry from Harvard University. He studied articular cartilage regeneration and autologous chondrocyte transplantation as a research fellow during his studies at Harvard Medical School. He subsequently entered the Harvard Combined Orthopaedic Residency Program and continued his participation in basic science and clinical research projects, along with developing software to aid in reconstructive knee surgery. Dr. Ramappa has made presentations at various conferences and has been published in such journals as *Biomaterials* and the *Journal of Bone and Joint Surgery*.

Michael A. Terry, M.D.

Dr. Terry studied mechanical engineering as an undergraduate at the University of Illinois at Urbana/Champaign. Upon graduating from the University of Chicago's Pritzker School of Medicine, he received awards for outstanding performance in general surgery and in clinical medicine and was named to the Alpha Omega Alpha National Honor Medical Society. Dr. Terry completed his residency at Hospital for Special Surgery in New York City, where his research projects included the study of thromboembolic disease, diagnostic shoulder arthroscopy, and an augmented rotator cuff repair model in sheep.

SPECIAL COURSES

Foundation Hosts Webcast

On-Line Program Provides Continuing Education for Orthopaedic Surgeons Treating Degenerative Joint Disease

The pioneering work of the Foundation's cartilage research program was the topic for a webcast that will be made available online for one year beginning January 1, 2004. Titled *Overcoming the Challenge of Degenerative Joint Disease: Innovative Surgical and Pain Management Techniques*, the program was hosted by the professionals and staff of the Steadman◆Hawkins Sports Medicine Foundation.

Co-chairs are Dr. J. Richard Steadman, Steadman-Hawkins Clinic principal and founder of the Steadman◆Hawkins Sports Medicine Foundation, and Dr. Richard J. Hawkins, also a principal of the Steadman-Hawkins Clinic.

The four-hour roundtable, funded by Pfizer, Inc., and sponsored by the Postgraduate Institute for Medicine, features a world-renowned, international faculty of orthopaedic surgeons, pain specialists, and researchers, each of whom has pioneered innovative treatments for treating articular cartilage injuries. The webcast, which offers continuing medical education credit, is designed to meet the educational needs of orthopaedic surgeons involved in the care of patients with degenerative joint disease. Topics included:

1. Review of the basic science of normal and injured articular cartilage.
2. Discussion of current concepts in pain response and their influence on surgical management decisions.
3. Explanation of treatment alternatives for knee and shoulder chondral defects, as discussed by a faculty of leading experts and pioneers in the field.
4. Description of anti-inflammatory use in the treatment of chronic degenerative joint disease.

The webcast was supported by an educational grant from Pfizer, Inc., a global, research-based company with a longstanding commitment to health education. In the production of the webcast, the faculty included:

- **J. Richard Steadman, M.D.**, who presented *Acute Chondral Defects in the Young, Active Patient*. His lecture featured a discussion of microfracture, a surgical procedure he has pioneered for the formation of reparative cartilage.

2003-2004 Fellows with Drs. William I. Sterett, J. Richard Steadman, and Richard J. Hawkins. Rear, left to right: Dr. Sterett, Douglas J. Lowery, M.D.; Andrew L. Chen, M.D.; Michael A. Terry, M.D.; and Dr. Steadman; front left to right: Charles B. May, Jr., M.D.; Timothy S. Bollom, M.D.; Arun Ramappa, M.D.; and Dr. Hawkins.

- **Richard J. Hawkins, M.D.**, who presented his experience on *Chondral Defects.*

- **William G. Rodkey, D.V.M.**, Director, Basic Science Research, Steadman◆Hawkins Sports Medicine Foundation, who presented *Biologic Differences in Normal and Injured Cartilage*.

- **James P. Rathmell, M.D.**, professor, Department of Anesthesiology, Fletcher Allen Health Care, Burlington, Vermont., who presented *Emerging Concepts in the Pain Response and Influence on Perioperative Management Decisions*.

- **Kenneth P. Glassman, M.D.**, Denver Arthritis Center, who discussed *New Evidence in Long-term Management Decisions.*

- **Bruce S. Miller, M.D.**, University of Michigan Sports Medicine Program and former Steadman-Hawkins Fellow, who lectured on *Osteotomy and Alignment Implications for the Arthritic Knee*, including a presentation on high tibial osteotomy as a surgical procedure to treat malalignment of the knee.

With growing worldwide interest and concern over the increase in degenerative arthritis, this webcast was timely and relevant to both the orthopaedic world and lay community.

Where are they now. . .

The graduating class of 2002/2003 Steadman-Hawkins Fellows is busy establishing new careers in orthopaedics.

Michael J. Milne, M.D., started a solo practice with the help of another sports medicine surgeon in St. Louis, his hometown.

Scott A. Hacker, M.D., moved to El Cajon, Calif. Dr. Hacker is working with the Alvarado Orthopaedic Medical Group in San Diego.

Timothy D. Farley, M.D., moved to Ladue, Mo. Dr. Farley is working with the Missouri Bone and Joint Center in St. Louis.

Timothy O'Brien, M.D., moved to Bozeman, Mont. Dr. O'Brien has joined Alpine Orthopaedics, which specializes in knee and shoulder surgery.

James Van den Bogaerde, M.D., returned to California. He is working with The Permanente Medical Group in Roseville.

Reed L. Bartz, M.D., remains in Colorado. He is Assistant Professor at the University of Colorado Sports Medicine Clinic, Department of Orthopaedics, University of Colorado Health Sciences Center. He is also Team Physician for the University of Colorado and the University of Denver.

Presentations & Publications

A primary goal of the Foundation is to distribute the results of its research. In 2003, principal investigators and Fellows published 36 papers in scientific and medical journals and delivered 123 presentations to a variety of professional and lay audiences worldwide.

In fulfillment of its education mission, the Foundation is proud of the quality and quantity of educational video media produced by the Visual Services Department. At the 69th Annual Meeting of the American Academy of Orthopaedic Surgeons in Dallas, Texas, 25 teaching video presentations were accepted by the Academy. Eight of these videos were produced by the Foundation, and for the third consecutive year, the Foundation submitted an award winner: Diagnostic Wrist Arthroscopy: Equipment, Anatomy and Surgical Technique, by Sumant G. Krishnan, M.D., and Randy W. Viola, M.D.

2003 PRESENTATIONS

Bartz, R.L., M.D.; Sabick, M.B., M.D.; Decker, M.J., M.S.; Torry, M.R., Ph.D.; Schlegel, T.F., M.D.; Hawkins, R.J., M.D.:
"Comparison of Shoulder and Elbow Kinetics between Professional and Little League Throwers," Poster Presentation, *American Orthopaedic Society for Sports Medicine* 29th Annual Meeting, San Diego, Calif., July 20, 2003.

Briggs, K.K., M.P.H., M.B.A.; Steadman, J.R., M.D.:
"Correlation between the 2000 IKDC Score, Lysholm Score, and Patient Satisfaction," Poster Presentation, *Arthroscopy Association of North America 22nd Annual Meeting,* Phoenix, Ariz., April 24-27, 2003.

"Physical Activity Goals in Patients Seeking Treatment for Osteoarthritis of the Knee," *American Public Health Association Annual Meeting,* San Francisco, Calif., November 14-19, 2003.

Cameron, M.L., M.D.; Briggs, K.K., M.P.H., M.B.A.; Horan, M.P.; Hawkins, R.J., M.D.:
"The Relative Risk of Glenohumeral Arthritis in Patients with Shoulder Instability," *American Academy of Orthopaedic Surgeons 70th Annual Meeting,* New Orleans, La., February 6, 2003.

Cameron, M.L., M.D.; Briggs, K.K., M.P.H., M.B.A; Horan, M.P.; Hawkins, R.J., M.D.:
"The Relative Risk of Glenohumeral Arthritis in Patients with Shoulder Instability," *International Society of Arthroscopy, Knee Surgery, and Orthopaedic Sports Medicine Congress,* Auckland, New Zealand, March 10-14, 2003. [Richard Caspari Award Finalist]

Cameron, M.L.,M.D.; Briggs, K.K., M.P.H., M.B.A.; Steadman, J.R., M.D.:
"Reproducibility and Reliability of the Outerbridge Classification for Grading Chondral Lesions of the Knee," Poster Presentation, *International Society of Arthroscopy, Knee Surgery, and Orthopaedic Sports Medicine Congress,* Auckland, New Zealand, March 10-14, 2003.

Cameron, M.L.,M.D.; Kocher, M.S.,M.D.; Briggs, K.K., M.P.H., M.B.A; Horan, M.P.; Hawkins, R.J., M.D.:
"The Prevalence of Glenohumeral Osteoarthrosis with Shoulder Instability," Poster Presentation, *International Society of Arthroscopy, Knee Surgery, and Orthopaedic Sports Medicine Congress,* Auckland, New Zealand, March 10-14, 2003.

Cameron, M.L.,M.D.; Briggs, K.K., M.P.H., M.B.A.; Horan, M.P.; Hawkins, R.J., M.D.:
"Association between Glenohumeral Arthritis with Longstanding Anterior Instability of the Shoulder," *American Orthopaedic Society for Sports Medicine 29th Annual Meeting,* San Diego, Calif., July 22, 2003.

Corenman, D.S., M.D., D.C.
"Human Physiology, Incidence of Skier or Snowboard Injury and Safety Considerations, Sport Biomechanical Reaction Time in High Speed Skiing with Application to Ski Safety," *American Association for the Advancement of Science Annual Meeting,* "The Science of Snow and Skiing," Denver, Colo., February 13-18, 2003.

Corenman, D.S., M.D., D.C.; Torry, M.R., Ph.D.; Shelburne, K.B., Ph.D.; Yanagawa, T., M.A.:
"Biomechanics of Skiing and Skiing Injuries," *Injuries in Winter Sports Symposia, National Science Foundation,* Denver, Colo., February 20-23, 2003.

"The Physiology of Lumbar and Cervical Discs," *2003-04 Orthopaedics and Spine Lecture Series,* Vail, Colo., October 6, 2003.

"Recognition and Treatment of Spinal Injuries in the Athlete," *Grand Rounds, Vail Valley Medical Center,* Vail, Colo., October 6, 2003.

"The Acute Recognition and Management of On-Hill Spinal Injuries," *Copper Mountain Ski Patrol,* Copper, Colo., November 10, 2003.

"The Acute Recognition and Management of On-Hill Spinal Injuries," *Vail Mountain Ski Patrol,* Vail, Colo., November 10, 2003.

"The Acute Recognition and Management of On-Hill Spinal Injuries," *Keystone Ski Patrol,* Keystone, Colo., November 10, 2003.

Folk, J.W., M.D.
"Patient Satisfaction and Functional Outcomes in Microfracture of the Degenerative Knee," *American Academy of Orthopaedic Surgeons 70th Annual Meeting,* New Orleans, La., February 5-7, 2003.

"Knee Injuries, Anatomic Considerations; Cadaveric Knee Dissection," *Breckenridge Ski Patrol,* Breckenridge, Colo., March 16. 2003.

"Nonoperative Management of the Arthritic Knee," *Steadman◆Hawkins Sports Medicine Foundation Symposium,* Vail, Colo., May 8, 2003.

"Ask the Expert," *2003-04 Orthopaedics and Spine Lecture Series,* Vail, Colo., July 7, 2003.

"Posterior Cruciate Ligament & Posterolateral Corner Reconstruction," *Steadman-Hawkins Fellows Meeting,* Vail, Colo., July 10-12, 2003.

"Nonoperative Management of the Arthritic Knee," *2003-04 Orthopaedic and Spine Lecture Series,* Vail, Colo., August 4, 2003.

Hawkins, R.J., M.D., F.R.C.S.(C)
"Electrothermal Arthroscopic Shoulder Capsulorrhaphy: A Minimum 2-Year Follow-Up," *Scientific Exhibit, American Academy of Orthopaedic Surgeons 70th Annual Meeting,* Final Program AOSSM/COMSS Society, New Orleans, La., February 3-9, 2003.

"Ulnar Collateral Ligament Reconstruction of the Elbow: The Docking Procedure," Video Presentation, AWARD WINNER, *American Academy of Orthopaedic Surgeons 70th Annual Meeting,* New Orleans, La., February 3-9, 2003.

"The Principles and Techniques of Heat Application Glenohumeral Instability Update," *American Academy of Orthopaedic Surgeons 70th Annual Meeting,* New Orleans, La., February 9, 2003.

"Rotator Cuff Tendonitis: Is There a Need for Acromioplasty?" *AOSSM Specialty Day, American Academy of Orthopaedic Surgeons 70th Annual Meeting,* New Orleans, La., February 8, 2003.

"Biomechanics of Upper Extremity Movements," *National Football League Physicians Society Annual Scientific Meeting,* Indianapolis, Ind., February 20, 2003.

"Rotator Cuff and Biceps Tendon Update," *Visiting Professorship, Washington University School of Medicine,* St. Louis, Mo., April 9, 2003.

"Glenohumeral Instability Update," *Visiting Professorship, Washington University School of Medicine,* St. Louis, Mo., April 9, 2003.

"Shoulder Modeling," *Hawkins Society,* Hilton Head, S.C., May 8-10, 2003.

"Examination of the Shoulder," *18th Annual Advances on the Knee and Shoulder Conference,* Cincinnati, Ohio, May 25, 2003.

"Biceps Problems in Athlete," *18th Annual Advances on the Knee and Shoulder Conference,* Cincinnati, Ohio, May 25, 2003.

"Methods of Treatment for the Irreparable Rotator Cuff," *18th Annual Advances on the Knee and Shoulder Conference,* Cincinnati, Ohio, May 25, 2003.

"Open Treatment of Rotator Cuff Tears," *18th Annual Advances on the Knee and Shoulder Conference,* Cincinnati, Ohio, May 25, 2003.

"Comprehensive Examination of the Shoulder. A breakout session," *18th Annual Advances on the Knee and Shoulder Conference,* Cincinnati, Ohio, May 25, 2003.

"Arthroscopic Knot Tying and Suture Passing Laboratory. A breakout session," *18th Annual Advances on the Knee and Shoulder Conference,* Cincinnati, Ohio, May 25, 2003.

"Open Treatment of Posterior Shoulder Instability," *18th Annual Advances on the Knee and Shoulder Conference,* Cincinnati, Ohio, May 26, 2003.

"Advances in Arthroscopic Shoulder Procedures. A breakout session," *18th Annual Advances on the Knee and Shoulder Conference,* Cincinnati, Ohio, May 26, 2003.

"Accuracy of Rotator Cuff Diagnosis on the Basis of Physical Examination with and without MRI," *Poster Presentation, American Orthopaedic Society for Sports Medicine 29th Annual Meeting,* San Diego, Calif., July 20, 2003.

"Diagnosis and Treatment of Impingement," *Current Issues of MRI,* San Francisco, Calif., August 24, 2003.

"Shoulder Biomechanics and Modeling," *58th Annual Meeting, Twentieth Century Orthopaedic Association,* Sea Island, Ga., October 31, 2003.

"Shoulder Biomechanics Update and Modeling," *Athletic Trainers of the Denver Broncos,* San Diego, Calif., September 19, 2003.

"Chondral Defects and Approach to the Arthritic Shoulder," International Webcast, *Overcoming the Challenge of Degenerative Joint Disease by Pfizer,* Vail, Colo., September 25, 2003.

Kocher, M.S., M.D.; Briggs, K.K., M.P.H., M.B.A.; Steadman, J.R., M.D.:
"Reliability, Validity, and Responsiveness of the Lysholm Score for Chondral Disorders of the Knee," *American Orthopaedic Society for Sports Medicine 29th Annual Meeting,* San Diego, Calif., July 20, 2003.

Krishnan, S.G., M.D.; Hawkins, R.J., M.D.; Horan, M.P.:
"A Critical Review of the Recurrence of Glenohumeral Instability after Open Surgical Procedures: One Surgeon's Experience," Poster Presentation, *American Academy of Orthopaedic Surgeons 70th Annual Meeting,* New Orleans, La., February 3-9, 2003.

Krishnan, S.G., M.D.; Steadman, J.R., M.D.; Hydeman, K.; Close, M.:
"Lysis of Pretibial Patellar Tendon Adhesions (Anterior Interval Release) to Treat Anterior Knee Pain after ACL Reconstruction," *American Academy of Orthopaedic Surgeons 70th Annual Meeting,* New Orleans, La., February 5, 2003.

Miller, B.S., M.D.; Joseph, T.A., M.D.; Noonan, T.J., M.D.; Horan, M.P.; Hawkins, R.J., M.D.:
"Rupture of the Subscapularis Tendon after Shoulder Arthroplasty: Diagnosis, Treatment, and Outcome:" Poster Presentation, *American Academy of Orthopaedic Surgeons 70th Annual Meeting,* New Orleans, La., February 3-9, 2003.

Miller, B.S., M.D.; Rich, V.J.; Sterett, W.I., M.D.:
"Posterior Tibial Slope following Medial Opening Wedge Proximal Tibial Osteotomy for Varus Arthrosis of the Knee," Poster Presentation, *American Academy of Orthopaedic Surgeons 70th Annual Meeting,* New Orleans, La., February 3-9, 2003.

Miller, B.S., M.D.; Steadman, J.R., M.D.; Briggs, K.K., M.P.H., M.B.A; Folk, J.W., M.D.; Rodrigo, J.J., M.D.:
"Patient Satisfaction and Functional Outcome after Microfracture of the Degenerative Knee," *American Academy of Orthopaedic Surgeons 70th Annual Meeting,* New Orleans, La., February 3-9, 2003.

Miller, B.S., M.D.; Steadman, J.R., M.D.; Briggs, K.K., M.P.H., M.B.A; Folk, J.W., M.D.; Rodrigo, J.J., M.D.:
"Patient Satisfaction and Functional Outcome after Microfracture of the Degenerative Knee," *International Society of Arthroscopy, Knee Surgery, and Orthopaedic Sports Medicine Congress,* Auckland, New Zealand, March 10-14, 2003.

O'Holleran, J.D.,M.D.; Kocher, M.S., M.D., M.P.H.; Horan, M.P.; Briggs K.K., M.P.H., M.B.A.; Hawkins, R.J., M.D.:
"Determinants of Patient Satisfaction with Outcome after Rotator Cuff Surgery," Poster Presentation, *American Academy of Orthopaedic Surgeons 70th Annual Meeting,* New Orleans, La., February 3-9, 2003.

Rodkey, W.G., D.V.M.
"Meniscus Regeneration: Scientific Background and Trends (CMI)," *3rd Basel International Knee Congress,* Basel, Switzerland, January 27-29, 2003.

"The Surgical Treatment of Articular Cartilage Defects of the Knee: Microfracture Technique," *Instructional Course Lecture, American Academy of Orthopaedic Surgeons,* New Orleans, La., February 5-9, 2003.

Rodkey, W.G., D.V.M.; Steadman, J.R., M.D.: "Collagen Meniscus Implants: Multicenter Clinical Trial Results and Long Term Follow-Up," *International Society of Arthroscopy, Knee Surgery & Orthopaedic Sports Medicine,* Auckland, New Zealand, March 10-14, 2003.

"Biology and Basic Science of Articular Cartilage," Invited Presidential Lecture, *International Society of Arthroscopy, Knee Surgery and Orthopaedic Sports Medicine,* Auckland, New Zealand, March 10-14, 2003.

"Comparative Animal Models in Orthopaedic Research," Chairman, Invited Symposium, *International Society of Arthroscopy, Knee Surgery and Orthopaedic Sports Medicine,* Auckland, New Zealand, March 10-14, 2003.

"Patient Satisfaction and Functional Outcome after Microfracture of the Degenerative Knee," *International Society of Arthroscopy, Knee Surgery and Orthopaedic Sports Medicine,* Auckland, New Zealand, March 10-14, 2003.

"A Minimally Invasive Technique ('Healing Response') to Treat Acute ACL Injuries in Patients 40 Years and Older," *International Society of Arthroscopy, Knee Surgery and Orthopaedic Sports Medicine,* Auckland, New Zealand, March 10-14, 2003.

"Microfracture to Treat Full-Thickness Chondral Defects in Competitive and Recreational Athletes. A Long Term (7 to 17 years) Clinical Outcomes Study," *2nd European Congress of Sport Traumatology,* Monte Carlo, Monaco, May 1-3, 2003.

"Anterior Cruciate Ligament Injuries Round Table," Chairman, *2nd European Congress of Sport Traumatology*, Monte Carlo, Monaco, May 1-3, 2003.

"Long Term (5 to 6 years) Follow-Up of Collagen Meniscus Implants Used to Reconstruct the Injured Medial Meniscus. A Prospective Clinical Study," *2nd European Congress of Sport Traumatology,* Monte Carlo, Monaco, May 1-3, 2003.

"5 to 6 Year Follow Up Results of Collagen Meniscus Implants," *6th Congress of the European Federation of National Associations of Orthopaedics and Traumatology,* Helsinki, Finland, June 4-10, 2003.

"A Minimally Invasive Technique ('Healing Response') to Treat Acute ACL Injuries in Patients 40 Years and Older," *6th Congress of the European Federation of National Associations of Orthopaedics and Traumatology,* Helsinki, Finland, June 4-10, 2003.

"Patient Satisfaction and Outcome After Microfracture of the Degenerative Knee," *6th Congress of the European Federation of National Associations of Orthopaedics and Traumatology,* Helsinki, Finland, June 4-10, 2003.

"CMI: The Vail Experience. Modern Strategies to Treat Knee Injuries," *Marienhouse Hospital,* Wurselen, Germany, June 18, 2003.

"Microfracture: The Vail Experience. Modern Strategies to Treat Knee Injuries," *Marienhouse Hospital,* Wurselen, Germany, June 18, 2003.

"Articular Cartilage: In Sickness and in Health," International Webcast, *Overcoming the Challenge of Degenerative Joint Disease by Pfizer,* Vail, Colo., September 25, 2003.

"Collagen Meniscus Implants: Techniques and Results," Invited Presidential Guest Speaker, *40th Spanish Orthopaedic and Traumatology Society Congress,* Tenerife, Canary Islands, Spain, October 1-4, 2003.

"How to Preserve the Meniscus. Round Table Chairman," *40th Spanish Orthopaedic Surgery and Traumatology Society Congress,* Tenerife, Canary Islands, Spain, October 1-4, 2003.

"The Use of the Healing Response Technique to Treat ACL Injuries in Patients Over 40 Years Old. Tissue Repair and Regeneration Techniques in Knee Surgery," *Dipartimento Di Scienze Ortopediche E Traumatologiche. "Mario Boni" Tissue Repair and Regeneration Techniques in Knee Surgery,* Varese, Italy, October 29-30, 2003.

"Collagen Meniscus Implants (CMI): The Vail Experience. Tissue Repair and Regeneration Techniques in Knee Surgery," *Dipartimento Di Scienze Ortopediche E Traumatologiche. "Mario Boni" Tissue Repair and Regeneration Techniques in Knee Surgery,* Varese, Italy, October 29-30, 2003.

"The Collagen Meniscus Implant (CMI)," *Sports Knee Surgery Symposium, The* University of Warwick, Coventry, United Kingdom, November 3-4, 2003.

"Biology and Basic Science of Articular Cartilage," *Sports Knee Surgery Symposium,* The University of Warwick, Coventry, United Kingdom, November 3-4, 2003.

"Comprehensive Approaches to Articular Cartilage Repair and Management: The Microfracture Technique," *National Cartilage Course for Sports Medicine Fellows,* Carlsbad, Calif., December 5-6, 2003.

Schlegel, T.F., M.D.
"Indications for the use of a Porcine Scaffold for Rotator Cuff Repairs," *13th Annual Winter Total Joints & Sports Medicine Symposium,* Park City, Utah, January 16-19, 2003.

Schlegel, T.F., M.D.; Hawkins, R.J., M.D.; Lewis, C.W.; Turner, A.S.:
"An In Vivo Comparison of the Modified Mason Allen versus a Horizontal Mattress Stitch on Tendon Healing to Bone: A Biomechanical and Histologic Study in Sheep," *ASES, American Academy of Orthopaedic Surgeons 70th Annual Meeting,* New Orleans, La., February 8, 2003.

Schlegel, T.F., M.D.; Martin, L., M.D.; Keller, J., M.D.; Boublik, M., M.D.; Hawkins, R.J., M.D.:
"The Use of Corticosteroids for Acute Acromioclavicular Separations," *National Football League Physicians Society Annual Sports Science Symposium,* Indianapolis, Ind., February 20, 2003.

"Indications for the Use of Porcine Scaffold for Rotator Cuff Repairs," *Concepts and Controversies in Total Joint Arthroplasty and Sports Medicine,* Palm Desert, Calif., March 2003.

Schlegel, T.F., M.D.; Hawkins, R.J., M.D.; Lewis, C.W.; Turner, A.S.:
"The Effects of Swine Small Intestine Submucosa Augmentation on Tendon Healing under Tension: Histological and Mechanical Evaluation in Sheep," *American Orthopaedic Society for Sports Medicine 29th Annual Meeting,* San Diego, Calif., July 22, 2003.

"Indications for the Use of Porcine Scaffold for Rotator Cuff Repairs," *Advances in Knee and Shoulder Arthroscopic Surgery,* Rosemont, Ill., July 31, 2003.

"Update on Arthroscopic Rotator Cuff Repairs," *Western Orthopaedic Summer Meeting — Rocky Mountain Chapter,* Colorado Springs, Colo., August 1, 2003.

"Microfracture for Articular Cartilage Lesions," *43rd Annual Winnipeg Orthopaedic Symposium,* Winnipeg, Manitoba, Canada, October 16-17, 2003.

"Current Concepts Rotator Cuff Repair," *43rd Annual Winnipeg Orthopaedic Symposium,* Winnipeg, Manitoba, Canada, October 16-17, 2003.

"Upper Extremity Injuries in the NFL," *43rd Annual Winnipeg Orthopaedic Symposium,* Winnipeg, Manitoba, Canada, October 16-17, 2003.

"Utilizing Porcine Collagen as Soft Tissue Reinforcement," *Advances in Knee and Shoulder Arthroscopic Surgery,* Rosemont, Ill., October 21-22, 2003.

Shelburne, K.B., Ph.D.; Torry, M.R., Ph.D.; Yanagawa, T., M.A.; Pandy, M.G., Ph.D.:
"Theoretical Analysis of the Flexed Knee Pattern in ACL Deficient Gait," *American Society of Mechanical Engineers Summer Bioengineering Conference,* Key Biscayne, Fla., June 25-29, 2003.

Steadman, R.J., M.D.
"ACL Injuries in Top Athletes," *3rd Basel International Knee Congress and Instructional Course,* Basel, Switzerland, January 29, 2003.

"Articular Cartilage Injury in the Athlete: Treatment Options in 2003," *American Academy of Orthopaedic Surgeons 69th Annual Instructional Course Meeting,* New Orleans, La., February 5, 2003.

"Lysis of Pretibial Patellar Tendon Adhesions (Anterior Interval Release) to Treat Anterior Knee Pain after ACL Reconstruction Anterior Interval Release," *American Academy of Orthopaedic Surgeons 69th Annual Co-Author Meeting,* New Orleans, La., February 5, 2003.

"Patient Satisfaction and Functional Outcome after Microfracture of the Degenerative Knee," *American Academy of Orthopaedic Surgeons 69th Annual Co-Author Meeting,* New Orleans, La., February 5, 2003.

"Microfracture: 11 Year Outcomes," *Arthroscopy Association of North American Specialty Day,* New Orleans, La., February 8, 2003.

"Microfracture," *International Society of Arthroscopy, Knee Surgery and Orthopedic Sports Medicine,* Auckland, New Zealand, March 10-14, 2003.

Steadman, J.R., M.D.; Cameron, M.L., M.D.; Briggs, K.K., M.P.H., M.B.A.; Rodkey, W.G., D.V.M.
"A Minimally Invasive Technique ('Healing Response') to Treat Acute ACL Injuries in Patients 40 Years and Older," Poster Presentation, *International Society of Arthroscopy, Knee Surgery, and Orthopaedic Sports Medicine Congress,* Auckland, New Zealand, March 10-14, 2003.

"Collagen Meniscus Implant," *Arthroscopy Association of North America Annual Meeting, Instructional Course Lecture, Meniscus Surgery Update 2003,* Phoenix, Ariz., April 24-27, 2003.

"The Degenerative Knee," *International Update on Osteoarthritis of the Knee,* Dallas, Texas, June 11, 2003.

"Arthroscopy of the Degenerative Knee," *Steadman-Hawkins Fellows Meeting,* Vail, Colo., July 10-12, 2003.

"The Healing Response Technique," *Kerlan-Jobe Annual Alumni Research Conference* , San Diego, Calif., July 18-19, 2003.

"The Degenerative Knee," *Kerlan-Jobe Annual Alumni Research Conference,* San Diego, Calif., July 18-19, 2003.

"The Degenerative Knee," *Current Issues of MRI 12th Annual Symposium,* San Francisco, Calif., August 24-27, 2003.

"Articular Cartilage: In Sickness and in Health," International Webcast, *Overcoming the Challenge of Degenerative Joint Disease by Pfizer,* Vail, Colo., September 25, 2003.

"Long-Term Results of Microfracture in Athletes," *Dipartimento Di Scienze Ortopediche E Traumatologiche.* "Mario Boni" *Tissue Repair and Regeneration Techniques in Knee Surgery,* Varese, Italy, October 29-30, 2003.

"The ACL Healing Response — Clinical Findings," *Dipartimento Di Scienze Ortopediche E Traumatologiche.* "Mario Boni" *Tissue Repair and Regeneration Techniques in Knee Surgery,* Varese, Italy, October 29-30, 2003.

"CMI — Our Experience," *Dipartimento Di Scienze Ortopediche E Traumatologiche.* "Mario Boni" *Tissue Repair and Regeneration Techniques in Knee Surgery,* Varese, Italy, October 29-30, 2003.

"Current Issues in ACL Surgery," *Sports Knee Surgery Symposium,* University of Warwick, United Kingdom, November 3-4, 2003.

"Management of DJD — Microfracture & Arthrolysis," *Sports Knee Surgery Symposium,* University of Warwick, United Kingdom, November 3-4, 2003.

"The Healing Response," *Sports Knee Surgery Symposium,* University of Warwick, United Kingdom, November 3-4, 2003.

"Abrasion Arthroplasty/Microfracture," *UCSF Comprehensive Knee Cartilage Symposium State of the Art in 2003,* San Francisco, Calif., November 8, 2003.

"Ski Injuries, Old and New," *Birds of Prey 2003, Federation of International Skiing Medical Symposium,* Beaver Creek, Colo., December 3, 2003.

Sterett, W.I., M.D.
"Posterior Tibial Slope following Medial Opening Wedge Proximal Tibial Osteotomy for Varus Arthrosis of the Knee," Poster Presentation, *American Academy of Orthpaedic Surgeons 70th Annual Meeting,* New Orleans, La., February 5-9, 2003.

Sterett, W.I., M.D.; Torry, M.R., Ph.D.; Shelburne, K.B., Ph.D.; Yanagawa, T., M.A.:
"Surgical Treatment, Rehabilitation and Functional Gait Analysis of High Tibial Osteotomy," *Rocky Mountain Chapter American College of Sports Medicine,* Denver, Colo., Feburary 20-23, 2003.

"High Tibial Osteotomy: Surgical Correction of the Varus Knee," *Rocky Mountain Chapter American College of Sports Medicine,* Denver, Colo., February 22, 2003.

"Determinants of Patient Satisfaction after Medial Opening Wedge High Tibial Osteotomy," *Arthroscopy Association of North America 22nd Annual Meeting,* Phoenix, Ariz., April 23-27, 2003.

"Technique and Determinants of Patient Satisfaction for Medial Opening Wedge HTO," *EBI Sports Medicine Physician Forum,* Parsippany, N.J., May 16, 2003.

"Unicompartmental Arthroplasty, HTO and Other Joint Preservation Techniques," *EBI Sports Medicine Physician Forum,* Parsippany, N.J., May 16, 2003.

Sterett, W.I., M.D.; Rich, V.J.; Barry, E.:
"Complications after HTO," *American Orthopaedic Society for Sports Medicine Annual Meeting,* San Diego, Calif., July 20-23, 2003.

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Sterett, W.I., M.D.; Steadman, J.R., M.D.:
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"Tibial rotation strength post-ACL reconstruction: a comparison of hamstring versus patellar tendon autografts," *Clinical Journal of Sports Medicine* (In review).

AWARD WINNING VIDEOS

The American Academy of Orthopaedic Surgeons has designated the following educational videos produced by the Foundation as award winners:

2003, *Anatomical Lateral Ligamentous Reconstruction of the Ankle Utilizing Autologous Hamstring Graph,* by Michael J. Curtin, M.D.; Robert T. Burks, M.D.; and Karen Melhart.

2002, *Diagnostic Wrist Arthroscopy, Equipment, Anatomy, and Surgical Technique,* by Randall W. Viola, M.D.; and Sumant G. Krishnan, M.D.

2001, *Repair of Injuries to the Extensor Mechanism: Quadriceps and Patellar Tendons,* by J. Richard Steadman, M.D.; Richard J. Hawkins, M.D.; and Spero Karas, M.D.

2000, *Arthroscopic Bankart Repair with Heat Probe Capsulorraphy Double and Single Anterior Cannula Techniques,* by Richard J. Hawkins, M.D.; and Michael J. Curtin, M.D.

1998, *Scapulothoracic Arthrodesis,* by Richard J. Hawkins, M.D.; Kenneth M. Oates, M.D.; Randall W. Viola, M.D., and Scott Mair, M.D.

1997, *Elbow Contracture Release: Through a Posterior Incision,* by Richard J. Hawkins, M.D.; Kenneth Faber, M.D.; and Steven B. Singleton, M.D.

1995, *Revision Anterior Cruciate Ligament Reconstruction,* by J. Richard Steadman, M.D.; Arlon Jahnke, M.D.; Mark T. Dean, M.D.; and Bruce Piatt, M.D.

Recognition

The Steadman◆Hawkins Sports Medicine Foundation is proud of the many advances it has made between 1988 and 2003.

These achievements are examples of the quality contributions made to orthopaedics and science.

FIFTEEN YEARS OF EXCELLENCE

In 15 years, more than 400 papers, 1,000 presentations, and 60 teaching videos have been accepted by peer reviewed medical/scientific publications and organizations for publication and/or presentation. Many have been award winners, including the following:

- At The American Academy of Orthopaedic Surgeons 70th Annual Meeting, two video presentations were selected as Award Winners: "Ulnar Collateral Ligament Reconstruction of the Elbow: The Docking Procedure," and "Anatomical Lateral Ligamentous Reconstruction of the Ankle Utilizing Autologous Hamstring Graph," by Michael J. Curtin, M.D.; Robert T. Burks, M.D.; and Karen Melhart, New Orleans, La., February 3-9, 2003.
- The American Society of Biomechanics selected the abstract, "Anterior-Cruciate Ligament Forces in the Intact Knee During Normal Gait," as winner in the 2002 Journal of Biomechanics Award competition. Kevin Shelburne, Ph.D., Marcus Pandy, Ph.D.; Frank C. Anderson, Ph.D.; and Michael Torry, Ph.D., jointly authored the abstract. The Award, one of the most prestigious in the biomechanics field, was presented to the Foundation's Biomechanics Research Laboratory at the Fourth World Congress on Biomechanics in August 2002 in Calgary.
- Staff Scientist Mike Decker of the Biomechanics Research Laboratory won the prestigious Scherb Award for his paper, "Mechanisms of Compensating for ACL Deficiency During Gait," at the XVIIIth Congress of the International Society of Biomechanics, held July 2001 in Zurich, Switzerland.
- In 2000, the Resident Fellow Clinical Research Award was presented to the Clinical Research Department and Fellows Drs. Mininder Kocher and John M. Wright by the Arthroscopy Association of North America for the paper "Determinants of Patient Satisfaction after Anterior Cruciate Ligament Reconstruction." Co-authors included J. Richard Steadman, M.D.; David Zurakowski, Ph.D.; Karen Briggs, M.B.A.; William I. Sterett, M.D.; and Richard J. Hawkins, M.D.
- John M. Wright, M.D., was a co-recipient of The Hip Society Otto Aufranc Award 2000 for coauthoring the research paper, "The Role of Labral Lesions in the Development of Early Degenerative Hip Disease."
- At the annual meeting of the American Orthopaedic Society for Sports Medicine in June 2000 the Clinical Research Department won the Aircast Clinical Investigational Award for the paper, "Acute PCL Injuries and Bone Bruising," by Fellow Scott D. Mair, M.D.
- Also in 2000, Dr. Michael Torry, Director of Biomechanics Research Laboratory, won the prestigious International Society of Biomechanics Clinical Biomechanics Award, given once every two years for outstanding research in the field of biomechanics and human performance. Dr. Torry's award-winning paper was titled "Intra-Articular Knee Joint Effusion Induces Quadriceps Avoidance Gait Patterns."
- Dr. J. Richard Steadman and Dr. William G. Rodkey were co-recipients of the GOTS-Beiersdorf Research Award 2000. The Award was given for a paper submitted describing the history of the Collagen Meniscus Implant from its inception to the present day. The GOTS-Beiersdorf Research Award is the most prestigious orthopaedic research award in the German-speaking world. It is presented only once every two-to-four years. Judged by a jury of internationally recognized experts from throughout the world, this award recognizes orthopaedic research that impacts on quality-of-life issues.

Associates

The Steadman◆Hawkins Sports Medicine 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 backgrounds in biomechanics, engineering, clinical research, veterinary science, and computer science. Together, they take a multidisciplinary approach to their work in solving orthopaedic sports medicine problems.

ADMINISTRATION

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Chief Executive Officer and President

John Welaj
Chief Operating Officer

Karyll Nelson
BioSkills Laboratory Director and Executive Assistant

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Vice President for Program Advancement

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Amy Ruther
Development Coordinator

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Director

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Director

Marilee Horan
Research Associate

BIOMECHANICS RESEARCH LABORATORY

Michael Torry, Ph.D.
Director

Kevin B. Shelburne, Ph.D.
Senior Staff Scientist

Takashi Yanagawa
Research Fellowship/Internship

EDUCATION

Greta Campanale
Coordinator

INFORMATION SYSTEMS

Jean Claude Moritz
Manager

VISUAL SERVICES

Joe Kania
Coordinator

Karen Melhart
Coordinator

Independent Accountants' Report

Board of Directors
Steadman◆Hawkins Sports Medicine Foundation
Vail, Colorado

We have audited the accompanying statements of financial position of Steadman◆Hawkins Sports Medicine Foundation as of December 31, 2003 and 2002, and the related statements of activities, cash flows and functional expenses for the years 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 audits.

We conducted our audits in accordance with auditing standards generally accepted in the United States of America. Those standards require that we plan and perform the audit to obtain reasonable assurance about whether the financial statements are free of material misstatement. 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 audits provide a reasonable basis for our opinion.

In our opinion, the financial statements referred to above present fairly, in all material respects, the financial position of Steadman◆Hawkins Sports Medicine Foundation as of December 31, 2003 and 2002, and the changes in its net assets and its cash flows for the years then ended in conformity with accounting principles generally accepted in the United States of America.

BKD, LLP

February 6, 2004
Colorado Springs, CO

Statements of Financial Position

DECEMBER 31, 2003 AND 2002

ASSETS

	2003	2002
Cash	**$ 255,752**	$ 444,068
Accounts receivable	**357,067**	261,569
Accounts receivable, related party	**1,434**	32,203
Investments	**2,260,949**	1,822,333
Contributions receivable	**115,833**	71,334
Contributions receivable, related party	**31,500**	31,000
Prepaid expenses and other	**39,823**	13,079
Property and equipment, net	**313,969**	120,540
Total assets	**$ 3,376,327**	$ 2,796,126

Liabilities and Net Assets

Accounts payable	**$ 20,267**	$ 46,223
Accrued expenses	**67,871**	57,827
Deferred revenue	**18,900**	–
Total liabilities	**107,038**	104,050
Net Assets		
Unrestricted	**2,901,361**	2,233,119
Temporarily restricted	**367,928**	458,957
Total net assets	**3,269,289**	2,692,076
Total liabilities and net assets	**$ 3,376,327**	$ 2,796,126

See Notes to Financial Statements

Statements of Activities

YEAR ENDED DECEMBER 31, 2003

	Unrestricted	Temporarily Restricted	Total
REVENUES, GAINS AND OTHER SUPPORT			
Corporate partner support	$ 886,223	$ 27,000	$ 913,223
Contributions	730,199	477,490	1,207,689
Grants	1,825	219,625	221,450
Fundraising events, net of $376,038 of expenses	90,114	–	90,114
Fellows and other meetings	8,100	–	8,100
Video income	55,224	–	55,224
Other income	16,876	–	16,876
Net assets released from restrictions	815,144	(815,144)	0
Total revenues, gains and other support	2,603,705	(91,029)	2,512,676
EXPENSES			
Biomechanics research program	400,040	–	400,040
Basic science program	156,125	–	156,125
Clinical research program	346,243	–	346,243
Education program	259,457	–	259,457
Office of Information Services	248,614	–	248,614
Management and general	577,243	–	577,243
Fundraising	394,042	–	394,042
Total expenses	2,381,764	–	2,381,764
OTHER INCOME			
Investment income	446,301	–	446,301
CHANGE IN NET ASSETS	668,242	(91,029)	577,213
NET ASSETS, BEGINNING OF YEAR	2,233,119	458,957	2,692,076
NET ASSETS, END OF YEAR	$ 2,901,361	$ 367,928	$ 3,269,289

See Notes to Financial Statements

Statements of Activities

YEAR ENDED DECEMBER 31, 2002

	Unrestricted	Temporarily Restricted	Total
REVENUES, GAINS AND OTHER SUPPORT			
Corporate partner support	$ 902,750	$ 115,400	$ 1,018,150
Contributions	702,237	368,533	1,070,770
Grants	41,500	105,137	146,637
Fundraising events, net of $71,378 of expenses	31,324	–	31,324
Fellows and other meetings	59,827	–	59,827
Video income	11,239	–	11,239
Other income	10,967	–	10,967
Net assets released from restrictions	423,218	(423,218)	0
Total revenues, gains and other support	2,183,062	165,852	2,348,914
EXPENSES			
Biomechanics research program	377,459	–	377,459
Basic science program	174,798	–	174,798
Clinical research program	342,455	–	342,455
Education program	362,601	–	362,601
Office of Information Services	235,076	–	235,076
Management and general	510,291	–	510,291
Fundraising	456,226	–	456,226
Total expenses	2,458,906	–	2,458,906
OTHER INCOME (LOSS)			
Investment loss	(266,069)	–	(266,069)
CHANGE IN NET ASSETS	(541,913)	165,852	(376,061)
NET ASSETS, BEGINNING OF YEAR	2,775,032	293,105	3,068,137
NET ASSETS, END OF YEAR	$ 2,233,119	$ 458,957	$ 2,692,076

See Notes to Financial Statements

Statements of Cash Flows

YEARS ENDED DECEMBER 31, 2003 AND 2002

	2003	2002
OPERATING ACTIVITIES		
Change in net assets	**$ 577,213**	$ (376,061)
Items not requiring (providing) cash		
Depreciation	**87,633**	221,256
Realized and unrealized (gains) losses on investments	**(418,128)**	291,672
In-kind contributions of investments	**(116,280)**	(151,800)
Changes in		
Accounts receivable	**(64,729)**	(204,223)
Contributions receivable	**(44,999)**	13,933
Prepaid expenses	**(26,744)**	1,002
Accounts payable	**(25,956)**	(72,467)
Accrued expenses	**10,044**	(72,925)
Deferred revenue	**18,900**	–
Net cash used in operating activities	**(3,046)**	(349,613)
INVESTING ACTIVITIES		
Purchase of property and equipment	**(281,062)**	(1,859)
Purchases of investments	**(1,006,813)**	(89,266)
Sales of investments	**1,102,605**	419,321
Net cash (used in) provided by investing activities	**(185,270)**	328,196
DECREASE IN CASH	**(188,316)**	(21,417)
CASH, BEGINNING OF YEAR	**444,068**	465,485
CASH, END OF YEAR	**$ 255,752**	$ 444,068

See Notes to Financial Statements

Statements of Functional Expenses

YEAR ENDED DECEMBER 31, 2003

Programs	Biomechanics Research	Basic Science	Clinical Research	Education	Office of Information Services	Total	Management and General	Fundraising	Total
Salary and benefits	$ 272,908	$ 21,560	$ 229,289	$ 98,127	$ 148,232	$ 770,116	$ 263,355	$ 175,183	$ 1,208,654
Payroll taxes	16,357	1,627	14,659	6,295	8,444	47,382	11,465	10,329	69,176
Entertainment	–	–	–	422	–	422	–	–	422
Travel	6,277	5,573	6,559	40,609	6,661	65,679	15,532	4,326	85,537
Utilities	4,768	3,785	2,142	2,150	4,620	17,465	4,506	2,004	23,975
Telephone	5,871	326	6,339	1,712	3,855	18,103	6,012	2,901	27,016
Consulting and contract labor	22,839	92,384	26,033	5,072	5,146	151,474	203,990	45,733	401,197
Legal and accounting	6,296	266	5,435	1,546	4,180	17,723	4,065	4,057	25,845
Postage and freight	2,661	300	2,852	1,211	2,380	9,404	2,186	3,145	14,735
Exhibits and meetings	850	–	2,414	61,493	83	64,840	189	359	65,388
Research projects	32,142	–	698	10,722	–	43,562	–	–	43,562
Facility rent	9,564	6,842	21,397	3,888	8,247	49,938	3,637	4,106	57,681
Promotion	189	3	703	528	136	1,559	826	44,390	46,775
Repair, maintenance and equipment	4,183	189	4,736	812	2,471	12,391	3,998	1,682	18,071
Board and SAC meeting	–	–	–	5,322	–	5,322	1,191	1,059	7,572
Dues, subscriptions, books and journals	766	–	–	7,689	–	8,455	74	1,418	9,947
General insurance	–	–	–	–	–	–	30,917	–	30,917
Printing	1,828	245	6,947	1,410	1,172	11,602	1,273	46,101	58,976
Supplies	7,912	3,241	6,602	1,502	15,861	35,118	3,618	4,453	43,189
Program support	307	19	283	66	189	864	311	22,004	23,179
Depreciation	3,526	19,704	6,638	7,034	36,318	73,220	7,236	7,177	87,633
Other	796	61	2,517	1,847	619	5,840	12,862	13,615	32,317
	$ 400,040	$ 156,125	$ 346,243	$ 259,457	$ 248,614	$ 1,410,479	$ 577,243	$ 394,042	$ 2,381,764

Statements of Functional Expenses

YEAR ENDED DECEMBER 31, 2002

Programs	Biomechanics Research	Basic Science	Clinical Research	Education	Office of Information Services	Total	Management and General	Fundraising	Total
Salary and benefits	$263,834	$24,558	$210,604	$61,242	$153,995	$714,233	$211,923	$170,414	$1,096,570
Payroll taxes	17,730	1,519	14,009	5,654	8,818	47,730	5,363	10,504	63,597
Entertainment	250	673	53	24,479	–	25,455	1,890	36,616	63,961
Travel	12,130	3,162	2,257	55,654	5,939	79,142	74,425	7,764	161,331
Utilities	8,236	3,753	–	816	3,158	15,963	2,974	1,538	20,475
Telephone	5,989	2,785	11,018	5,020	5,786	30,598	10,598	4,861	46,057
Consulting and contract labor	18,324	89,747	22,429	2,116	2,363	134,979	6,264	44,390	185,633
Legal and accounting	9,704	2,031	6,429	2,153	2,399	22,716	2,906	10,883	36,505
Postage and freight	1,266	675	5,723	1,409	1,264	10,337	1,832	6,894	19,063
Exhibits and meetings	3,442	500	315	103,606	–	107,863	35	67	107,965
Research projects	(979)	–	(496)	50,433	–	48,958	–	–	48,958
Facility rent	8,031	4,002	26,593	1,357	4,057	44,040	7,214	2,656	53,910
Promotion	27	54	27	372	54	534	685	67,495	68,714
Repair, maintenance and equipment	7,212	4,118	16,971	8,909	6,655	43,865	5,898	4,082	53,845
Board and SAC meeting	–	–	–	7,608	–	7,608	3,382	7,634	18,624
Dues, subscriptions, books and journals	1,106	82	50	5,386	58	6,682	164	1,203	8,049
General insurance	–	–	–	–	–	–	27,247	250	27,497
Printing	4,202	452	6,072	6,567	2,156	19,449	5,611	36,398	61,458
Supplies	3,200	6,636	5,447	990	4,646	20,919	8,096	5,470	34,485
Program support	248	85	263	13,711	399	14,706	–	7,596	22,302
Depreciation	13,123	29,879	10,147	4,493	33,264	90,906	126,194	4,156	221,256
Other	384	87	4,544	626	65	5,706	7,590	25,355	38,651
	$377,459	$174,798	$342,455	$362,601	$235,076	$1,492,389	$510,291	$456,226	$2,458,906

Notes to Financial Statements

YEARS ENDED DECEMBER 31, 2002 AND 2001

NATURE OF OPERATIONS AND SUMMARY OF SIGNIFICANT ACCOUNTING POLICIES

Nature of Operations
Steadman◆Hawkins Sports Medicine Foundation (the Foundation) is a not-for-profit foundation located in Vail, Colorado that is organized for educational and scientific purposes to advance medical science and research. The Foundation's primary sources of support are public donations and grants and corporate partners.

Corporate Partners
The Foundation has agreements with several corporations where the Foundation's research and product development is provided to the corporation in exchange for an annual payment to the Foundation. These agreements are recorded as income in the year payment is due.

Contributions
Gifts of cash and other assets received without donor stipulations are reported as unrestricted revenue and net assets. Gifts received with a donor stipulation that limits their use are reported as temporarily or permanently restricted revenue and net assets. 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 revenue and net assets unless explicit donor stipulations specify how such assets must be used in which case the gifts are reported as temporarily or permanently restricted revenue and net assets. 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.

Cash
At December 31, 2003, the Foundation's cash accounts exceeded federally insured limits by approximately $134,000.

Accounts Receivable
Accounts receivable are stated at the amount billed to customers. The Foundation provides an allowance for doubtful accounts, which is based upon a review of outstanding receivables, historical collection information and existing economic conditions. Accounts receivable are ordinarily due 30 days after the issuance of the invoice. Accounts past due more than 120 days are considered delinquent. Delinquent receivables are written off based on individual credit evaluation and specific circumstances of the customer.

Property and Equipment
Property and equipment are depreciated over the estimated useful life of each asset. Leasehold improvements are depreciated over the shorter of the lease term plus renewal options or the estimated useful lives of the improvements.

Investments and Investment Return
Investments in equity securities having a readily determinable fair value and all debt securities are carried at fair value. Investment return includes dividend, interest and other investment income and realized and unrealized gains and losses on investments carried at fair value. Investment return is reflected in the statements of activities as unrestricted or temporarily restricted based upon the existence and nature of any donor or legally imposed restrictions.

Use of Estimates
The preparation of financial statements in conformity with accounting principles generally accepted in the United States of America 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 revenues, expenses, gains, losses and other changes in net assets during the reporting period. Actual results could differ from those estimates.

Income Taxes
The Foundation is a qualifying organization under Section 501(c)(3) of the Internal Revenue Code and a similar provision of state law. Consequently, no provision for income taxes has been made in the financial statements.

Reclassifications
Certain reclassifications have been made to the 2002 financial statements to conform to the 2003 financial statement presentation. These reclassifications had no effect on the change in net assets.

INVESTMENTS AND INVESTMENT RETURN

Investments at December 31 consist of the following:

2003	2002	
Stock and equity funds	**$ 1,042,178**	$ 882,811
Equity securities	**903,094**	471,614
Fixed income funds	**177,600**	414,255
Money market funds	**138,077**	53,653
$ 2,260,949	**$ 1,822,333**	

At December 31, 2003 and 2002, approximately 86% and 74%, respectively, of the Foundation's investments consisted of equity securities and equity mutual funds.

Investment income during 2003 and 2002 consists of the following:

	2003	2002
Interest and dividend income	**$ 28,173**	$ 25,603
Net realized and unrealized gains (losses) on investments	**418,128**	(291,672)
Investment income (loss)	**$ 446,301**	$ (266,069)

CONTRIBUTIONS RECEIVABLE

Contributions receivable at December 31 are due as follows:

	2003	2002
Due in less than one year	**$104,000**	$ 79,200
Due in one to five years	**50,000**	25,000
	154,000	104,200
Less unamortized discount	**(6,667)**	(1,866)
Due from related parties	**(31,500)**	(31,000)
	$115,833	$ 71,334

Approximately 37% and 48% of total contributions receivable at December 31, 2003 and 2002, respectively, are from one donor.

The Foundation receives support and pledges from members of the Board of Directors and employees. These pledges receivable are included in contributions receivable, related party.

PROPERTY AND EQUIPMENT

Property and equipment at December 31 consists of the following:

	2003	2002
Equipment	**$ 734,979**	$1,426,439
Furniture and fixtures	**22,326**	45,984
Leasehold improvements	**258,736**	731,780
	1,016,041	2,204,203
Less accumulated depreciation	**702,072**	2,083,663
	$ 313,969	$ 120,540

TEMPORARILY RESTRICTED NET ASSETS

Temporarily restricted net assets at December 31 are available for the following purposes:

	2003	2002
Education	**$ 185,200**	$ 104,541
Unrestricted contributions receivable	**87,333**	102,334
Biomechanics research	**65,912**	230,368
Administration	**29,483**	–
Basic science	**–**	21,714
	$ 367,928	$ 458,957

RELEASE OF TEMPORARILY RESTRICTED NET ASSETS

Net assets were released from donor restrictions by incurring expenses satisfying the restricted purposes or by occurrence of other events specified by donors as follows:

	2003	2002
Purpose restrictions accomplished		
Biomechanics research	**$ 345,269**	$ 41,614
Education	**234,816**	245,416
Administration	**192,739**	–
Basic science programs	**27,319**	19,000
Clinical research	**–**	57,250
	800,143	363,280
Time restrictions expired		
Collection of contributions receivable	**15,001**	59,938
Total restrictions released	**$ 815,144**	$ 423,218

OPERATING LEASES

Noncancellable operating leases for property and equipment expire in various years through 2008. Two of the property leases require the Foundation to pay all executory costs (property taxes, maintenance and insurance). Future minimum lease payments at December 31, 2003 are:

2004	$71,932
2005	63,433
2006	62,183
2007	60,932
2008	60,932
	$319,412

Rental expense of $97,603 and $115,661 for the years ended December 31, 2003 and 2002, respectively, is recorded in the statements of activities.

PENSION PLAN

The Foundation has a defined contribution pension plan under IRS Section 401(k). The plan is open to all employees after one year of employment. The Foundation's contributions to the plan are determined annually. The Foundation elected to match 50% of participants' contributions up to 6% during 2003 and 2002. Under this formula, the Foundation made contributions of $14,488 and $19,147 for the years ended December 31, 2003 and 2002, respectively.

SIGNIFICANT ESTIMATES AND CONCENTRATIONS

Accounting principles generally accepted in the United States of America require disclosure of certain significant estimates and current vulnerabilities due to certain concentrations. Those matters include the following:

CORPORATE PARTNERS

During 2003 and 2002, approximately 70% and 59%, respectively, of all corporate partner support was received from three corporate partners.

Steadman◆Hawkins Sports Medicine Foundation
A 501(c)(3) nonprofit organization

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