# Orthopaedic Excellence

A publication from Midwest Orthopaedics at Rush (MOR)
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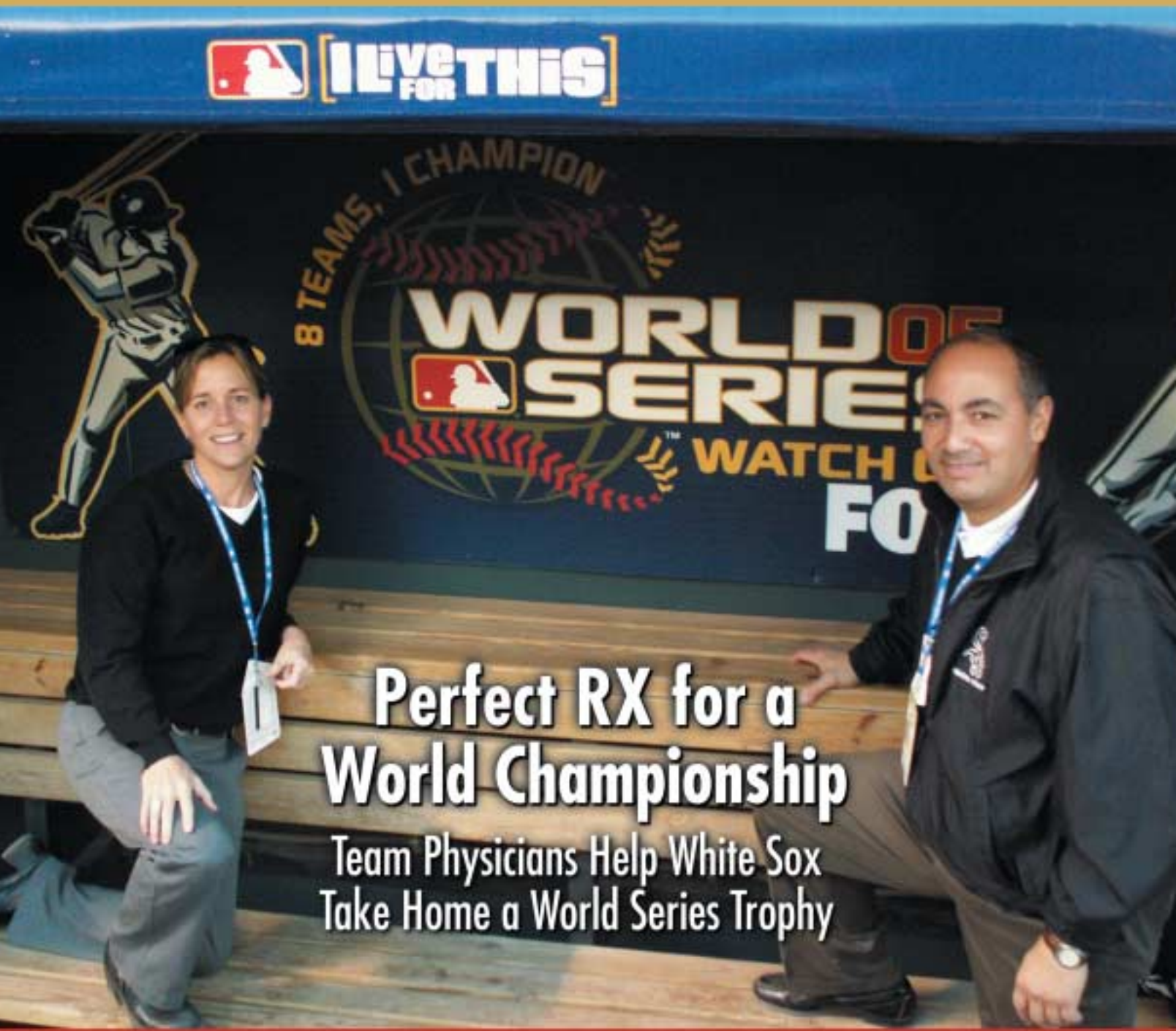
Midwest Orthopaedics at Rush Makes the Grade...and the Cover!
— See page 6




## Perfect RX for a World Championship

Team Physicians Help White Sox Take Home a World Series Trophy

**Preserving Motion:** Total Disc Replacement May Provide Alternatives to Fusion Surgery

**Minimally Invasive Fracture Surgery:** An Overview

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Orthopaedic Excellence

Volume 2 • Issue 3




# In this issue



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# President's Letter

Let me first wish everyone all the best for 2006 and beyond. I hope 2005 was as fun and exciting for you and your organizations as it was for me and Midwest Orthopaedics at Rush (MOR). My personal involvement in the White Sox World Series Championship was an absolute blast, something I'll always remember. We were also excited about the improvement in the Rush Orthopaedic Department's *U.S. News and World Report* ranking from tenth in the country in 2004 to eighth in 2005. We believe our close collaboration with Rush University Medical Center, Rush University, and the Department of Orthopaedics at Rush will enable us to keep providing the best possible care to your patients as we advance our standing among the nation's best orthopaedic programs.

MOR continued to expand in 2005 with the addition of Rush physicians Steve Gitelis, MD, and Walt Virkus, MD. Drs. Gitelis and Virkus will enhance our clinical capabilities in orthopaedic oncology, in which they both have a nationally recognized practice, and orthopaedic trauma, which Dr. Virkus practices. This broadening of our service should benefit your patients and organizations. We also strengthened our primary care sports medicine program by bringing on board Trish Palmer, MD, from the University of Utah, and bolstered our spine section with the skills of Kern Singh, MD. Dr. Singh joined us in September 2005 after completing a spine surgery fellowship at Emory University. All four of these physicians will increase and improve our ability to provide care to your patients as conveniently and efficiently as possible.

In 2006, we will expand our foot and ankle section with the addition of Johnny Lin, MD. Dr. Lin is completing his foot and ankle fellowship at the University of Tennessee's Campbell Clinic and will join our practice in September. We are also planning to add a joint replacement physician at Rush and a primary care sports medicine physician at our Central DuPage Hospital (CDH) office. We think these new staff members will help us provide more timely care for your patients. Having the right physicians in MOR is the most important responsibility our group undertakes. Each addition to our practice involves much scrutiny and deliberation. Growing the organization is not our goal. Rather, we want to bring in physicians who will best serve your needs and those of your patients. In some areas, we continue to struggle with meeting the demand for our services and providing care in an appropriate, patient-friendly timeframe. The addition of the new physicians mentioned here should help us address this issue.

In August 2005, we opened a new office in CDH's new Ambulatory Services Pavilion. We look forward to expanding our presence at this location and in the western suburbs. We also enlarged our administrative offices in Westchester to accommodate current and future growth. This summer, we plan to open a new clinic next to the Westchester administrative site. We are also evaluating a dedicated orthopaedic outpatient clinic on the Rush campus that would allow us to consolidate our existing fragmented Rush Professional Office Building and downtown facilities. We plan to open in 2009 as we move ahead with this project. We look forward to continuing our sports medicine/team medical services programs with the Chicago White Sox, Chicago Bulls, Chicago Rush, Chicago Bandits, Chicago Blaze, and Chicago Steel. We hope to expand these programs in 2006 by adding the Chicago Force, a new women's professional football team, as well as by implementing an outreach program focused on providing athletic training, injury prevention, and safety programs and services to sports clubs across the Chicago area.

We would like to hear from each and every one of you regarding your experiences — good and bad — with our organization. Please feel free to contact me or our CEO, Dennis Viellieu, at 708-236-2611 if we can help you with anything.

God bless and have a great year.

Charles A. Bush-Joseph, MD
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**Orthopaedic Excellence**

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Midwest Orthopaedics at RUSH

# Physician Listing

**Howard An, MD**
Spine, Back, and Neck

**Gunnar Andersson, MD**
Spine, Back, and Neck

**Bernard Bach Jr., MD**
Sports Medicine

**Richard Berger, MD**
Joint Reconstruction

**Charles Bush-Joseph, MD**
Sports Medicine

**Mark Cohen, MD**
Hand, Wrist, and Elbow

**Brian Cole, MD**
Sports Medicine, Cartilage Restoration

**Craig Della Valle, MD**
Joint Reconstruction

**John Fernandez, MD**
Hand, Wrist, and Elbow

**April Fetzer, DO**
Physical Medicine/Pain Management

**Joseph Fillmore, MD**
Physical Medicine/Pain Management

**Jorge Galante, MD**
Joint Reconstruction

**Steven Gitelis, MD**
Orthopaedic Oncology/Joint Reconstruction

**Edward Goldberg, MD**
Spine, Back, and Neck

**George Holmes Jr., MD**
Foot and Ankle

**Joshua Jacobs, MD**
Joint Reconstruction

**Simon Lee, MD**
Foot and Ankle

**Gregory Nicholson, MD**
Sports Medicine and Shoulder

**Trish Palmer, MD**
Sports Medicine and Women's Sports Medicine

**Wayne Paprosky, MD**
Joint Reconstruction

**Frank Phillips, MD**
Spine, Back, and Neck

**Anthony Romeo, MD**
Sports Medicine, Elbow, and Shoulder

**Aaron Rosenberg, MD**
Joint Reconstruction

**Mitchell Sheinkop, MD**
Joint Reconstruction

**Kern Singh, MD**
Spine, Back, and Neck

**Scott Sporer, MD**
Joint Reconstruction

**Nikhil Verma, MD**
Sports Medicine and Shoulder

**Walter Virkus, MD**
Orthopaedic Oncology/Trauma

**Kathleen Weber, MD**
Sports Medicine and Women's Sports Medicine

**Yejia Zhang, MD**
Physical Medicine/Pain Management

# Chairman's Letter

The Department of Orthopaedic Surgery at Rush University Medical Center had a banner year in 2005, one marked in particular by the opening and success of the Spine and Back Center. The new center further enhances clinical collaboration across orthopaedics, neurosurgery, and physiatry clinicians and specialties, resulting in better, more comprehensive care for patients. We are looking forward to this program's continued success and expansion.

We are also very happy to note that our orthopaedic program improved in national ranking from tenth to eighth in *U.S. News and World Report's* "Best Hospitals" issue. As we move ahead, we will continue to work hard and focus on innovation to maintain our place among the top institutions in the United States.

On the individual front, some of our foremost physicians have once again been recognized and named to leadership positions at the national level. Bernie Bach, MD, Director of Sports Medicine at Rush, has been named President of the Herodicus Sports Medicine Society and President-Elect of the American Orthopaedic Society for Sports Medicine, the world's most renowned sports medicine organization. In 2005, Bernie was also named to the endowed Claude Lambert–Susan Thompson Chair in Orthopaedics.

Honors also went to Josh Jacobs, MD, who was elected President of the Orthopaedic Research Society, a very prominent, prestigious national post in orthopaedics. Dr. Jacobs chairs the American Association of Orthopaedic Surgeons' Council on Research and is a member of the National Institutes of Health Advisory Council on Musculoskeletal Research, as well.

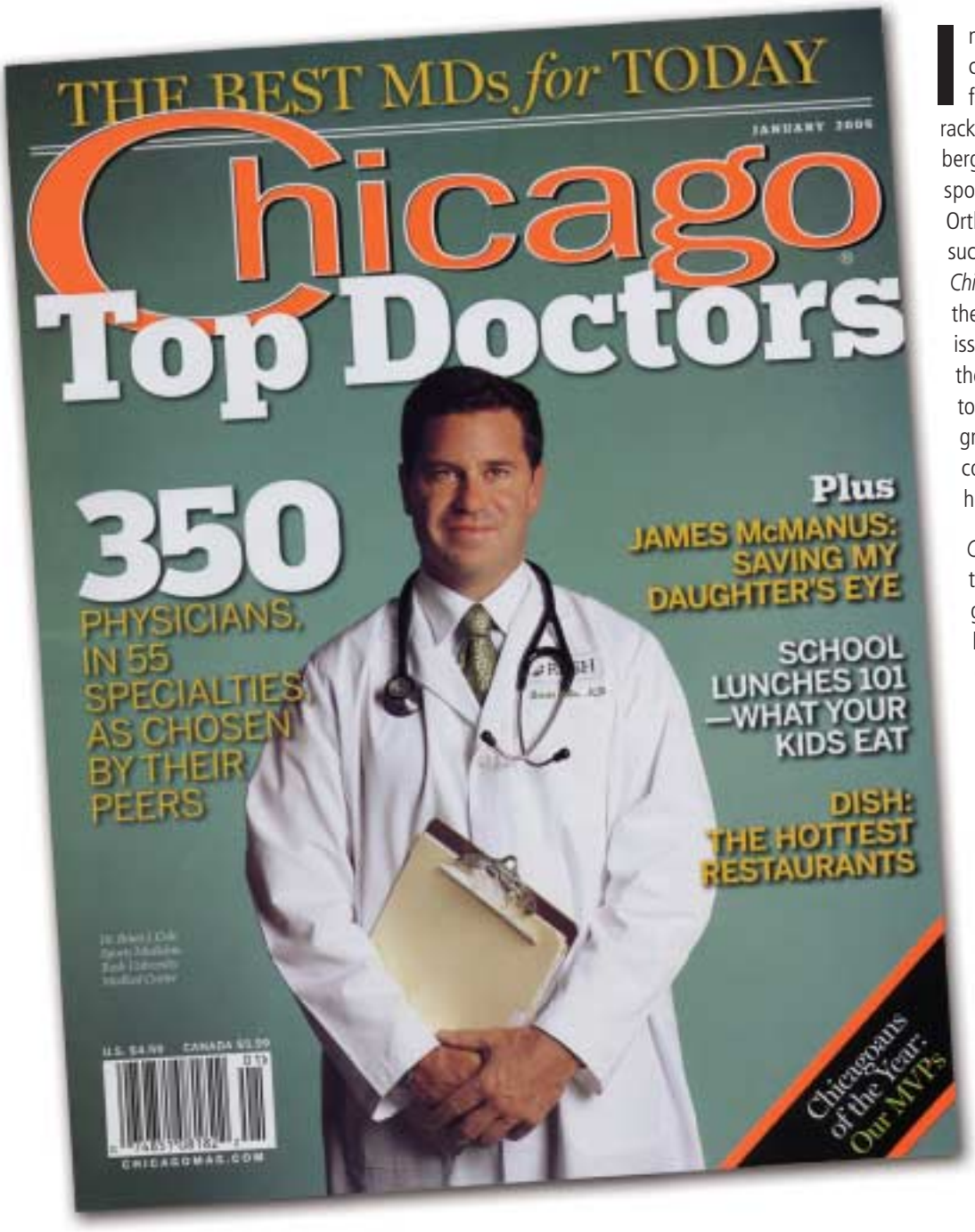
In other news, the department is developing a single destination facility for delivering outpatient orthopaedic care at Rush through Rush University Medical Center and Midwest Orthopaedics at Rush. A new facility of this type on Rush's campus can become a national orthopaedic destination for patients, students, and clinicians. This collaboration could also improve the quality of our research, the delivery of our care, and the integration of our services across multiple specialties. It is a dream we hope to realize.

Best regards,

Gunnar Andersson, MD, PhD
Department of Orthopaedic Surgery
Rush University Medical Center

# Midwest Orthopaedics at Rush Makes the Grade...and the Cover!

## Staff Physicians Win Repeat Honors as 'Top Doctors'




Imagine walking into your local grocery or convenience store and discovering your own face staring back at you from the magazine rack. How would you feel? Surprised? Flabbergasted? Embarrassed? Brian J. Cole, MD, a sports medicine physician with Midwest Orthopaedics at Rush (MOR), describes just such an experience as "a bit unnerving." *Chicago Magazine* honored Dr. Cole as one of the area's "Top Doctors" in its January 2006 issue and put him on the front cover. Once the initial shock passed, Dr. Cole found much to appreciate in the recognition. "It was a great honor being selected and put on the cover, not to mention a lot of fun," he says.

*Chicago Magazine* also profiled Dr. Cole in the inside pages. The story focused on his groundbreaking research and work in cartilage transplantation and in shoulder, elbow, and knee arthroscopy. The article also noted his roles as head team physician for the Chicago Bulls and team physician for the Chicago White Sox.

Three other MOR physicians joined Dr. Cole in being honored as "Top Doctors." The first is Bernard R. Bach Jr., MD. Dr. Bach directs the Rush sports medicine program. He is also President of the Herodicus Sports Medicine Society, President-Elect of the American Orthopaedic Society for Sports Medicine, and recipient of the Claude Lambert–Susan Thompson Endowed Chair in Orthopaedics. Dr. Bach has been selected as a "Top Doctor" five consecutive times.

Another honoree was Mark S. Cohen, MD, a hand-and-elbow surgeon who received "Top Doctor" recognition for the fourth consecutive time since joining the practice. Dr. Cohen has directed the Hand and Elbow Section at Rush since 1993. He also serves as Director of Education in Rush's Department of Orthopaedics. Dr. Cohen has won several research and teaching awards, written 60 scientific papers, and given more than 160 national and international speeches on hand, wrist, and elbow conditions.

Also acknowledged was Jorge O. Galante, MD. Dr. Galante is a founding member of MOR and a worldwide pioneer in joint replacement. For more than four decades, he has earned worldwide recognition, including many national and international awards for his research and clinical contributions in the field of total hip and total knee replacement. Dr. Galante has also been selected as a "Top Doctor" multiple times.

In some respects, Chicago Magazine's choosing MOR physicians for its 2006 "Top Doctors" list came as no surprise. MOR member and long-time Chairman of the Department of Orthopaedics at Rush, Gunnar Andersson, MD, PhD, points out that MOR is an academically affiliated practice whose physicians subspecialize in specific orthopaedic areas. According to Dr. Andersson, this relationship gives them a certain renown in their field. In addition, MOR physicians are heavily involved with Rush University Medical Center's fellowship programs in three of the subspecialties, which promote name recognition as well. "These are some of the main reasons for the practice's success in the "Top Doctor" rankings," he says.

Midwest Orthopaedics at Rush is a 30-physician, highly subspecialized orthopaedic group practice. *U.S. News & World Report* has ranked the orthopaedic program at Rush as eighth in the nation and first in Illinois. MOR physicians are board certified and fellowship trained in their subspecialties, hold academic appointments at Rush Medical College, are on the medical staff at Rush University Medical Center, and are active in research. The physicians also provide services at Central DuPage and Oak Park Hospitals. ●

*For more information about MOR and its physicians, please visit www.rushortho.com or call 877-MD-BONES.*

# A Sporting Chance

## Brian J. Cole, MD, MBA, Sports Medicine, Rush University Medical Center

As director of the Cartilage Restoration Center at Rush, Brian J. Cole, MD, MBA, uses cutting-edge orthopaedic, rehabilitative, and transplant techniques to treat shoulder, elbow, and knee injuries, while also serving as one of the team physicians for the Bulls and the White Sox and as orthopaedic consultant to the Rush, the local arena-football franchise. He lives in Lincoln Park with his wife, Emily, an assistant state's attorney, and their three children. "My family loves going to the games," says Cole, 43. "My kids don't know what it's like to sit in a regular seat. They have no idea how good they have it."

***Q. Do you have any tips for the average weekend athlete?***

A. I think cross-training is important, rather than just focusing on one exercise, like running. Don't give up running, but find some alternatives, like swimming or ellipticals. Nutrition is clearly important, but people overlook it.

***Q. If you do suffer a sports injury, when should you see a doctor?***

A. If there is a joint involved and significant pain that does not go away quickly; if there is swelling, stiffness, or any numbness or tingling — those are things that need to be evaluated. You should see someone — it could be your primary-care physician — who can assess whether this is something that needs immediate attention or something that can be watched to the point of resolution.

***Q. What is the impact of age on a person's ability to participate in athletic activities?***

A. A component that often gets overlooked is the emotional aspect of what happens as we age. I'm going through it myself. I think about it every single day: what would it mean if I couldn't run, if I couldn't lift weights, if I couldn't be active with my kids? You would be amazed at the psychological impact that something as simple as knee pain can have on an individual. So there is nothing better than when a patient comes in for a follow-up and says, "You changed my life, because I no longer have pain."

***Q. What is different about treating a professional athlete?***

A. The first thing is, you always need to look at these people as patients, as individuals with physical problems. But you are trying to safely return them to play and you are trying to move very quickly. So we do things that we obviously wouldn't do to the general population to try and encourage rapid healing and rehabilitation.

***Q. Last March, after Eddy Curry, the Bulls' young center, experienced potentially life-threatening heart problems, the team sat him down through the end of the season and the playoffs before finally trading him to the New York Knicks. John Paxson, the team's general manager, was criticized for how he handled the situation. Was that criticism justified?***

A. We wanted to do the right thing for Eddy Curry as a human being. John Paxson never let the goal of "we have to win a game" usurp letting all the physicians involved make what they felt was the right medical decision. He did for Eddy what he would have done for his own son. ●

# Lateral Epicondylitis: Causes and Treatments

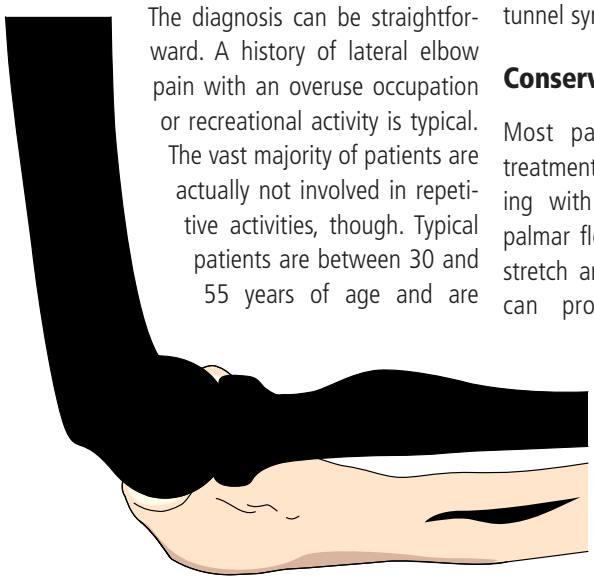
## Patience Is a Prime Factor in Recovery from Tennis Elbow

**By Gregory P. Nicholson, MD**

Lateral epicondylitis (tennis elbow) was first described over a hundred years ago. The condition is most prevalent in the fourth and fifth decade of life and is usually the result of overuse. The name actually is inappropriate, because the condition is not an inflammation of the tendon, but a tendinosis (a degenerative condition) of the tendon origin of the common extensor tendons of the forearm, primarily the extensor carpi radialis brevis (ECRB).

Studies have shown that the pathology involves microtears of the tendon with noninflammatory granulation-type tissue replacing the tendon substance. This small area is the origin of the pain. It is truly a "princess and the pea" phenomenon, with the area of tendon pathology being quite small. A similar process can be seen in "jumper's knee" of the patella tendon and in Achilles' tendon degeneration.

The diagnosis can be straightforward. A history of lateral elbow pain with an overuse occupation or recreational activity is typical. The vast majority of patients are actually not involved in repetitive activities, though. Typical patients are between 30 and 55 years of age and are certainly active. The activity is sporadic in intensity, however, and this unevenness may be a contributing factor. Thus, it is not necessary to be involved in repetitive work or sports to be afflicted with the symptoms of lateral epicondylitis.



**Lateral view of the elbow joint showing relative positions of skeletal structures (humerus, radius, and ulna)**

### Diagnosing the Problem

Physical examination will reveal tenderness over the tendon origin at the lateral epicondyle. This pain will be accentuated with resisted wrist extension with the elbow flexed. The pain may be worsened when resisted wrist extension is performed with the elbow positioned in extension.

Resisted long finger extension can help to delineate radial tunnel syndrome symptoms, which are localized more distal to the lateral epicondyle on the forearm. The differential diagnosis can include intraarticular elbow pathology (such as a plica, synovitis, or radiocapitellar joint pathology), radial tunnel syndrome, and cervical disease.

### Conservative Treatments First

Most patients will respond to conservative treatment for lateral epicondylitis. Gentle stretching with the elbow extended and the wrist palmar flexed to place the extensor tendons on stretch and then massage to the tendon origin can provide compliance and pain relief. Progressive, resistive exercise below the pain level can be specified for the forearm muscles.

Counterforce bracing can help "fool" the tendon origin into seeing less force and allow the tendon to heal. Avoiding lifting with the forearm in pronation can help. Injections are not usually indicated, because this condition is degenerative, not inflammatory; however, early in the recovery process a one-time steroid injection can relieve pain and facilitate rehabilitation. Repeated steroid injections are not advised. This condition is stubborn, and the patient should be informed of the variability in symptom intensity over time. It can take six to nine months for symptoms to resolve.

Because of the variability in etiology and time course of resolution of symptoms, many differing types of treatments have been attempted. These other nonsurgical treatments have included extracorporeal shock treatment, botulinum toxin (botox) injections, office percutaneous tenotomy, blood injections, and multiple corticosteroid injections.

If conservative measures fail and the patient remains symptomatic after six months of treatment, then surgical intervention is considered. Remember, however, that the presentation and time course can vary considerably among patients. Most patients will respond to time, activity modification, and some form of therapy as discussed above. When surgery is considered, the surgical treatment should address the underlying pathology, namely the degenerative area in the tendon origin of the ECRB tendon.

### Surgical Options

There are many described operations for lateral epicondylitis; however, simple excision in an elliptical fashion of the affected degenerative tendon area (a surprisingly small area) in the origin of the ECRB with repair of the longitudinal tendon excision has shown consistent results with regard to excellent pain relief and strength return. Patients are usually immobilized for one week, and then range-of-motion exercises are initiated.

Strengthening exercises are begun at four weeks postoperatively; and usually at around four months out, the patient can return to work and resume sports and activity with unlimited upper extremity movement. The physicians at Midwest Orthopaedics at Rush do not advocate lateral epicondylectomy or complete release of the tendon origin. These types of procedures have the potential to violate the lateral ligament complex.

Arthroscopic approaches to lateral epicondylar tendon pathology have shown the ability to access the abnormal tendon region. Intraarticular pathology can be identified and addressed with this approach. Thus, if there is a suspicion of concomitant intraarticular pathology, the arthroscopic approach can be utilized.

The arthroscopic approach has also emphasized the fact that the ECRB tendon origin is proximal to the midportion of the radiocapitellar joint. This location has implications for both the open and arthroscopic approaches. Surgical dissection or excision below the "equator" of the radiocapitellar joint can inadvertently injure the lateral ligament complex, which can lead to a postoperative complication of lateral rotatory instability of the elbow. This complication can cause significant disability and should be avoided.

Reasons for surgical treatment failure can include a concomitant radial tunnel syndrome, intraarticular pathology, and damage to the lateral ligamentous structures of the elbow, as discussed above. Activity modifications and use of the counterforce brace may still be needed in a percentage of patients as they return to work and sport activity. The average time to return to full-duty work and sports varies with the intensity of the activity, but three to five months is not uncommon.

**Lateral view of the anconeus muscle with bony attachments.**

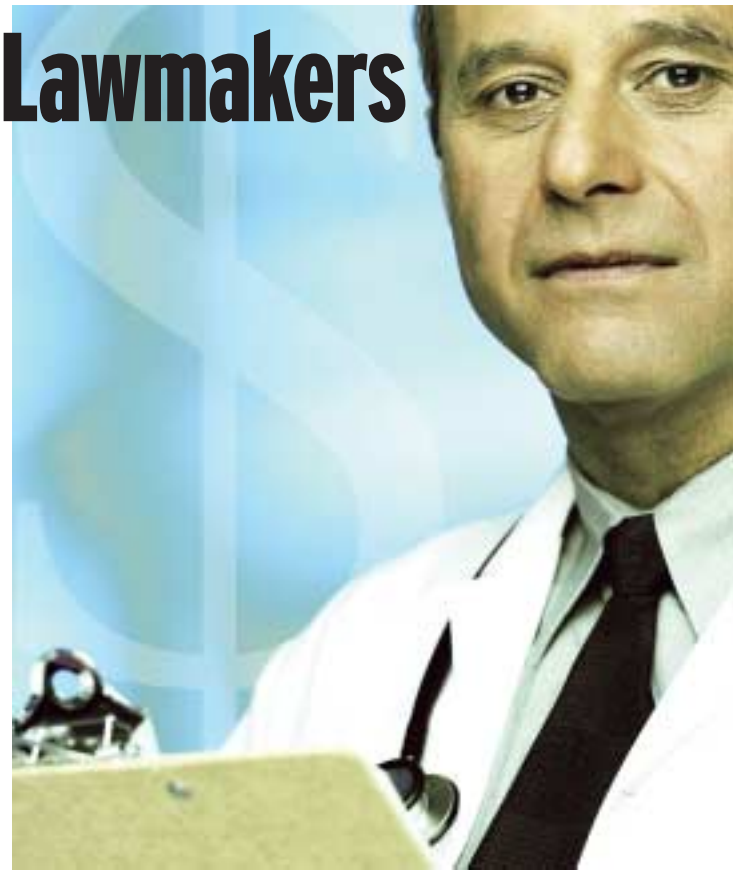
Lateral epicondylitis is a common elbow condition occurring in the fourth to sixth decades of life. It can have a variable and stubborn time course. The vast majority will respond to proper activity modifications, therapy, and patience. Surgical treatment, if indicated, should address the underlying tendon pathology. ●

***Gregory P. Nicholson, MD**, a medical graduate from Indiana University School of Medicine, completed his internship and residency at University Hospital of Cleveland and served a fellowship in shoulder surgery at the New York Orthopaedic Hospital at Columbia-Presbyterian Medical Center in New York City. Dr. Nicholson is Board Certified by the American Board of Orthopaedic Surgery and a Fellow of the American Academy of Orthopaedic Surgeons. He specializes in shoulder and elbow surgery, utilizing state-of-the-art arthroscopic and open surgical techniques to treat sports-related, traumatic, arthritic, and occupational conditions.*

# Keeping Up with the Lawmakers

## Understanding the 2005 Amendments to the Illinois Workers' Compensation Act

**By Eugene F. Keefe, JD, Keefe & Associates, Chicago, IL**



**Speeding compensability determinations will help both insurance carriers/TPAs and the medical community as it should provide more certainty of costs for the carriers and rapid payment for the medical providers.**

On July 20, 2005, the governor of Illinois signed HB2137 (Public Act 94-0277), a bill that made significant changes to the state's Workers' Compensation Act. Some of the more important changes included those focusing on a medical fee schedule, utilization review, balance billing, delayed payment penalties, and past due interest rates. Here are some of the highlights of note for caregivers and medical billers.

### Medical Fee Schedule

February 1, 2006, the Illinois medical community implemented a new global medical fee schedule that applies to all work-injury-related treatment. The schedule applies to all medical caregivers providing such treatment. Many observers feel the new schedule may speed up the determination of whether a claim is compensable. We feel insurance carriers/third-party administrators (TPAs) may want to quickly determine compensability so as to move work injury cases into the fee schedule and not cause medical providers to send medical bills at much higher "sticker price" rates. Prior to implementation of the medical fee schedule, insurance carriers/TPAs had no incentive to make such a determination — they were getting hit with high workers' compensation bills whether they accepted the claim or not. We were told the increased speed in determining compensability was one impact of implementation of medical fee schedules in other states, particularly Michigan and Wisconsin — once they brought in the fee schedule, adjusters were told to make a clear determination on compensability as rapidly as possible. If that happens, the change will mark an improvement for the medical community and the insurance industry.

Speeding compensability determinations will help both insurance carriers/TPAs and the medical community as it should provide more certainty of costs for the carriers and rapid payment for the medical providers. We also feel quicker compensability determinations will lessen the need for litigation and attorney involvement on both sides, resulting in lower overall claim costs. Finally, we were aware of a number of physicians and other caregivers who would many times choose to make a questionable claim a work-related claim because they could charge effectively unlimited medical fees versus the discounts provided by group health providers, if a claim was found by the doctor not to be related to work. A medical fee schedule should slow or stop this practice because there will be discounts for both work-related treatment and nonwork-related care.

Under the new fee schedule requirements, Keefe & Associates strongly urges all medical providers to start doing three things for each claim:

- Get the name, phone number, and fax number of the workers' compensation (WC) bill payer as soon as possible; follow up to see if the claim has been accepted as compensable.
- Fax reasonable medical documentation about the treatment plan and care provided, along with recommendations regarding lost time and/or work restrictions, with each billing.
- Always, always get group health care insurance information as a backup in case all or some of the medical bills are disputed at any time.

All parties are waiting for the databases necessary to input the fee schedule into bill payer systems. The medical fee schedule directs payment of 90% of the 80th percentile of fees as the Illinois standard for WC medical billing. When the databases are released, all bill payers in the WC defense industry will hustle to get this information into their computers and pay discounted bills.

Miscellaneous concerns include whether doctors and hospitals will take WC patients at these rates. We understand the medical fee cuts are not as severe as most group health plans sought. There is also no intention to implement the medical fee schedule by using a multiplier of Medicare reimbursement, as other states have done.

If you dislike the fee schedule, avoid it!!! The new law allows doctors and medical caregivers to

contract directly with employers or insurance carriers/TPAs for any service at any rate. There is no provision requiring injured workers to go to a specific provider, however. We are advising all occupational health providers to set up agreements directly with employers and carriers. If you already have such an agreement or a preferred provider organization in place, have the document amended to state that the provisions fall outside of the fee schedule.

## Utilization Review

Utilization review (UR) can now be used in Illinois WC claims to dispute reasonableness and necessity of medical treatment and lost time. This concept is new to Illinois and will be further developed in the years to come. In addition to optimizing medical treatment, UR might be used to demonstrate that a claimant should be back at modified or full work. Many states have implemented UR with great success and to the satisfaction of the medical community and employers alike.

## Balance Billing

What happened to balance billing? The practice, which involves taking partial payment from the carrier while continuing to bill the employee, is now illegal — sort of. The unusual aspect is that while it is clearly against the "law," there is no penalty. We understand some providers will still do it. Potential methods do exist to stop balance billing, however. We suggest you contact counsel if you plan to continue the practice.

Medical billers and medical caregivers still have a problem that the new amendments do not address. Medical providers and insurance carriers/TPAs are not actually parties to WC claims. So what do they do if they disagree about the medical fee schedule? The legislation created no formal or informal procedure to resolve medical bill payment disputes. In response, we have recommended that the Illinois Workers' Compensation Commission consider creating a bill dispute panel similar to one that exists in Wisconsin.

Another action that is clearly proscribed but has no penalty attached is that of medical providers seeking to collect from WC patients while WC issues are under dispute. The idea behind the proscription is to slow down overzealous collection actions that can affect an injured worker's credit rating during bona fide litigation. No one knows if this concept will change collection agency practices. Veteran observers feel many agencies, never known for adhering closely to the law, may simply ignore this one.

Under the balance billing amendment, work-related medical treatment bills are now due within 60 days on undisputed compensable bills. The sole requirement is that medical bills must be accompanied with "substantially all data." There is no definition of "substantially all data," but we assume it means CPT and ICD9 codes and dates of service.

## Delayed Payment Penalty

Starting February 1, 2006, injured workers in litigation may be entitled to a $30-per-day penalty for unreasonable delay or nonpayment of medical and temporary total disability benefits. Claims that are not litigated may not be subject to this "late fee." Most doctors and other caregivers continue to wonder why the patient gets a bonus when they are not being paid in a similar fashion. You can take that up with your lobbyists. There seems to be no defined reason for this provision other than to penalize Illinois business and "reward" litigious claimants.

## Past Due Interest Rate Changes

Doctors, hospitals, and other medical caregivers will be able to charge 1% per month as interest on unpaid medical bills with appropriate documentation. Due to the double whammy of the new interest charges and the $30-per-day penalty, you should assume medical billers will immediately receive rejected claims if they lack CPT and ICD9 codes and dates of service, along with a form letter outlining the missing information. Such letters may reduce exposure to delayed payment penalties.

## Illinois Medical Fee Schedule Advisory Board

As a final note, a Medical Fee Advisory Board has been appointed and has already met and voted on implementation of the schedule. By the time this is published the Illinois fee schedule should already be in place. A searchable, downloadable schedule will be posted on the Workers' Compensation Commission's Web site. Further information may be found on the web at http://www.state.il.us/agency/iic/WCMFAB.pdf. ●

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***Eugene F. Keefe*** *received his Bachelor's degree from Loyola University of Chicago and graduated from John Marshall Law School. He is a member of the Chicago Bar Association, Illinois Workers' Compensation Lawyers Association, and Workers' Compensation Claims Association. Keefe is the editor for* Workers' Compensation Law Update *as well as the co-author of "The Road to Understanding Workers' Compen-sation",* Journal of Workers' Compensation, *Vol. 4, No. 2, Winter, 1995, Standard Press, Boston, MA.*

# Preserving Motion

## Total Disc Replacement May Provide Alternatives to Fusion Surgery

**By Frank M. Phillips, MD**

Spinal motion-preserving technology in general, and total disc replacement (TDR) in particular, has captured the imagination of the spinal community. In the lumbar spine, this technology has been touted as an alternative to fusion surgery for the treatment of axial low back pain.[1,2] Cervical disc replacement has a shorter clinical history than lumbar disc replacement and to date has been used following anterior discectomy for the treatment of radiculopathy or myelopathy. Some cervical TDR implants are "shrunk down" versions of their lumbar predecessors, whereas others have unique design characteristics. When considering cervical disc replacement, it is important to understand the specific kinematics, anatomy, disease processes, and treatment outcomes pertaining to the cervical spine.

Issues relating to cervical disc replacement are quite different from those in lumbar disc replacement surgery. Lumbar disc replacement has been considered for the treatment of degenerative disc disease, a condition for which treatment success with fusion has been quite limited.[1,2] In contrast, fusion following an anterior cervical discectomy has been quite successful. Lumbar disc replacement surgery involves a specific decision to proceed with TDR surgery. In the cervical spine, the decision to proceed with anterior decompressive surgery for radiculopathy or myelopathy is made independent of the choice of reconstruction. Once decompression is accomplished, the surgeon may then decide to proceed with TDR, or placement of a structural interbody device with or without supplementary plate fixation.

Clinical trials (ongoing and planned) for cervical disc arthroplasty include patients having decompression for the treatment of cervical spondylosis giving rise to radiculopathy or myelopathy. The high success rate and long-term track record of anterior cervical decompression and fusion (ACDF) in the treatment of these conditions, raises the question as to the need for the development of alternate procedures. Proponents of artificial disc technology claim that although cervical arthrodesis is often clinically successful in the short term, fusion results in increased biomechanical stresses at adjacent segments that may hasten degeneration at these levels.[3,4,5,6] Alternatively, artificial disc replacement maintains motion at the operated level, thereby maintaining adjacent level kinematics and reducing the rate of adjacent level degeneration when compared with fusion. The fate of segments adjacent to a fusion has indeed become the rationale for the development of TDR and merits further discussion.


**Figure 1: Flexion (A) and extension (B) lateral radiograph obtained six months after insertion of a Bryan TDR at C6-7**

### Degeneration Adjacent to Fusion Biomechanical Data

Biomechanical studies have shown that cervical fusion alters adjacent level kinematics[3,4] whereas TDR leads to a normalization of load transfer and kinematics at adjacent levels when compared with fusion. DiAngelo, et al., have shown that after anterior cervical fusion, the loss of motion at the index level is compensated for by an increase in motion at adjacent segments.[3] In contrast, use of an artificial disc replacement did not alter motion at either the instrumented or adjacent levels. Eck, et al., found a 73% and 45% increase in intradiscal pressure at levels cephalad and caudad to a simulated fusion, respectively.[5] In contrast, after TDR (Bryan, Medtronic Sophamor Danek, Memphis, TN), Wigfield and colleagues recorded stress profiles in the adjacent level intervertebral discs that were similar to those seen in nontreated, intact specimens.[6] In the adjacent level annulus, the artificial disc led to reduced stresses when compared with spines with a simulated fusion.

### Clinical Data

Cervical spondylosis is thought to be an inevitable consequence of aging. After the age of 40 years, almost 60% of the population has radiographic evidence of cervical spine degeneration and by the age of 65 years, 95% of men and 70% of women have at least one degenerative change on roentgenograms.[7,8,9] The rates of adjacent level degeneration after cervical fusion must, therefore, be compared with this natural history data.

Baba, et al., reported that at an average of eight years after ACDF, 25% of patients developed new onset spinal stenosis adjacent to the previously fused segments.[10] Gore and Sepic observed new spondylosis in 25% of 121 patients and progression of pre-existing spondylosis in another 25% of patients who had undergone prior ACDFs with a mean follow-up of five years.[11] They noted no correlation between these new radiographic findings and the development of clinical symptoms. In a follow-up study of 50 patients, Gore and Sepic

described that 14% of patients underwent additional surgery for adjacent level disease after ACDF.[12] It remains challenging to determine whether the reports of degeneration adjacent to cervical fusion reflect only the consequence of altered biomechanics resulting from the fusion, or represent to some degree the natural tendency towards degeneration of the cervical spine with aging, particularly in the group of individuals who have had clinical symptoms and signs leading to surgery. Hillibrand, et al., reported on the long-term follow-up of 409 patients who had anterior cervical decompression and fusion procedures.[13] They reported that 14% of patients had additional neck surgery over a 21-year period with an average annual incidence of development of adjacent level disease of 3%. The authors noted that anterior cervical fusion performed at more than one level had a significantly lower rate of development of adjacent level disease than those fusions performed at a single level. This outcome seems counterintuitive, as one might have predicted that the longer fusion constructs would result in greater adjacent-level stresses than single-level fusion. Hillibrand, however, noted "the results of this study suggest that adjacent segment degeneration was a common problem, but may reflect the natural history of the underlying cervical spondylosis."[14] In conclusion, review of the literature suggests that although biomechanical studies have proven the deleterious effects of cervical fusion on adjacent level kinematics, the clinical relevance is not clearly established.

Other rationales for the use of cervical TDR relate to the complications or morbidity associated with ACDF. Anterior cervical arthrodesis heals gradually, and it does not always heal. In many cases, surgeons impose limitations on patient activities in an effort to enhance fusion. Such limits may slow the patient's ability to return to normal employment and lifestyle. After disc replacement, patients will likely be able to resume unlimited activities more rapidly. In a small percentage of ACDFs, pseudarthrosis develops that may compromise the ultimate clinical results, leading to a revision surgery.[15,16] This complication obviously would be eliminated by TDR. In addition, TDR would eliminate the risks and morbidities associated with bone graft procurement for arthrodesis. Before embracing TDR technology, however, it is necessary to ensure that a new set of more significant complications and morbidities are not created by this intervention ***(Table 1)***.

**Table 1. Cervical Disc Replacement: Criteria for Adoption**

- Reduce the incidence of adjacent level degeneration compared with fusion
- Equivalent or improved effectiveness in terms of lasting relief of presenting signs and symptoms compared with ACDF
- Long-term durability (wear of bearing surfaces, osseous-integration, subsidence)
- Ease of implantation
- Complication rate that is no higher than that of ACDF, until additional outcome benefits are proven that might overweigh any added risks
- Acceptable cost

**Table 2. Cervical Disc Replacement Design Considerations**

- **Articulation kinematics**
  - One-piece vs. two-piece articulation
  - Constrained vs. unconstrained
  - Fixed vs. mobile axis of rotation
- **Materials**
  - CoCr
  - Stainless Steel
  - Titanium
  - Polyethylene
  - Polycarbonate/urethane
- **Articulation**
  - Metal-on-polymer
  - Metal-on-metal
- **Footplate geometry and dimensions**
- **Attachment to bone**
  - Interference fit
  - Porous surface coatings
  - Anchors to vertebral body (screws, fins, spikes)

## Disc Design

Implant design characteristics are important for functioning and longevity of TDR. The articulating surfaces must be able to tolerate anticipated load without fatigue or failure, while minimizing friction, and should have superior wear characteristics with minimal debris generation. In addition, the implants must remain permanently affixed to the adjacent vertebral bodies ***(Table 2)***.

## Implant Kinematics

Although the stated goal of all cervical prosthesis designs is to restore, or maintain, normal cervical disc motion after discectomy, the kinematics and biomechanics of cervical TDRs have not been widely reported. Cervical range of motion involves complex coupled motions that may be difficult to reproduce artificially. Puttlitz, et al., have reported recently that in a cadaveric model, a ball-and-socket design disc prosthesis (Prodisc C, Synthes, Paoli, PA) produced normal physiologic motion and maintained coupled motion patterns.[17] The importance of restoring physiologic motion in a degenerating motion segment that is naturally tending towards decreased range of motion is unclear, as are the consequences. In addition, the increased motion after TDR may allow for ongoing nerve irritation unless the neural elements are adequately decompressed. It is therefore imperative to decompress the neural elements directly during TDR surgery and probably desirable that the prosthesis provides foraminal distraction to effect, and maintain, decompression of the nerve roots.

Most TDR articulations have either single-gliding or double-gliding interfaces. The geometry of articulations in current double-gliding designs of cervical TDR includes ball-and-socket and saddle designs that permit rotation and in some instances translation. In order to protect the facet joints from abnormal stresses, the implant should have an axis of rotation (AOR) that mimics that seen in the normal spine. In certain implant designs the AOR remains fixed, whereas in others it is dynamic.

Implants may be constrained or relatively unconstrained, in which case they are reliant on surrounding soft tissues to provide restraint to extremes of range of motion. With unconstrained implants, appropriate soft tissue tensioning is important for stability. Retention of the posterior longitudinal ligament has been shown to enhance stability after discectomy when placing a cervical prosthesis.[18] Generally, unconstrained devices allow translation and diminish stress concentration at specific points on the articulating surfaces. The lack of constraint may, however, subject the facet joints to greater shear and torsional loads.[19,20] These unconstrained devices have a mobile AOR, so that they may be more forgiving of small errors in implant placement. More constrained devices achieve greater stability; however, they create greater stresses at the implant–bone interfaces. Constrained devices generally have a fixed AOR and in theory minimize shear at the facet joint.[19] Devices with a fixed AOR may be less forgiving, however, and require precise anatomic placement so that the TDR AOR mimics the natural posterior AOR of the motion segment.

## Implant Materials

Metal composition of the prosthesis is an important design consideration. Cobalt chrome (CoCr) alloys have been used extensively as bearing

**Table 3: Cervical Disc Prostheses**

| |  |  |  |  |  |
|---|---|---|---|---|---|
| | Bryan | Prestige, Prestige LP | Prodisc-C | PCM | CerviCore |
| Footprint |  |  |  |  |  |
| Footprints available | Diameter mm<br>14<br>15<br>16<br>17<br>18 | Width depth mm<br>12* x 12<br>12* x 14<br>12* x 16<br>12* x 18 | Width depth mm<br>15 x 12<br>15 x 14<br>17 x 14<br>17 x 16<br>19 x 16<br>19 x 18 | Width depth mm<br>15 x 12<br>17 x 12<br>20 x 17 | Width depth mm<br>12x12<br>12x14<br>14x16<br>16x18 |
| Heights | 11 mm<br>10.3 mm compressed | 6 mm<br>7 mm<br>8 mm | 5 mm<br>6 mm<br>7 mm | 6.5 mm<br>8.0 mm | 5-10 mm |
| Articulation | Stainless steel-polycarbonate-urethane | Chrome cobalt; metal-on-metal | Chrome cobalt; metal-on-polyethylene | Chrome cobalt; metal-on-polyethylene | Chrome cobalt; metal-on-metal |

* Estimated width

surfaces in joint arthroplasty because of their excellent wear characteristics. Stainless steel alloys have long been used as orthopaedic implants; however, they have not been widely used for arthroplasty because of inferior mechanical properties. Titanium alloys have generally not been widely used for articulating components because of their poor wear characteristics. In the cervical spine, where MRI imaging may be required after TDR, titanium, with its improved MRI imaging compatibility, offers distinct advantages. Surface treatment of titanium, such as coating with nitride or diamond-like carbon, may improve hardness and wear characteristics.[21,22]

In the appendicular skeleton, generation of wear debris is the primary source of artificial joint implant degradation; and the subsequent tissue and systemic reaction to the debris is an important factor in limiting longevity of the prosthesis. Debris has been associated with osteolysis, implant loosening, and prosthesis failure.[23,24] These complications are influenced by not only the number, but also the size and shape of the wear particles.[25] Debris may be generated by wear, fretting, or fragmentation. Polyethylene-on-metal provides a low friction articulation, but generates polyethylene wear debris. Polyethylene wear is an established cause of failure of hip and knee arthroplasty. Cross-linking with gamma irradiation has been used to improve wear properties of ultra-high molecular weight polyethylene, but this process can also affect the mechanical properties.[26,27] Metal-on-metal articulation has gained popularity because of dramatically lower wear rates compared with polyethylene-on-metal articulations. Although with metal-on-metal articulations the wear debris generated is markedly less volumetrically, there are greater numbers of debris particles that are smaller than particles generated by polyethylene-on-metal articulations. Enthusiasm for metal-on-metal articulating surfaces must be tempered by reports of systemic metal deposition after hip arthroplasty, although no adverse clinical effects have been attributed to the deposition of heavy metal.[28,29,30] It is uncertain whether dissemination of metallic debris after hip arthroplasty is analogous to an arthroplasty in the relatively avascular, nonsynovial, cervical disc space. In addition, metal-on-metal prostheses provide less shock absorption than metal-on-polyethylene articulations. To date, acceptable rates of wear (typically to 10 million test cycles) have been claimed by the manufacturers of all cervical devices in their U.S. Food and Drug Administration (FDA) Investigational Device Exemption (IDE) submissions. Manufacturers have also reported that wear particles generated have been nontoxic in rabbit studies.

## Fixation to Bone

Long-term implant fixation depends on bone ingrowth into the surface of the prosthesis. Ingrowth depends on initial stability of the implant, pore size, and pore geometry. The initial stability with a TDR depends on soft tissue tensioning, implant surface geometry (corrugated or serrated), and dimensions, as well as any anchoring of the implant to the host bone using, for example, stabilizing fins or screws. Surface coatings to improve bony ingrowth include titanium wire mesh, plasma-sprayed titanium, porous CoCr, and bioactive materials, such as hydroxyapatite and calcium phosphate. Although not well characterized in cervical implants, good bony ingrowth into the surface of lumbar disc implants has been demonstrated in nonhuman primates.[19]

The potential for implant subsidence remains a concern with total disc implants. This phenomenon has been described after lumbar TDR.[31] Subsidence could lead to implant loosening and altered implant kinematics affecting TDR function and wear characteristics. It also leads to increased stresses on the facet joints. Maintaining the harder subchondral bone during discectomy, and placing a large enough implant footplate that is anchored on the peripheral apophysial ring and the harder lateral uncovertebral bone, may reduce the risk of subsidence.[32] With aging and development of osteoporosis, the impaired ability of the cancellous bone of the vertebral body to support the vertebral endplates may, however, place an implant at risk for late subsidence and failure.

## Clinical Trials

There are cervical disc replacement designs by a number of companies undergoing FDA IDE studies in the United States. These include the Prestige and Bryan discs (Medtronic Sophamor Danek, Memphis, TN), ProDisc Cervical (Synthes, Paoli, PA), and the PCM (Cervitech, Roundhill, NJ). At the time of this writing, the CerviCore (Stryker, Rutherford, NJ) is awaiting approval for an IDE study ***(Table 3)***.

## Prestige

The Prestige ST prosthesis, currently in U.S. IDE study, is a two-piece prosthesis constructed of stainless steel, employing a ball-in-groove articulation. This design permits motion in flexion, extension, lateral bending, and axial rotation about the center of rotation of the ball component of the upper base plate. The ball-socket design allows for anterior-posterior translation of the center of rotation. The endplates are roughened by grit blasting to promote bony ingrowth

and are attached to the adjacent vertebral bodies with a locking screw.

Traynelis has reported the results of wear testing (presumably obtained from the implant manufacturer).[33] After 10 million cycles in flexion and extension and 5 million cycles of a coupled axial rotation and lateral bending, 0.37 to 0.42 $mm^3$/million cycles of material were lost. This result compares favorably with the 5 $mm^3$/million cycles of debris generated by CoCr total hip prosthesis. No information as to the size of particles generated was published.

The design of the Prestige ST has been modified (Prestige STLP) to include rails to secure the prosthesis to the adjacent vertebral body endplates, which eliminates the anterior profile of the prosthesis that originally had been placed for screw attachment.

Robertson and Metcalf reported the four-year results in 14 of 17 patients who had a Prestige I prosthesis implanted for "end-stage" disease, in patients who "often had a history of multiple previous fusions."[34] Radiographic analysis confirmed maintained motion at the operated segment. In 2002, Robertson reported on patients with single-level cervical radiculopathy or myelopathy who were decompressed and randomized to receive uninstrumented arthrodesis or the Prestige II disc device (precursor to Prestige ST).[35] Twenty-seven patients were randomized to each arm. At two years, the arthroplasty groups had retained motion across the operated level and had improved pain and physical function scores when compared with the arthrodesis group. Porchet and Metcalf (2004), reported on what appears to be the same cohort (55 patients) showing clinical improvement in both the ACDF and the arthroplasty groups with radiographic results showing that the Prestige II disc maintained motion at the treated level.[36]

## Bryan Disc

The Bryan disc is a single-piece, metal-on-polymer prosthesis comprised of a polycarbonate/polyurethane core between two porous-coated endplate shells, encapsulated by a polymer sheath. The instantaneous axis of rotation is variable and not limited by the geometry of articulating surfaces normally characteristic of two-piece disc designs. The polyurethane sheath is intended to contain debris and prevent soft tissue ingrowth, The endplates are porous-coated titanium alloy. At the time of this writing, over 4,000 Bryan prostheses have been implanted worldwide, and a U.S. IDE is in process ***(Figure 1)***.

Anderson, et al., have reported the results of wear testing for the Bryan Disc.[37] After 10 million cycles, the mean height loss was 0.75%. Particles generated had a mean diameter of 3.89 microns. Particle shape varied from those generated after hip and knee arthroplasty testing. After 40 million cycles, endplate-to-endplate contact was observed. The change in prosthetic height was 0.02mm per million cycles. The authors stated that they believed that 100,000 to 400,000 stimulator cycles represent one year of clinical use. The in vivo inflammatory response of the device was studied in a caprine model at the C4-5 level. No inflammatory response was observed one-year postimplantation.

Goffin, Komusteh, et al., reported similar motion after implantation of Bryan discs at C5-6 as

compared with normal volunteers.[38] Goffin, Casey, and coauthors reported on 60 patients who underwent single level anterior discectomy and placement of a Bryan disc prosthesis.[39] At 12 months they reported success rates of 85% to 90%. Two patients had possible device migration. Range of motion was preserved and no device has been revised or explanted. Duggal and colleagues recently reported on 26 patients treated with the Bryan disc for degenerative cervical radiculopathy or myelopathy.[40] A significant improvement in Neck Disability Index and a trend towards improved SF-36 scores was noted at 24 months. Motion was preserved at the treated spinal segment (mean 7.8 degrees.) Pickett, et al., reported on 14 patients who received the Bryan disc prosthesis and were followed from six to 24 months.[41] Motion at the index level was similar preoperatively and at final follow-up. The treated level, however, became and remained more kyphotic after insertion of the Bryan prosthesis.

Goffin and associates reported heterotopic ossification (HO) around the Bryan disc with some impact on clinical results.[42] Development of HO may be the result of the extensive bone removal (milling) required for implantation of this particular prosthesis. Heller, et al.,[41] have recommended routine use of nonsteroidal antiinflammatory medication in the perioperative period to reduce the risk of HO, and this practice is required in the U.S. IDE study with this prosthesis.

### Prodisc-C

The Prodisc-C is constructed of two chromium-cobalt endplates with sagittal fins for fixation into the adjacent vertebral body and a fixed polyethylene core. The joint consists of a concave cephalad component that rides on an ultra high molecular weight polyethylene (UHMWPE) insert fixed to the caudad component. This articulation provides coupled motion without independent translation resulting in a fixed center of rotation in the vertebral body below the disc space. The surfaces of the prosthesis in contact with the vertebrae have a plasma-spray titanium layer to promote bony ingrowth.

### Porous-Coated Motion (PCM)

The PCM is a polyethylene-on-metal design with a large radius UHMWPE bearing surface attached to the caudal endplate, allowing for translational motion. The cobalt-chromium endplates are coated with titanium with electrochemically coated calcium phosphate in a 1:1 ratio. The surface encourages osseous integration. The PCM endplates are shaped to maximize support in the dense lateral bone in proximity to the uncovertebral joints.

Pimenta in Brazil implanted 81 PCM discs in 52 patients who had degenerative disc disease and radiculopathy or myelopathy.[44] Surgery took approximately 50 minutes per level and estimated blood loss was 50cc per level implanted. Significant improvement in pain-intensity, disability, and analgesic use was noticed at one-year follow-up. Complications included a single prosthesis that displaced 4mm anteriorly and one case of mild HO.

### CerviCore

The CerviCore prosthesis is a metal-on-metal (chrome-cobalt) design with a saddle shaped articulation. The designers of this device assert that the articulation allows for maintaining the axis of vertebral rotation in the caudal vertebral

body during flexion-extension, while simultaneously maintaining the AOR in the cephalad-vertebral body during lateral bending, mimicking the normal disc AOR. The designers also claim that the articulation mimics the function of the uncovertebral articulation and promotes vertebral foraminal widening during coupled rotation and bending. These claims await verification. The base plates feature a titanium spray and three spikes. After placement of the device, bone screws are inserted through anterior flanges into the vertebral bodies. To date there are no reports of clinical implantation of this prosthesis.

## Conclusion

Cervical disc replacement is an exciting technology that preserves motion at the instrumented level(s) and will potentially improve load transfer to the adjacent levels when compared with fusion. Clinical reports of success of cervical TDR are encouraging, but are also quite preliminary. The consequences of failure of a cervical TDR implant in close proximity to the spinal cord, the esophagus, and the trachea must be considered. In addition, reconstructive strategies after device failure are likely to be complex. As the U.S. IDE studies are completed, a clearer role for the place of cervical TDR in the spine surgeon's armamentarium should emerge. Most implant designs in trial are quite similar, and alternative design concepts will probably be developed in the future. ●

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# Perfect RX for a World Championship

## Team Physicians Help White Sox Take Home a World Series Trophy

**By Dennis Viellieu**

It was one Cinderella story after another. The Boston Red Sox did it in 2004, winning the World Series and breaking the Curse of the Bambino that had dogged them since 1918. Then the Chicago White Sox took it all in 2005, winning their first World Series since 1917 and forever putting to rest the embarrassment and shame of the Black Sox scandal of 1919.

One of the keys to success for the 2005 World Champion White Sox was certainly the low incidence of injury, especially among the pitching staff. The White Sox pitchers — some of Major League Baseball's best — stayed healthy, which was vital to the team's incredible 11-1 run through the playoffs.

"Professional baseball teams tread a fine line between success and failure. A few additional effective innings by a pitcher or a position player staying healthy for a couple of extra games can make a huge difference," says Dr. Chuck Bush-Joseph, Lead Team Physician. "We definitely saw that with the White Sox this year as some key players worked through injuries and made important contributions at critical times." Like any other team, the White Sox have had their share of nagging injuries. Sox legend Frank Thomas' foot problems have sidelined him for most of the last two seasons. Dustin Hermanson and Joe Crede have struggled with bad backs, and Jermaine Dye even had to deal with an infected spider bite on a road trip. The White Sox medical team faces these kinds of challenges every day.

### Prevention and Quick Response

The primary job of the White Sox medical staff is twofold: first and foremost, prevent injuries that keep players off the field, and second, provide effective treatment when injuries occur and return athletes to action as quickly as possible. Enter the White Sox medical team and its winning prescription.

Longtime Head Trainer Herm Schneider and his assistant Brian Ball head up the White Sox medical staff. Brian and Herm got topnotch help in 2005 from Midwest Orthopaedics at Rush (MOR), which fields a team of physicians led by Chuck Bush-Joseph, MD, and Kathy Weber, MD. Dr. Weber handles internal and sports medicine issues, while Dr. Bush-Joseph deals with orthopaedic concerns.

With her training in sports medicine, internal medicine, and exercise physiology, Dr. Weber was uniquely qualified to address orthopaedic injuries and medical conditions, such as heat illness, head injuries, allergies, viral infections, high blood pressure, and diabetes. Her comprehensive approach also helped Sox players cope with postseason stress and anxiety. She even treated a player with a champagne allergy, an inopportune complication that arose during the otherwise joyous celebrations.

Joining Dr. Weber to provide internal medicine and medical coverage through spring training and the regular season were MOR physician Trish Palmer, MD, as well as Scott Palmer, MD; Dragan Djordjevic, MD; Joseph Hennessy, MD; and Syed Shah, MD, physicians who practice privately and are affiliated with Rush University Medical Center.

Additional doctors working with Dr. Bush-Joseph to address musculoskeletal issues included fellow MOR staff members Bernard Bach Jr., MD; Gregory Nicholson, MD; Brian J. Cole, MD, MBA; Anthony Romeo, MD; Nikhil Verma, MD; and Mark Cohen, MD.

**Left to right: Kathy Weber, MD, and Chuck Bush-Joseph, MD, pictured with the Chicago White Sox's World Series trophy**

## Experience All Around

This year marked MOR's second season working with the Chicago White Sox. Herm Schneider chose the practice because he needed the most comprehensive medical service available. "I wanted our players, staff, and front office personnel to have the best medical expertise," says Schneider. "In addition, I wanted the team to have access to a full-service academic medical facility like Rush University Medical Center, which is just minutes away from our home field."

The 2005 season was Schneider's third as a trainer for a World Championship team (he worked as assistant trainer with the champion Yankees in 1977 and 1978), and he clearly had demanding expectations for his physician partners. MOR did not disappoint him, and neither did the team. "This season was special because it was my first championship as Head Athletic Trainer, because I've been with the team so long, and because 1917 was the last time this organization won a title," says Schneider.

Herm has been Head Trainer for the White Sox since 1979, so he understands the importance of patience and consistently good medical attention. Over the past three seasons, the White Sox have placed fewer players on the disabled list than any other major league team.

## Teamwork, Teamwork, Teamwork

Whenever injuries occurred, MOR physicians were right there to make accurate, rapid diagnoses and to initiate effective immediate care, which helps reduce an injured player's time away from the game. The key to providing this excellent service is the same approach players use to win: teamwork.

"Herm has my cell number, and I have his. It takes a constant flow of communication to keep players healthy," says Dr. Bush-Joseph. "Our close working relationship with the White Sox training staff enabled us to diagnose and treat injuries quickly, minimizing player downtime. That was especially critical in August, when Herm and I really had to stay on top of every injury."

Apart from being on the field for every home game during the season, and every home and away game during the playoffs and World Series, the MOR physician team was also involved with player conditioning and training throughout the year.

**Left to right: White Sox Assistant Trainer Brian Ball; White Sox Head Trainer Herm Schneider; MOR member and White Sox Lead Team Physician Charles A. Bush-Joseph, MD; former MOR sports medicine fellow and current Minnesota Twins Team Physician, Pearce McCarty, MD**

The team physicians handled a broad range of responsibilities: diagnosing and treating problems on the field; caring for visiting team players, coaches, and umpires; providing follow-up and continued care in the office; doing phone consultations; facilitating emergency care; managing team care on the road; and coordinating all medical personnel involved in ensuring the overall health of the players, their families, and the White Sox staff.

## The 2005 Championship Run and Beyond

During the 2005 playoff season, Dr. Bush-Joseph and Dr. Weber were "on call" to travel at a moment's notice. They were with the team for every pitch of every inning of every postseason game. Fortunately, the only major injury came during a victory party when one of the coaches cut his foot on a broken champagne bottle. "I sewed it up right then and there," said Dr. Bush-Joseph. "The patient was already sufficiently anesthetized."

One of the things Dr. Bush-Joseph will always remember was how the team traveled in style, especially in Houston. "Everywhere we went, we had a police motorcycle escort shutting off traffic in front and behind us. This must be how it feels to travel with the President of the United States."

As the only female physician traveling with the White Sox, Dr. Weber inadvertently created an unexpected challenge for the medical team. After the games clinching the division and league championships, the White Sox wanted to leave immediately for the next playoff location to maximize their preparation time. Since a champagne "bath" accompanied each championship win, everyone needed a shower before getting on the plane. For the males, it presented no problem since the celebrations took place in the men's locker room. Unfortunately, none of these facilities offered a separate shower for women. Between the party's end and takeoff, the medical team constructed a makeshift shower so Dr. Weber could clean up before the trip. "My colleagues and the players were great. They actually got to be very handy at building these temporary showers quickly. We never missed a flight," says a thankful Dr. Weber.

The coming season looks bright for the White Sox and for MOR. "Next year will be our third with the White Sox," says Dr. Weber. "We can use the solid foundation we've built thus far to further develop a model system of comprehensive medical care for individual athletes and the team." MOR physicians and their internal medicine colleagues will cover the entire 2006 Spring Training Schedule in Tucson and provide full coverage for all the home games next season. MOR physicians will also conduct medical evaluations of potential draftees and free agents, which will help the White Sox player development staff make the best personnel decisions for future success. ●

# Shoulder Rehabilitation after Surgery

## Early Physical Therapy Allows Optimal Outcomes for the Patient

**By Kimberly A. Kollwelter, PT, DPT, MSPT, CIMT, STC, CSCS**

Shoulder dysfunction is common in today's society. Many individuals, both young and old, experience injuries that require shoulder surgery to help alleviate subjective pain and/or improve function. The most common shoulder surgeries include rotator cuff repairs, subacromial decompressions, SLAP (superior labram, anterior/posterior) repairs, and Bankart lesion repairs. Following surgery, an immediate physical therapy program is crucial to decrease pain, increase motion, and educate the patient in proper exercises — including how to perform activities of daily living (ADL) without compromising the repaired tissue.

### It Hurts to Wait

Typical practice suggests that many surgeons do not refer their patients to physical therapy until one to six weeks postoperatively.[1,2,3] Most surgeons simply instruct their patients to begin exercising independently during this time period. However, compliance to acute postoperative exercise programs is typically considered low due to increased subjective pain levels. In addition, patients tend to perform these exercises incorrectly or with compensatory movement patterns. Patients are simply not skilled at the exercises or the rehabilitation techniques; and often for years previously, they have utilized compensatory movement patterns, which led to their surgical condition. An immediate physical therapy program following surgery can increase compliance and ensure the patient is completing the exercises without compensation. Following surgery, the most common step is immobilization through the use of a sling. The majority of surgeons keep the shoulder immobilized for a period of three to six weeks.[2,3,4,5,6,7] Immobilization time varies depending on the quality of tissue repaired, the quality of bone tissue, the magnitude of the tear, the security of the repair, and the surgeon's discretion.[2,3,6] Immobilization of the repaired tissue is an important step for the healing process, which allows for the repaired tissue to scar down; however, passive range of motion (PROM) exercises performed by a skilled physical therapist may begin day one postoperatively without putting stress on the involved tissue. It is also important to begin moving the joints down the kinetic change in a controlled manner to decrease stiffness and swelling in the distal joints.

### The Benefits of Early Rehabilitation

It has been my clinical experience that patients who are seen by a physical therapist at day one postoperatively have increased range of motion (ROM) and decreased overall pain during their rehabilitation programs. It is much easier to attain full physiological ROM and normal mobility within the glenohumeral joint capsule with early rehabilitation. By waiting the standard one to six weeks postoperatively to begin physical therapy, patients typically begin to have significant restrictions in their capsule, regardless of procedure (acromioplasty, rotator cuff repair, SLAP repair, et cetera). Attaining full ROM after a few weeks of immobilization is much more difficult for the therapist to achieve. Because of these factors, the physical therapist often has to be more aggressive to stretch out the capsule properly, which results in increased pain for the patient. Anecdotally, patients with day one physical therapy report getting off their pain medication earlier than patients who began rehabilitation at a later date. This phenomenon has been shown in the literature as well. Kim et al.[4] found that individuals who began physical therapy on day one postoperatively displayed increased ROM early on and a faster return to functional activity compared with a group that began formal therapy three weeks postoperatively. Kim et al.[4] also found that individuals who began therapy immediately had decreased pain. It is important to note that the participants in the accelerated therapy group of this study did not have an increased incidence of reinjury.

### Day One of Rehabilitation

Patients presenting to physical therapy postoperatively on day one receive a dressing change and instruction in ADLs. Instruction in ADLs includes donning and doffing the sling in a manner that does not stress the involved tissue. The first session also involves education on a home exercise program (HEP) and demonstrating to the patient the safe and proper way to don and doff articles of clothing. A common HEP given on day one includes Codman's exercises, gripping exercises, scapular retraction and depression exercises, and active elbow flexion/extension exercises, unless the biceps is an involved structure (biceps tenodesis or some SLAP repairs). Frequently, patients perform Codman's exercises incorrectly and turn this PROM exercise into an active range of motion (AROM) exercise. This simple example illustrates the importance of physical therapist instruction and education regarding the proper rehabilitation technique. Kibler[8] found that open chain Codman's exercises only create 9% of a maximal voluntary contraction to the rotator cuff if performed correctly. Manual PROM performed by the therapist is also started on day one. Kibler[8] found PROM exercises that support the upper extremity and emphasize humeral head depression only create 5% of a maximal voluntary contraction. The therapist will perform PROM within the desired range, depending on the type of surgery and the quality of the tissues involved.

### Communication Is Key

Communication is the key to understanding almost any issue. In this example, the physical therapist will know only the type of surgery and quality of the tissues involved with adequate communication from the surgeon — typically with a referring script or with a phone conversation. With this information, the therapist will be able to progress the patient early on without putting inappropriate stress on the involved tissue. Interdisciplinary communication between the physician and physical therapist is extremely important to ensure the most optimal outcome for the patient, both postoperatively and nonoperatively. Since many patients do not understand the details and method of the operation performed, the physical therapist is frequently asked questions regarding his or her specific surgery because of the

increased amount of contact time during the patient's rehabilitation sessions. With adequate communication between the physician and the physical therapist, the therapist can educate the patient on what activities are appropriate and can be completed without putting stress on the procedure. In addition, the patient can be given more information regarding the best care for his or her shoulder while at home and moving forward.

## PROM to ROM

Following postoperative day one, the physical therapist progresses PROM exercises, while continuing to protect the involved tissues. PROM includes both physiological motion and joint mobilizations. When physiological motion is performed, it is important to glide the humeral head manually to maintain the proper biomechanics within the joint. An example is manually gliding the head of the humerus inferiorly when passively taking the arm into elevation **(Figure 1)**. If the therapist does not manually glide the humeral head inferiorly with elevation, the humeral head will glide superiorly and impinge the subacromial tissues. The subacromial tissues affected would include the supraspinatus tendon and subacromial bursa.[9]

Joint mobilizations are performed day one postoperatively, as well. Joint mobilizations continue to be a part of the treatment protocol provided by a physical therapist until full ROM is attained. Grade I and II mobilizations are performed to increase nutrition and lubrication to the joint surfaces, as well as decrease pain through the Gate Control Theory of Pain. Grade I and II mobilizations start at the beginning arthrokinematic ROM and only go to the midpoint of arthrokinematic motion. Grade III and IV mobilizations are performed to increase joint extensibility by breaking adhesions or stretching out the capsule.[10] Grade III and IV mobilizations are not performed early on in the rehabilitation process if the labrum or capsule were involved

structures in the surgical procedure. Due to posture and holding the arm in a protective position postoperatively, the posterior and inferior capsules are the most common to be restricted. Performing joint mobilizations early in the rehabilitation phase (day one) can prevent excessive scarring and restricted ROM following surgery. There are specific techniques to target the posterior **(Figure 2)** and inferior capsule **(Figure 3)**.

## Eye on Biomechanics

Besides the glenohumeral joint, other joints within the shoulder girdle complex may need attention for optimal biomechanics to occur. Physical therapists will assess the mobility of the sternoclavicular joint, acromioclavicular joint, and scapulothoracic joint. The scapula contributes approximately 60 degrees of the total 180 degrees of shoulder elevation. The glenohumeral joint contributes the other approximate 120 degrees.[9] The scapula frequently displays decreased ROM, which is commonly the result of postural deficiencies over time. With a compromised posture, the scapulae often sit protracted and caudally rotated. If motion is limited, and the full 60 degrees of cranial rotation is not available at the scapulothoracic joint, the glenohumeral joint will try to make up for this hypomobility by becoming hypermobile. A caudally rotated scapula will also increase the stress on the subacromial tissues with elevation. Once the scapula has its proper mobility, it can perform its proper contribution to function within the shoulder complex. The scapula's function is to provide a stable base for the humeral head, as well as provide a kinematic link between the upper extremity and the axial system.[7] Scapular dyskinesis is frequently associated with shoulder injuries, even if the scapula has full ROM passively. It is often caused by inhibition or overactivation of the scapular muscles. Serratus anterior and the lower trapezius are common muscles affected by inhibition. The upper trapezius is the most common muscle affected by overactivation.[11] Scapular mobilizations and scapular control exercises can begin immediately postoperatively without placing stress on the involved tissues. Scapular control exercises, including scapular depression and retraction, do not require glenohumeral movement.[11]

By beginning physical therapy on postoperative day one, the therapist can begin to address any deficits in the biomechanics of the entire shoulder girdle, as well as educate the patient in the proper exercises to correct the deficits without placing inappropriate stress on the involved tissues. Beginning this process early will help ensure normal mobility of the sternoclavicular, acromioclavicular, and scapulothoracic joints by the time the glenohumeral joint is allowed full ROM. Normalizing mobility of the entire shoulder girdle will not only decrease stress on the involved structures in the short term, but also decrease the chance of re-injury in the long term. Another reason to start postoperative shoulder patients in physical therapy on day one is to allow for a smooth and appropriate transition from PROM to active-assisted ROM (AAROM) and finally to active and resisted ROM. The physical therapist will provide expert instruction and mentorship to ensure that the patient is completing all activities while maintaining optimal quality of motion and concurrently improving the quantity of motion. Patients frequently demonstrate compensatory patterns and increased subjective pain levels, which increase the stress on the surrounding structures. Physical therapists are very aware of these compensation patterns and can reinforce proper movement patterns until they become habit.



**Left to right: Figure 1, Figure 2, Figure 3 — It has been my clinical experience that patients who are seen by a physical therapist at day one postoperatively have increased range of motion and decreased overall pain during their rehabilitation programs.**

## Changing Opinions

Physicians' opinions of postsurgical shoulder rehabilitation programs vary widely. Most

surgeons agree on beginning a few exercises within the first few weeks after surgery. Based on the literature[4] and on my own clinical experience, beginning formal physical therapy at day one postoperatively has been shown to be beneficial. Superior communication between the surgeon and the therapist and early mobilization are the keys to increased mobility, decreased pain, and an earlier return to function while protecting and allowing the involved structures to heal. The patient is provided with more education and a smoother transition throughout the various stages of his or her shoulder rehabilitation in this scenario. The end result is a patient who displays more function with less subjective pain, who is more educated with less frustration, and who is, in short, happier.

Patients who are happier with their outcome and their rehabilitation make our careers very rewarding. Anecdotally, I think we can all agree on that. The benefits of early postoperative rehabilitation on shoulder patients extend not only to the patients that we serve, but also is a rewarding improvement to our respective professions.

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Editor's Note: Kimberly A. Kollwelter is not affiliated with Midwest Orthopaedics at Rush (MOR). Treatment recommendations presented in this article are solely the professional opinion of the author. MOR physicians direct postoperative physical therapy in accordance with each patient's individual medical case specifics.

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# Minimally Invasive Fracture Surgery

## An Overview

By Walter W. Virkus, MD

Minimally invasive surgery is becoming more popular with patients because of smaller incisions and possibly shorter recovery times. While many orthopaedic fracture surgeries have been performed with minimally invasive techniques for years, the possibilities are expanding to additional types of fractures. In addition to smaller incisions and shorter recovery periods, minimally invasive fracture surgery actually may allow the fracture to heal faster than with more invasive surgical options.

### Fracture Healing

Fractures heal by one of two methods, called primary and secondary fracture healing. The method of healing is determined by how closely and tightly the fracture is held together. When the bone ends are only loosely held together, as in cast treatment, the bones heal by secondary, or indirect, fracture healing. In this form of healing, a blood clot or hematoma forms around the fracture. Factors released by the injured bone lead to the formation of fibrocartilage callus in this hematoma. The fibrocartilage is then converted to woven or immature bone, which is slowly remodeled into mature haversian bone over many months.

This process results in a ball of new bone surrounding and joining the fractured ends of the bone. This type of healing also occurs in operative fracture care when partial stability is obtained. If there is excessive motion between the fracture fragments, the fibrocartilage will not be converted to bone and nonunion will result.

Primary, or direct, bone healing occurs when the fractured ends are perfectly aligned and held tightly in place, called rigid stability. It can only occur with surgery. In primary healing, osteoclasts (bone resorbing cells) bore tunnels through the bone and across the fracture site. In these tunnels new mature bone is grown. The bone strength is restored by direct knitting of one bone to the other. If the bones are not held tightly, or if they are held tightly but are not perfectly aligned end-to-end, nonunion can result. Both types of healing require the fractured bone to have a good blood supply, which it receives from the surrounding muscle. If too much muscle is torn off the bone during the open reduction and plating, nonunion can occur.

In operative fracture care, the type of stability and resultant desired healing depends on the type of fracture and its location. Rigid stability and primary fracture healing can only be obtained with an open reduction and internal fixation, usually with plates and screws. Only rarely is it possible with minimally invasive techniques. Relative stability and secondary fracture healing are achievable with a wide variety of surgical techniques, many of them minimally invasive. In fact, one reason minimally invasive fracture surgery is beneficial to patients is that the nutrient-rich hematoma that forms at the time of the fracture is not washed away, as it is in open fracture surgery, which likely speeds the time to callus formation and, eventually, to healing.


**Healed distal femur fracture**

### Minimally Invasive Techniques

Minimally invasive fracture surgery can be divided into two types. The first is intramedullary nailing or rodding. This type of surgery has been utilized for 40 years. This technique is mostly used in fractures of the tibia, femur, and humerus when the fracture is in the middle of the bone. A hole is made at one end of the bone and a reamer is used to clean out the bone marrow in the middle of the bone. Then the rod or nail is inserted down the middle of the bone. Locking screws are placed through the nail at each end to prevent the bone from collapsing or twisting.

A more recent minimally invasive technique for fractures involves using plates and screws inserted through small incisions. The terms percutaneous plating or submuscular plating are sometimes used to describe this technique. In percutaneous plating, the fractured bone is straightened by any of a variety of techniques, using x-ray to determine when the bone is aligned closely. The fracture does not need to be realigned perfectly in this technique. Then a small incision is made on one side of the fracture. A tunnel is created between the bone and the overlying muscle or skin. The plate is bent to match the surface of the normal, nonbroken bone. The plate is placed into the tunnel and across the fracture. Then screws are placed through the plate into the bone on both sides of the fracture through very small skin incisions, using x-ray guidance.

Although the fracture is not held as tightly as when the fracture is aligned through a large incision and direct vision, the hematoma that forms the callus is not washed away, which allows the healing to occur more rapidly. In addition, since less muscle is pulled off the bone with this technique, the bone receives a larger blood supply, which also assists in healing.

### Only Sometimes the Answer

So why not perform minimally invasive fracture surgery all the time? Well, it is not possible in all

**Minimal incision through which the larger plate is inserted across the fracture**

fractures. Most fractures that extend into a joint and split the cartilage need to be realigned perfectly to minimize the risk of posttraumatic arthritis. In most cases, perfect alignment can only be obtained by looking at the fragments and the joint surface directly through an open incision. In addition, some areas, like the forearm, have a lot of arteries and nerves very close to the fracture area. In these circumstances, the risk of minimally invasive surgery is too high because these important structures cannot be seen on x-ray, and therefore cannot be protected.

Lastly, minimally invasive fracture surgery is much more difficult and takes longer than traditional open surgery. It takes a lot of experience to be able to get the fracture aligned when you can see only the ends of the bones on x-ray instead of looking at them directly. Placing the plate and putting in the screws using x-ray guidance is also very difficult and takes some practice.

**Postoperative distal tibia fracture**

Despite the longer surgical times, there are many benefits to minimally invasive fracture surgery. Although the smaller incisions are nice, they are probably the smallest benefit from the medical point of view. The real benefits are the minimal muscle injury and the preservation of the fracture hematoma and blood supply to the bone.

As mentioned, preserving the hematoma and blood supply seems to increase the speed of bone healing, sometimes dramatically, which is certainly a benefit to any patient. Additionally, smaller incisions usually mean much less damage to the muscles around the fracture. Less damage allows for faster rehabilitation and helps minimize joint stiffness, allowing the patient to return more quickly to the activities of daily life.

## Pluses and Minuses

There are many benefits to minimally invasive fracture surgery. While not possible in all fracture cases, newer techniques and implants are available to increase the number of fractures that can be treated with these methods. Minimally invasive surgery is more difficult and takes longer than traditional surgery, and the surgeon's experience can play a large role in a successful outcome. ●

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# At the Cutting Edge

## The New Field of Cartilage Transplantation Brings Fresh Options for Repairing Damaged Shoulders

**By Brian J. Cole, MD, MBA, and Andreas H. Gomoll, MD**

**Figure 1: Smaller cartilage defect treated with autologous chondrocyte implantation**

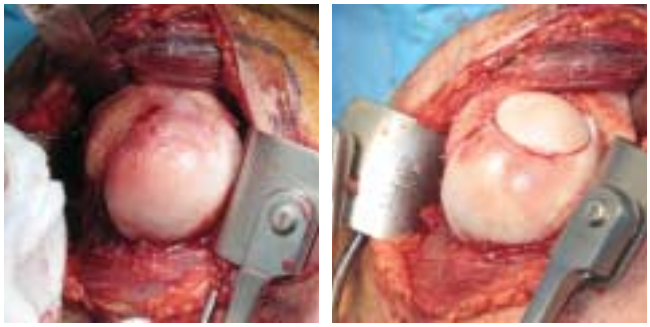

**Figure 2: (left) Photograph of a large defect of the humeral head; (right) photograph of a fresh osteochondral allograft used to replace the damaged cartilage**

Damage to the articular cartilage (the cartilage that covers the surface of the bone) is a relatively rare cause of shoulder pain compared with other causes, such as impingement or tears of the rotator cuff. While there are excellent therapeutic options for impingement and tears, however, treatment for cartilage injuries, especially in young and active patients, has become available only recently.

### Types of Shoulder Damage

Cartilage damage in the shoulder is divided into several categories — acute versus chronic and localized versus diffuse. The best-known and most common type of cartilage damage is the chronic, diffuse type that results from osteoarthritis, also known as degenerative arthritis. Treatment for osteoarthritis in the shoulder, similar to that in other joints, includes anti-inflammatory medications, physical therapy, injections, and ultimately a joint replacement. In shoulder replacements, the damaged cartilage is removed and replaced with a metal-and-plastic prosthesis, similar to hip and knee replacements. Although shoulder replacement provides good pain relief, functional gains are less predictable; in addition, like all mechanical parts, artificial shoulders wear out over time and might require subsequent surgery. For these reasons, surgeons have traditionally attempted to avoid joint replacements in younger patients.

In addition, cartilage damage in younger patients is often not caused by arthritis, but is a result of traumatic injuries, such as a shoulder dislocation during which cartilage is chipped, or less frequently because of problems with the blood supply, where a piece of bone with the attached cartilage dies off and becomes detached. This type of damage is often localized and more acute in nature. It often presents as a deep pain that worsens with increased activities. Sometimes patients experience popping or clicking, and report limited motion or weakness. To diagnose these injuries, surgeons often initially obtain x-rays, possibly followed by magnetic resonance imaging (MRI) or a computed tomography (CT) scan. Guided by the patient's symptoms and physical and radiographic findings, the physician will often attempt conservative treatment at first.

### Treating Conservatively

Conservative treatment with physical therapy, anti-inflammatory medications, and steroid injections largely provides symptomatic relief, without true healing of the damaged cartilage. The patient's symptoms will often decrease dramatically even with conservative measures, however, and surgery is avoidable. If all conservative measures are exhausted and the symptoms continue to exist, surgical intervention is considered. Traditional surgical options include arthroscopy for joint debridement, essentially a cleaning of the joint while viewing through a small camera to remove scar tissue and loose pieces of cartilage. This procedure can improve symptoms dramatically, but often provides only temporary relief, since it still does not correct the underlying cartilage damage.

### Enter Cartilage Transplants

Because certain lifelong restrictions, such as limited carrying or lifting, have to be accepted by the patient with a shoulder replacement, and because other replacements may become necessary over time, surgeons and patients alike have been looking for alternatives to joint replacement and for something more effective than simply cleaning the joint out arthroscopically. The new field of cartilage restoration promises to provide a biological answer to this problem and avoid the implantation of a metal and plastic prosthesis. Originally developed and applied for the treatment of cartilage damage in the knee joint, cartilage transplantation now is applied increasingly to other joints, such as the shoulder, hip, and ankle. Within the field of cartilage transplantation, three distinct technologies aim to restore articular cartilage — autologous chondrocyte, osteochondral autograft, and osteochondral allograft transplantation.

### Autologous Chondrocyte Transplantation (ACI)

This technique involves the arthroscopic harvesting of a small piece of cartilage from the patient's knee, which is then used to grow new cartilage in the lab. Once the cartilage cells have multiplied sufficiently over the course of several weeks, the patient returns for implantation of the cells. This second procedure involves open surgery, as opposed to the arthroscopic method used for the cell harvest. The physician excises the damaged cartilage, covering the resultant hole with a flap of periosteum. This periosteum, a thin tissue similar to a skin that covers all bones, is harvested from the patient's shinbone through a small inci-

sion during the same procedure. Once the flap is in place with multiple small stitches to the surrounding cartilage, the now-covered hole is filled with the cartilage cells that were grown in the lab. The cells then start to produce cartilage tissue that closely resembles the original articular cartilage **(Figure 1)**.

## Osteochondral Autograft Transplantation

In this procedure, healthy cartilage from the patient's knee takes the place of the damaged cartilage in the shoulder. The surgeon removes a round area of damaged cartilage, together with a cylinder of underlying bone, with a punch-like device. The surgeon then obtains a piece of cartilage and bone of similar dimensions from an area of the knee joint where there is extra cartilage. The physician makes use of the cylinder of healthy bone and cartilage to fill-in the defect in the shoulder. The hole in the knee fills in with scar tissue over time.

## Osteochondral Allograft Transplantation

Similar to the above-described autograft transplantation, allograft transplantation utilizes cylinders of healthy bone and cartilage to replace damaged cartilage. The difference lies in the source of the tissue. While the term 'autograft' implies that the patient's own tissue is used, 'allograft' means tissue from somebody else. Similarly to heart and kidney transplants, bone and cartilage is obtained from tissue donors. Unlike these organ transplants, however, cartilage and bone transplants do not require immune suppression, and there is no organ rejection. Prior to transplantation, the tissue undergoes extensive testing for diseases and infections, but a minimal risk remains. The main advantage of allograft over autograft transplantation is the ability to treat large areas of cartilage and bone damage **(Figure 2)** and the avoidance of surgery on the patient's own knee, which decreases pain and speeds up recovery after the operation.

The physicians at Midwest Orthopaedics at Rush routinely perform all three types of transplants as guided by patient symptoms, radiographic findings, and patient preference.

## Future Directions

Research is ongoing on several fronts to improve cartilage transplantation. New technologies are emerging that will allow surgeons to perform autologous chondrocyte transplantation arthroscopically through keyhole surgery, rather than through an open incision. While this technology is already in use in Europe, it has not received U.S. Food and Drug Administration (FDA) approval yet for use in the United States. Other research is underway to make allograft transplantation safer using even better tests to rule out disease transmission. Additional research involves allowing for a better supply of donated grafts by improving the time that these grafts can safely remain in storage prior to implantation (now, grafts have to go from the donor to the patient within a few days).

We are actively involved in improving patient outcomes by performing basic science research in the area of cartilage transplantation, as well as outcomes research, through which we are continually evaluating and improving our surgical technique in this evolving field at the cutting edge of orthopaedic surgery. ●

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***Andreas H. Gomoll, MD**, joined the Midwest Orthopaedics at Rush Sports Medicine Fellowship program after completing the Harvard Combined Orthopaedic Residency Program at Massachusetts General Hospital in Boston. A native of Germany, Dr. Gomoll graduated from Ludwig-Maximilians-Universitaet Medical School in Munich and attended Oxford University on a visiting student scholarship. He specializes in sports medicine, and his research interests include rotator cuff disorders and bone and cartilage transplantation.*

# Be Wary During Winter

## Local Health Talk

**By Trish Palmer, MD**

Are you thinking about preventing winter sports and cold-related injuries? Most cold-related injuries can be prevented with a little planning, some preparation, and the proper equipment.

### Beware the Snow Shovel

One of the most common winter-related injuries results from shoveling snow. It is vigorous exercise and a big strain on the back that people don't appreciate. The weight and position are really bad for two parts of your back. A disc could be compressed, resulting in a pinched nerve. Also, the muscles in the lower back are small and easily strained.

### Prevent problems with good positioning and exercise.

When you lift 10 pounds close to your body, it exerts 10 pounds of pressure on the back. If you lift that same 10 pounds away from your body, as people often do when shoveling, it is seven times heavier, exerting 70 pounds of pressure on the back.

The best advice is don't do it. Our bodies are not built to shovel snow. Get a snowblower or pay the neighbor kid to do it for you.

If you insist on shoveling yourself, start exercising for some time before you attempt it. You need to get in shape and build up those back muscles.

### Winter Sports Prep

That advice holds true for winter sports as well. Exercising in cold weather places extra demands on the body. If you haven't exercised regularly in months, you are more likely to suffer an injury on the ski slopes or at the ice rink. Pay special attention to muscles particular to your chosen sport.

For downhill skiing, concentrate on strengthening the muscles of the upper leg, the quadriceps, and hamstrings. You want both sets of muscles to be strong or you could expose yourself to injury, like an ACL tear.

A great exercise is the wall sit. Sit against a wall as if you are in a chair. Make sure your upper legs are horizontal and your heels are directly beneath your knees. Try three sets of 30 seconds each. Try to hold the position for a few minutes at a time.

If you're hoping to be the next Nancy Kerrigan or at least stay on your feet while ice skating, work on strength and balance. Proprioception drills are simple exercises to strengthen your ankles and work on balance. Simply stand on one foot with your eyes closed and work up to being able to do this for 1-2 minutes at a time.

In addition to strengthening the quads and hamstrings, condition the calves and the muscles in the front of the leg. Calf raises are the most basic exercises for lower body strength. Be careful of squats and lunges which put a lot of pressure on the front of the knee.

To strengthen ankles, use resistance bands wrapped around the leg of a table and your foot. Flex feet toward your body. Repeat the exercise, moving your foot in a clockwise fashion, and then move the foot counterclockwise.

Snowboarding is gaining popularity and as a result, doctors are seeing more wrist and arm injuries, especially for beginners. On the upside, people with knee problems may want to transfer to snowboarding because it may be easier on the knees than skiing.

### Warm Up

Once the skating pond freezes and the snow falls, the most important part of protecting yourself during winter activities is being prepared. Warm up before you go outdoors for activities to loosen muscles and expand your lungs to handle the cold air.

Exercise and cold-induced asthma can be worse in the winter, so cover your mouth with a scarf to warm the air coming into your lungs. Dress warmly in layered clothing, hats, warm socks, and mittens.

### Watch Out

Always be aware of frostbite and hypothermia. On a day with a wind-chill, you can get frostbite much more quickly than you may think. Signs of frostbite include skin changing in color to pink and then white. In addition the body part will feel cold to the touch and become numb. The area tends to feel intensely painful on rewarming. Participate in outdoor activities with a partner and check each other for signs of hypothermia, which include shivering, drowsiness, and lack of coordination.

### Hydrate!

Don't forget to drink plenty of water before, during, and after your outdoor fun. Dehydration can also occur in the winter months with strenuous activities. Don't drink alcohol, which can restrict blood vessels and increase your risk for hypothermia. Protect your skin from the sun and wind using a sunscreen or sun block. The sun reflects off the snow and can quickly cause a sunburn, even though you might feel cold.

### Head Gear, Etc.

The importance of protective equipment and a proper fit cannot be stressed enough. Ensure that your skis, skates, shoes, and other equipment fit you correctly. Helmets are a must for skiing,

## 4 Rules of Winter Injury Prevention

**Rule #1: Quit while you're ahead**

If you feel yourself getting tired, then stop the activity. Fatigue can cause a loss of concentration, and one sloppy movement could result in a major setback.

**Rule #2: Stay energized**

Remember that your body needs fuel to make all those smooth moves. Pack plenty of water and have a snack during breaks.

**Rule #3: Exercise often**

Strong and flexible leg muscles allow freedom of movement and reduce the likelihood of injury. Maintaining a light exercise routine will improve athletic performance and overall health.

**Rule #4: Know your limits**

Buying an expensive ski vacation package does not make you an athlete. Unless you are an experienced skier, shrug off the pressure to outperform your peers.

sledding, and snowboarding. You wouldn't allow your children to bicycle without a helmet, why would you allow them to do other high-velocity sports without protection?

And finally, enjoy yourself but remember to stop before you get fatigued. Most winter-related injuries happen in the afternoon as participants tire out.

***Trish Palmer, MD**, is a sports medicine specialist at Midwest Orthopaedics at Rush, Chicago, Illinois. Dr. Palmer is a team physician for the United States Ski and Snowboard Association, working with alpine and freestyle ski team members. She is also a team physician for U.S. Speedskating. Her patients include members of the current alpine skiing, mogul skiing, aerial skiing, speedskating, bobsled, and skeleton teams. Dr. Palmer was Deputy Venue Medical Officer for Deer Valley for the 2002 Winter Olympics in Salt Lake City.*

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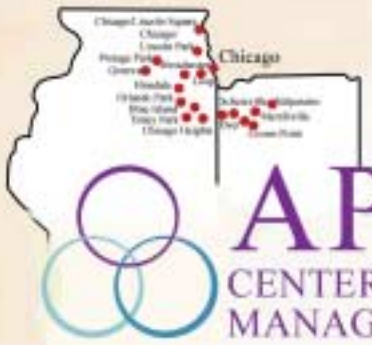


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