MESSAGE FROM THE CHAIR

AT THE DEPARTMENT OF ORTHOPAEDIC SURGERY AND REHABILITATION, OUR MISSION IS TO IMPROVE THE QUALITY OF ORTHOPAEDIC CARE THROUGH STATE-OF-THE-ART PATIENT CARE, SUPERIOR EDUCATION AND INNOVATIVE RESEARCH.

We are building a world-class research program in our Nano-Biotechnology and Biomechanics laboratories, where we are performing cutting-edge research to create “smart” implants that last longer and perform better, as well as innovative work on wear testing of joints that is helping to set national and international standards for testing of knee replacement systems. Continuing to be at the forefront of orthopaedic research and technology ensures that we can provide a superior education to our residents, as well as offer the latest techniques and most advanced diagnosis and treatment to our patients.

Constantly striving to excel in all aspects of our mission also inevitably brings growth. We are excited to announce that we have recruited two new physicians to our team. Drs. Beau Konigsberg and Curtis Hartman, who both specialize in adult reconstructive surgery, have joined our full-time faculty. You can learn more about each of them in the ‘Meet the Full-time Faculty’ section of our report.

We extend a sincere thank you to everyone who made private contributions to the department during the 2008–2009 calendar years. Please make sure to see the “Honor Roll of Contributors” we have published to show our appreciation for these gifts, which provide vital resources for the continued success of our department’s residency education program, research projects, and much more.

Thank you for your support!

KEVIN GARVIN, M.D.
Professor & Chair
OUR MISSION IN MOTION:

TO IMPROVE THE QUALITY OF ORTHOPAEDIC CARE THROUGH THE FUSION OF STATE-OF-THE-ART PATIENT CARE, SUPERIOR EDUCATION AND INNOVATIVE RESEARCH.

IN ACADEMIC CENTERS AROUND THE WORLD IT’S KNOWN AS THE “3-LEGGED STOOL” AND IT EMBODIES THE MISSION AND VISION OF UNMC’S DEPARTMENT OF ORTHOPAEDIC SURGERY. EACH LEG IS VITAL FOR THE SUCCESS OF NOT ONLY OUR ACADEMIC MISSION, BUT ALSO VITAL TO THE SUCCESS OF THE TWO OTHER LEGS.

LINKING PATIENT CARE, EDUCATION AND RESEARCH IS THE KEY TO ENSURING THAT WE CONTINUE TO OFFER THE BEST AND MOST INNOVATIVE CARE FOR OUR PATIENT’S MUSCULOSKELETAL PROBLEMS, PRODUCE THE BEST AND BRIGHTEST ORTHOPAEDIC SURGEONS OF THE FUTURE, AND DEVELOP NEW CLINICAL PROCEDURES AND SURGICAL TECHNIQUES THROUGH CUTTING-EDGE RESEARCH. HOWEVER, AT THE DEPARTMENT OF ORTHOPAEDIC SURGERY AND REHABILITATION, WE FEEL THAT JUST TREADING THE BEATEN PATH IS NOT ENOUGH. EVERY DAY OUR GOAL IS NOT TO SIMPLY APPLY EACH OF THESE OBJECTIVES, BUT TO EXCEL IN EACH AT SUCH A LEVEL THAT ONE PUSHES THE OTHER TO RISE TO A HIGHER STANDARD, CREATING A CONTINUOUSLY EVOLVING CYCLE OF EXCELLENCE.
PATIENT CARE: PROVIDING STATE-OF-THE-ART ORTHOPAEDIC CARE FOR PATIENTS AFFLICTED WITH MUSCULOSKELETAL DISORDERS

At the Department of Orthopaedic Surgery and Rehabilitation at the University of Nebraska Medical Center we offer the resources of a large, university-related hospital with the personal care and attention of a smaller department. Our team of dedicated, caring health professionals specializes in the prevention, diagnosis, and treatment of musculoskeletal disorders in children, teenagers, and adults. Our department provides quality, cost-effective care to more than 35,000 patients each year from Nebraska, the Midwest, and around the world. Several of our physicians are recognized each year on the annual “Best Doctors in America” list and many serve the profession as leaders in local, state, national, and international scientific organizations.

Our orthopaedic surgeons work closely with caring, experienced nurses and consult with physicians in other medical specialties to provide the latest comprehensive care. Faculty physicians in the Department of Orthopaedic Surgery and Rehabilitation treat thousands of patients each year in the areas of:

ADULT RECONSTRUCTIVE AND GENERAL ORTHOPAEDICS: inflammatory and degenerative joint problems, bone and soft tissue reconstruction and prosthetic joint replacement

FOOT AND ANKLE SURGERY: foot and ankle disorders ranging from the common to the complex, from bunions to fractures

HAND SURGERY: hand and wrist conditions such as arthritis, nerve compression and repair of congenital hand deformities and injuries

ORTHOPAEDIC ONCOLOGY: benign and malignant bone and soft tissue tumors, bone grafts and custom prosthetic implants

SHOULDER AND ELBOW: evaluation and management of shoulder and elbow arthritis, dislocations, fractures and tendon tears

TRAUMA: emergency evaluation, treatment, and long-term follow-up of fractures, dislocations and other musculoskeletal injuries

PEDIATRIC ORTHOPAEDICS: limb and spine deformities, bone and joint infections and fractures and dislocations of the arms, legs and spine in infants, children and teenagers

SPORTS MEDICINE: treatment of injuries or illnesses related to sports, such as sprains, ligament or cartilage injuries, or joint ailments in athletes of all ages

SPINE: evaluation and management of spine conditions such as deformities, injuries and deterioration
CREATING ORTHOPAEDIC SURGEONS OF TOMORROW; CULTIVATING FUTURE EDUCATORS

The orthopaedic residency program in Nebraska is fully accredited by the Accreditation Council for Graduate Medical Education (ACGME) and includes training in all nine orthopaedic subspecialties offered at the Department of Orthopaedic Surgery and Rehabilitation. The department's 20 orthopaedic residents are involved in daily patient care and important research activities during their five years of intensive training. Fifteen full-time clinical faculty and numerous staff members instruct, evaluate and mentor our residents at various hospital locations on the UNMC campus. Many more Omaha-area orthopaedic surgeons serve as volunteer faculty members, supervising our residents as they rotate through different subspecialty private-practice situations. Two full-time research faculty, lab technicians and a full-time research coordinator assist residents with their research projects.

Not only are we educating the orthopaedic surgeons of tomorrow, we are investing in the future of Nebraska by cultivating promising educators who will teach the orthopaedic surgeons of generations to come. Of all the men and women who have completed their orthopaedic surgical training through the Nebraska program, more than half are now practicing in the state of Nebraska. In addition, doctors throughout the region regard UNMC as a source of continuing medical education where they can learn the latest techniques for diagnosis, treatment and prevention of bone and joint diseases.
RESEARCH:
USING CUTTING-EDGE RESEARCH TO DEFINE TOMORROW’S DIAGNOSIS AND TREATMENT METHODS

We are building a world-class research program focusing on the areas of musculoskeletal diseases, molecular biology and genetics, and the development of less invasive surgical techniques and biomechanical engineering, especially knee implant simulation and testing and computer-aided and robotic surgery. Remaining at the forefront of orthopaedic research and technology means that we can offer patients the latest techniques and most advanced diagnosis and treatment, with personal care for patients and their families.

Our Biomechanics Laboratory and Nano-Biotechnology Laboratory are housed in the Scott Technology Center (STC), located on the Aksarben campus. Research faculty and other engineers at the Biomechanics Laboratory are performing cutting-edge experimental simulation and testing of the next generation of orthopaedic implants, and contributing to the development of multi-axial implant simulators. Through this research we are working to create implants that last longer and perform better, which are designed to suit the modern patient who is younger and more active.

This innovative work on wear testing of joints is also helping to set national and international standards for testing of knee replacement systems.

Our team of researchers and surgeons are also developing a novel freehand surgical navigation system for use in knee replacement surgery. This allows for more accurate bone cutting and better alignment of implants, with less trauma to the soft tissue and bone, which translates to faster recovery times for joint replacement patients.

Researchers at our Nano-Biotechnology Laboratory are working with super-small nanostructures that are undetectable to the human eye to make a big impact in the field of orthopaedic surgery. These miniscule structures are being used to create superhard, extremely wettable, “smart” infection-resistant coatings that will prolong the life of orthopaedic implants by reducing wear, thus reducing the need for revision surgery. In close collaboration with researchers from the UNMC departments of Genetics, Cell Biology and Anatomy, as well as Pathology and Microbiology, these durable coatings are being designed to promote bone marrow and normal cell growth, reducing both the probability of infections and patient recovery time. Because these versatile coatings can be applied to virtually any surface, they potentially have many other scientific and biomedical applications, including extending the life of critical mechanical components in aircraft, watercraft and ground vehicles, by increasing fuel efficiency and preventing corrosion.

As a result of the innovative research being done here, department researchers are attracting an increasing amount of external and international funding and acclaim, and have presented their results at prestigious national and international scientific and academic conferences.

Each year, the department continues to expand our surgery outcomes database, which is one more way that we are linking patient treatment, research and education. Currently there are over 3,500 surgery subjects in the database who have undergone total joint replacement, revision joint surgery, shoulder surgery, surgical treatment for osteogenesis imperfecta, or treatment for Whiplash Associated Disorders (WAD).

OUTCOMES RESEARCH:
PATIENTS HELPING PATIENTS

You don’t have to be a researcher or scientist to contribute to research that can positively affect the treatment methods of future orthopaedic patients. Many of our surgical patients give a little of their time to help us understand what is working and what might be improved, by allowing us to collect pre- and post-op data about their surgical case. Patients fill out questionnaires regarding their health, quality of life and functional status. This collection of data, known as an outcomes study, serves as a valuable tool for surgeons to evaluate and compare the effectiveness of various treatments, and ensure that diagnosis and treatment are continually evolving and improving.

Currently, there are over 3300 surgery subjects in our database who have undergone total joint replacement, revision joint surgery, shoulder surgery, surgical treatment for osteogenesis imperfecta, or treatment for Whiplash Associated Disorders (WAD).
It’s not every day that an orthopaedic surgery department can boast of winning an award related to the U.S. Olympics. And while it isn’t an Olympic gold medal, we think receiving an award for participating in the 2008 U.S. Olympic Swim Trials is still pretty darn impressive.

The award (pictured above) was presented to UNMC Physicians and the Department of Orthopaedic Surgery from the Omaha Sports Commission, in recognition for “providing exceptional care and service to the 2008 Olympic Swim Trial participants.”

The trials, which were held at the Qwest Center, boasted a record-setting attendance of 160,063 spectators – over 50,000 more than the previous trial record set by Long Beach, CA in 2004.

“The medical community really pulled together for this event and not only offered superior medical services at no cost, but also a welcoming attitude and the midwestern hospitality of which we are proud,” said Dr. Garvin.

When the request was put out for volunteers, an astounding number of physicians and staff from various specialties answered the call. Medical professionals from UNMC Physicians, the University of Nebraska Medical Center, and The Nebraska Medical Center, eagerly volunteered their time and knowledge to care for over 1250 athletes, coaches and trainers that came from all over the country to participate in the trials.

The Omaha swim trials experience got rave reviews from coaches and athletes alike. In addition to the award from the Omaha Sports Commission, and the warm accolades from those who attended the trials, the event was also named “Best Amateur Multi-Sport or Multi-Discipline Event” by SwimSwam Magazine.

In June of 2009, officials from USA Swimming and the Omaha Sports Commission announced that the U.S. Olympic Team Trials - Swimming will return to Omaha in 2012. The competition will take place from June 25 to July 2 at the Qwest Center Omaha, and will determine who will represent the U.S. in the London Games.

“We are thrilled to bring the Olympic Trials back to Omaha in 2012,” said Chuck Wielgus, USA Swimming executive director, in an interview with Swimming World magazine.

“We are thrilled to bring the Olympic Trials back to Omaha in 2012,” said Chuck Wielgus, USA Swimming executive director, in an interview with Swimming World magazine. “The 2008 Trials were a tremendous event, offering a fantastic experience for our athletes, fans, families and coaches. We look forward to not only recreating that excitement, but building on it, and putting together an even better show in 2012. We are fortunate to have great partners in the Omaha Sports Commission, the U.S. Olympic Committee, NBC and our corporate partner family, and together, I am confident that we will raise the bar on our sport’s marquee event.”

Blue Cross and Blue Shield of Nebraska has designated The Nebraska Medical Center as a Blue Distinction Center for Spine Surgery℠ and a Blue Distinction Center for Knee and Hip Replacement℠. Blue Distinction Centers for Spine Surgery and Blue Distinction Centers for Knee and Hip Replacement are part of the Blue Cross and Blue Shield Association’s expansion of its Blue Distinction℠ designation.

“It is an honor to be recognized as a Blue Distinction Center for Knee and Hip Replacement,” said Kevin Garvin, M.D., chairperson and professor of the Orthopaedic Surgery Department. “The designation validates the care we provide to patients affected with arthritis conditions of the hip and knee. Orthopaedic surgeons at The Nebraska Medical Center perform primary and complex hip and knee replacements on patients with arthritis, problems with joint disease from trauma, childhood hip and knee diseases and prosthetic joint infections.”

The Blue Distinction designation is awarded by the Blue Cross and Blue Shield companies to medical facilities that have demonstrated expertise in delivering quality health care in the areas of bariatric surgery, cardiac care, complex and rare cancers, knee and hip replacement, spine surgery and transplants. The program is part of The Blues® efforts to collaborate with physicians and medical facilities to improve the overall quality and safety of specialty care.

“We want to recognize and reward those network providers who are setting new standards of excellence in the quality of health care,” said Bill Minier, MD, chief medical officer at Blue Cross and Blue Shield of Nebraska. “We are pleased at the level of outstanding specialty care available to our members right here in our state.”
Meet the Full-Time Faculty

Kevin L. Garvin, M.D., Chairman

Kevin L. Garvin, M.D., is professor and chair of the University of Nebraska College of Medicine’s Department of Orthopaedic Surgery and Rehabilitation, as well as the L. Thomas Hood M.D., Professor of Orthopaedic Surgery and Rehabilitation. He received his M.D. degree from the Medical College of Wisconsin. He completed an orthopaedic surgery residency program at the University of Arkansas for Medical Sciences in Little Rock and a fellowship in hip surgery at the Hospital for Special Surgery in New York City. Dr. Garvin has served as associate editor for the Journal of Bone and Joint Surgery, as well as deputy editor for Clinical Orthopaedic and Related Research and continues to serve as a consultant reviewer for both publications. In addition, he is on the editorial board for Techniques in Knee Surgery. Dr. Garvin is a member of the American Orthopaedic Association (AOA), Traveling Fellow, 1995; chair, Resident Leadership Forum, 2008; Council of Orthopaedic Residency Directors Board, 2009-2013; the Hip Society (member, large Board of Directors, 2009-2013; Board of Specialty Societies Executive Committee, 2009-2013; the Knee Society, the Association of Mana, and Joint Surgeons and the Mid America Orthopaedic Association (president, 2004-2006). Dr. Garvin has been selected as one of the Best Doctors in America from 1999-2010. He was also selected as one of America’s Top Doctors by Castle Connolly Medical Ltd. (2007-2010). He is board certified in orthopaedic surgery with special interest in hip and knee reconstruction, as well as consultation and treatment of musculoskeletal infections.

Miguel S. Daccarett, M.D.

Sports Medicine and Orthopaedic Traumatology

Miguel S. Daccarett, M.D., is an assistant professor in the Department of Orthopaedic Surgery and Rehabilitation. He received his medical degree from Pontificia Universidad Javeriana, IHS in Bogota, Colombia in 1992. In coordination with his last year of medical school, he completed a general rotating internship at St. Ignatius University Hospital, and in 2006 completed his orthopaedic residency program at El Bosque University Orthopaedic Surgery Program in Bogota, Colombia. Dr. Daccarett has completed three orthopaedic fellowships, including an Orthopaedic Trauma Fellowship, (University of Louisville, KY, 2004), an Orthopaedic Oncology Fellowship, (University of Florida in Gainesville, FL, 2005), and an Orthopaedic Sports Medicine Fellowship (Harvard University Children’s Hospital in Boston, MA, 2006). He is a candidate member of The Musculoskeletal Tumor Society, as well as a member of the American Orthopaedic Society for Sports Medicine (AOSSM), the Orthopaedic Trauma Association (OTA), and faculty member of AO North America (AOA). He is also a member of the International Cartilage Repair Society (ICRS), the Colombian Society of Orthopaedic Surgery and Traumatology (CSCOT), and the International Society of Arthroscopy Knee Surgery and Orthopaedic Sports Medicine (ISAKOS). His special interest include the treatment of pelvis and peri-articular fractures, as well as arthroscopic assessment of fractures compromising the articular joint. He also has additional interest in the treatment of sports-related injuries and multiple joint injuries of the knee, including ACL and PCL reconstruction, cartilage repair procedures, osteochondral cartilage transfer (OATS) and meniscal repair and transplantation, as well as autologous chondrocyte transplantation (ACT).

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Mark E. Dietrich, M.D.

Sports Medicine and General Orthopaedics

Mark E. Dietrich, M.D., is an assistant professor in the Department of Orthopaedic Surgery and Rehabilitation. He received his medical degree from the University of Nebraska College of Medicine. Dr. Dietrich completed a five-year residency program at the University of Nebraska Medical School, followed by an Orthopaedic Sports Medicine Fellowship at Minnesota Sports Medicine in Minneapolis, Minnesota. He is a candidate member of the American Orthopaedic Society for Sports Medicine. Dr. Dietrich’s specialty interests include sports-related injuries, hip arthroscopy, and arthroscopic knee and shoulder reconstruction.

Paul W. Esposito, M.D.

Pediatric Orthopaedic Surgery

Paul W. Esposito, M.D., is a professor of Orthopaedic Surgery and Pediatrics at the University of Nebraska College of Medicine. He received his M.D. degree from Hahnemann Medical College and Hospital. He completed his internship and residency in orthopaedic surgery at the U.S. Naval Hospital, Oakland, California, and a pediatric orthopaedic fellowship at Children’s Hospital Medical Center Cincinnati. He is board-certified and he is a member of the Pediatric Orthopaedic Society of North America; a member of the American Orthopaedic Association; a fellow of the American Academy of Orthopaedic Surgeons; and a fellow of the American Academy of Pediatrics. He is active in the American Academy of Pediatrics (AAP), serving on the Section on Orthopedics, the Section on Sports Medicine, and the Council on Children with Disabilities. Dr. Esposito is a AAP representative to the U.S. Bone and Joint Decade (USBJD), a national organization dedicated to increasing awareness of bone and joint conditions and disease. He is also a reviewer for PEDIATRICS and the Journal of Pediatric Orthopaedics. He is the executive committee of the One World Health Center. Dr. Esposito is on the board of directors at Children’s Hospital Medical Center, serving as president of the Medical Staff (2008-2010), and is the pediatric orthopaedic surgeon of the osteogenesis imperfecta clinic. He has published a book chapter and made numerous presentations in the last two years regarding the treatment of osteogenesis imperfecta. Dr. Esposito was once again selected as one of Best Doctors in America in 2008-2010, on honor he has received since 1998. His special interests are in children’s extremity deformities, osteogenesis imperfecta, congenital and developmental disorders, and cerebral palsy.
EDWARD V. FEHRINGER, M.D.
Shoulder and Elbow Surgery

Edward V. Fehringer, M.D., is an associate professor at the University of Nebraska College of Medicine’s Department of Orthopaedic Surgery and Rehabilitation. He received his medical degree at the University of Nebraska College of Medicine in 1998. He completed his five-year orthopaedic residency at the University of Nebraska Medical Center with a fellowship in shoulder and elbow surgery at the University of Washington School of Medicine in Seattle, Washington. He is board certified by the American Board of Orthopaedic Surgery. He is a member of the American Shoulder and Elbow Surgeons and a fellow of the American Academy of Orthopaedic Surgeons. He is also a member of the American Orthopaedic Association, the Mid-America Orthopaedic Association, and the Arthroscopy Association of North America. He has been selected as one of the Best Doctors in America from 2003-2010. His clinical interests include shoulder and elbow arthritis, dislocations, fractures, and tendinopathies. His research interests include rotator cuff tears and their association with aging, and shoulder socket reconstruction in shoulders with arthritis.

GLEN M. GINSBURG, M.D.
Pediatric Orthopaedic and Spine Surgery

Glen M. Ginsburg, M.D., is an associate professor at the University of Nebraska College of Medicine’s Department of Orthopaedic Surgery and Rehabilitation. He is also a medical director of the Munroe-Meyer Institute Motion Analysis Laboratory. Dr. Ginsburg earned his M.D. degree from the State University of New York at Buffalo and completed his orthopaedic residency at the State University of New York at Buffalo. He completed his fellowship in developmental and pediatric orthopaedics at Children’s Hospital in Los Angeles. A board-certified orthopaedic surgeon, Dr. Ginsburg is a member of the Gatt and O’Connor Movement Analysis Society and the American Academy of Orthopaedic Surgeons. He is also a fellow of the American Academy of Orthopaedic Surgeons and the Pediatric Orthopaedic Society of North America. He is a fellow of both the American Board of Orthopaedic Surgery and the Spine Research Society. His areas of focus include pediatric spine deformities and scoliosis.

HANI HAIDER, PH.D.
Director, Orthopaedic Biomechanics and Advanced Surgical Technologies Laboratory

Hani Haider, Ph.D., is a professor at the University of Nebraska College of Medicine’s Department of Orthopaedic Surgery and Rehabilitation, and director of Biomechanical Engineering Research. Dr. Haider studied in England for his first degree and Ph.D. in Mechanical Engineering. From a fluid dynamics and mechanical faculty, teaching background at the University of Sheffield, he joined the faculty of University College London Medical School in 1987. He was the principal medical control software engineer who produced the British Starmer-Kracken Knee Simulator and the International Standards Organization (ISO) method for simulation and wear testing of bone replacement implants. He was invited to join the faculty of the University of Nebraska Medical Center in March 2000.

Dr. Haider had won three different University prizes in his university student career, and twice as faculty from the University of Nebraska Medical Center for Special and Outstanding Professional Achievement. He also received the “The IIG’s RIG-I International Research Prize” in 1998 and the HAP Paul Award by the International Society for Technology in Arthroplasty for innovation in joint replacement technology. In Nebraska, Dr. Haider has received over 30 research contracts, mostly from orthopaedic companies in the USA, and from Europe and Japan, as well as federal funding, altogether totaling over $5 million. He published over 150 papers in peer-reviewed journals and international conference proceedings in orthopaedics between 1987 and 2007. He is a member of the American Society for Knee Implant Wear Testing of ASTM International, and is a member of the ASTM Total Joint Specification Team and standard committees. He is a program director of the Interdisciplinary Society of Orthopaedics and Arthroplasty (OSA) and a member of its Board of Directors. Dr. Haider is one of two non-surgeon members of the Biomechanical Engineering Committee of The American Academy of Orthopaedic Surgeons (AAOS).

ANTHONY J. LAUDER, M.D.
Hand and Upper Extremity Surgery

Anthony J. Lauder, M.D., is an assistant professor at the University of Nebraska College of Medicine’s Department of Orthopaedic Surgery and Rehabilitation. He received his medical degree from the University of Nebraska College of Medicine in 1998. He completed his orthopaedic surgery residency at the University of Nebraska Medical Center in 2003. Following residency, Dr. Lauder completed a fellowship in Pediatric Orthopaedics at the University of Washington School of Medicine in Seattle, Washington. He is board certified by the American Board of Orthopaedic Surgery. He is a candidate member of the American Academy of Orthopaedic Surgeons and the Mid America Orthopaedic Association. He is also a fellow of the American Academy of Orthopaedic Surgeons, and a candidate member of the Scoliosis Research Society and the Pediatric Orthopaedic Society of North America (ROSA). Dr. Lauder is a fellow of the American Academy of Orthopaedic Surgeons, and a candidate member of the Mid America Orthopaedic Association. Dr. Lauder specializes in spinal deformities and scoliosis.

BEAU S. KONIGSBERG, M.D.
Adult Reconstructive Surgery

Beau S. Konigsberg, M.D., is an assistant professor at the University of Nebraska College of Medicine’s Department of Orthopaedic Surgery and Rehabilitation. He received his medical degree from the University of Nebraska College of Medicine in 2000. He completed an Orthopaedic Surgery Residency at the University of Nebraska Medical Center, in 2003. Following residency, Dr. Konigsberg completed a fellowship in Adult Reconstruction at the Rush University Medical Center and Rehabilitation Hospital in Chicago, Illinois, in 2005. He is fellowship trained in total hip and knee surgery in the University of Nebraska/Creighton University Medical Center Health Foundation in 2008. Following residency, Dr. Konigsberg completed a fellowship in Adult Reconstruction at the Rush University Medical Center and Rehabilitation Hospital in Chicago, Illinois. He is fellowship trained in total hip and knee surgery in the Rush University Medical Center and Rehabilitation Hospital in Chicago, Illinois. He is also a fellow of the American Academy of Orthopaedic Surgeons and the Mid America Orthopaedic Association. He is also a fellow of the American Academy of Orthopaedic Surgeons and the Mid America Orthopaedic Association. Dr. Konigsberg is a candidate member of the American Society for Surgery of the Hand, and a resident member of the American Academy of Orthopaedic Surgeons and Orthopaedic Research and Education Foundation. He is a candidate member of the American Society for Surgery of the Hand, and a resident member of the American Academy of Orthopaedic Surgeons and Orthopaedic Research and Education Foundation. Dr. Konigsberg specializes in hand and upper extremity surgery, and has special interests in traumatic and degenerative conditions related to the wrist.

CURTIS W. HARTMAN, M.D.
Adult Reconstructive Surgery

Curtis W. Hartman, M.D., is an assistant professor at the University of Nebraska College of Medicine’s Department of Orthopaedic Surgery and Rehabilitation. He received his medical degree from the University of Nebraska College of Medicine in 2003, and completed his orthopaedic surgery residency at the University of Nebraska/Creighton University Medical Center Health Foundation in 2008. Following residency, Dr. Hartman completed a fellowship in Adult Reconstruction at the Rush University Medical Center and Rehabilitation Hospital in Chicago, Illinois, in 2009. He is a candidate member of the American Academy of Orthopaedic Surgeons and the Mid America Orthopaedic Association, as well as a fellow of the American Academy of Orthopaedic Surgeons. He currently serves as the Chief Medical Officer and Program Director of the Rush University Medical Center and Rehabilitation Hospital’s Adult Reconstruction Program. Dr. Hartman specializes in comprehensive care for adult patients with hip and knee arthritis. His research interests include revision of failed hip and knee replacements, as well as management of infected hip and knee replacements.

BRIAN P. HASLEY, M.D.
Pediatric Orthopaedic and Spine Surgery

Brian P. Hasley, M.D., is an assistant professor of Orthopaedic Surgery at the University of Nebraska College of Medicine, Department of Orthopaedic Surgery and Rehabilitation. He received his medical degree from the University of Nebraska College of Medicine in 2003, and completed his orthopaedic surgery residency at the University of Washington School of Medicine in Seattle, Washington. He is board certified by the American Board of Orthopaedic Surgery. He is a fellow of the American Academy of Orthopaedic Surgeons and the Mid America Orthopaedic Association. He is also a fellow of the American Academy of Orthopaedic Surgeons and the Mid America Orthopaedic Association. He is a candidate member of the American Academy of Orthopaedic Surgeons, and a fellow of the American Academy of Orthopaedic Surgeons. He is also a fellow of the American Academy of Orthopaedic Surgeons. He is a fellow of the American Academy of Orthopaedic Surgeons, and a fellow of the Mid America Orthopaedic Association. Dr. Hasley has been selected as one of the Best Doctors in America from 2003-2010. His areas of focus in pediatric orthopaedic and spine surgery include pediatric orthopaedic and spine surgery, pediatric orthopaedic and spine surgery, and pediatric orthopaedic and spine surgery.

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Dr. Haider had won three different University prizes in his university student career, and twice as faculty from the University of Nebraska Medical Center for Special and Outstanding Professional Achievement. He also received the “The IIG’s RIG-I International Research Prize” in 1998 and the HAP Paul Award by the International Society for Technology in Arthroplasty for innovation in joint replacement technology. In Nebraska, Dr. Haider has received over 30 research contracts, mostly from orthopaedic companies in the USA, and from Europe and Japan, as well as federal funding, altogether totaling over $5 million. He published over 150 papers in peer-reviewed journals and international conference proceedings in orthopaedics between 1987 and 2007. He is a member of the American Society for Knee Implant Wear Testing of ASTM International, and is a member of the ASTM Total Joint Specification Team and standard committees. He is a program director of the Interdisciplinary Society of Orthopaedics and Arthroplasty (OSA) and a member of its Board of Directors. Dr. Haider is one of two non-surgeon members of the Biomechanical Engineering Committee of The American Academy of Orthopaedic Surgeons (AAOS).
MATTHEW A. MORMINO, M.D.
Orthopaedic Traumatology and Lower Extremity

Matthew A. Mormino, M.D., is associate professor and residency program director, as well as the Hermon Frick Johnson, Professor of Orthopaedic Surgery and director of the Orthopaedic Traumatology and Lower Extremity Surgery at the University of Nebraska College of Medicine. He received his M.D. degree from the University of Iowa College of Medicine and completed his orthopaedic surgery residency at Oregon Health & Science University. He also completed a trauma fellowship at the University of Washington. Mormino is a diplomat of the American Board of Orthopaedic Surgery, the American Academy of Orthopaedic Surgeons, the American Orthopaedic Association, the Orthopaedic Trauma Association, and the Musculoskeletal Society. He is a member of the American Academy of Orthopaedic Surgeons, the Orthopaedic Trauma Association, and the Musculoskeletal Society. He has been selected as one of the Best Doctors in America from 2005-2010. Dr. Mormino’s special concentrations include pelvic fractures, mal-unions and nonunions, foot and ankle trauma, and peripheral fractures.

FEREYDOON NAMAVAR, Sc.D.
Director, Nano-Biotechnology Laboratory

Fereydoon Namavar, Sc.D., is a professor at the University of Nebraska College of Medicine’s Department of Orthopaedic Surgery and Rehabilitation, and director of the Nano-Biotechnology Laboratory. He is an active member of the Nebraska Center for Materials and Nanoscience and a courtesy professor at the Department of Electrical Engineering at the University of Nebraska-Lincoln. Dr. Namavar earned his Doctor of Science, summa cum laude, degree in nanophysics, from the Institute for Nuclear and Radiation Physics at the Katholieke Universiteit Leuven in Belgium. Presently, he is involved with the development of novel concepts and technologies to maximize the lifetime of orthopaedic implants and minimize the possibility of wear and revision surgery through the development of novel nanomaterials for friction, wear reduction, and lubrication. He also studies for tissue engineering and enhancement of bone growth, and novel and bioactive coatings for short- and long-term applications of prosthetic devices. He is a collaborative research project with other UNMC faculty. Dr. Namavar is using a stem cell nanotechnology to regulate cell growth in order to enhance repair of cell proliferation, to either improve health or prevent disease with an emphasis on orthopaedic applications. Dr. Namavar has received grants and contracts from diverse corporations and government agencies, including NIH, NASA, and NSF. He collaborates with scientists around the world and holds several patents including US patent 6,045,761, entitled “Nano-crystalline, homo-metallic, protective coatings” for reducing the wear of medical implants.

SEAN V. MCGARRY, M.D.
Musculoskeletal Oncology

Sean V. McGarry, M.D., is an assistant professor at the University of Nebraska College of Medicine’s Department of Orthopaedic Surgery and Rehabilitation. Dr. McGarry received his medical degree from the Creighton University School of Medicine in 1998. He completed a surgery internship at the University of Colorado Health Sciences Center in 2000 and a residency in orthopaedic surgery at the University of Colorado - Shands Hospital in 2005, where he researched the role of stem cells in bone and soft tissue cancer. He is board certified by the American Board of Orthopaedic Surgery. He is an active member of both the American Academy of Orthopaedic Surgeons and the Musculoskeletal Tumor Society. He specializes in Orthopaedic Oncology with a focus on limb salvage.

N. ÅKE NYSTRÖM, M.D., PH.D.
Upper Extremity and Microvascular Surgery

N. Åke Nyström, M.D., Ph.D., is an associate professor at the University of Nebraska College of Medicine’s Department of Orthopaedic Surgery and Rehabilitation, and a joint appointment in the Department of Surgery and School of Pharmacy and Rheumatic Disease. Dr. Nyström completed his medical training, internship, and residency at the University of Umea School of Medicine in Sweden. After completing a fellowship in hand and upper extremity surgery at the University of Louisville, he returned to Sweden where he was a PHD in a vascular research setting in various hospitals. He joined the UNMC faculty in 2001 as orthopedic surgeon. He has been program director of hand surgery at the University of Nebraska Medical Center. Nyström specializes in hand and upper extremity surgery, as well as plastic and reconstructive surgery. He has been selected as one of the Best Doctors in America from 2007-2010. He was selected as one of the Best Doctors in America from 2007-2010. He was selected as one of the Best Doctors in America from 2007-2010.

LORI K. REED, M.D.
Foot & Ankle and General Orthopaedic Surgery

Lori K. Reed, M.D., is an assistant professor at the University of Nebraska College of Medicine’s Department of Orthopaedic Surgery and Rehabilitation. Dr. Reed received her medical degree from the University of Iowa College of Medicine in 1999. She completed her orthopaedic surgery residency at the Creighton University/University of Nebraska Medical Center Health Foundation. She then went on to complete her foot and ankle lower extremity reconstruction fellowship at the Florida Orthopaedic Institute in Tampa, FL. Dr. Reed is board certified in orthopaedic surgery. She is a member of the American Academy of Orthopaedic Surgeons, Orthopaedic Research and Education Foundation, American Orthopaedic Foot and Ankle Society, Orthopaedic Trauma Association, Mid-America Orthopaedic Association, Nebraska Orthopaedic Society, and the Emerging Leaders Program of the American Orthopaedic Association. Dr. Reed specializes in foot and ankle disorders, lower extremity post-traumatic reconstruction, and general orthopaedics.

SUSAN A. SCHERL, M.D.
Pediatric Orthopaedic Surgery

Susan A. Scherl, M.D., is a professor at the University of Nebraska College of Medicine’s Department of Orthopaedic Surgery and Rehabilitation. She received her M.D. degree from the Boston University School of Medicine. Dr. Scherl completed two years of a general surgery residency at St. Luke’s–Roosevelt Hospital Center in New York and completed a five-year orthopaedic residency at the State University of New York Health Science Center at Brooklyn, NY. She did her pediatric orthopaedic fellowship at Case Western Reserve University in Cleveland, OH. She is board certified in Orthopaedic Surgery. Dr. Scherl recently served as chair of the Pediatric Orthopaedic Society of North America (POSNA) Trauma and Prevention Committee and is also a member of the POSNA Education Committee, the AOSSM Leadership Development Committee, and the Orthopaedic Trauma Association Membership Committee. Dr. Scherl has been selected as one of the Best Doctors in America for 2003-2005, and 2007-2010. Her areas of focus are pediatric orthopaedic trauma and management of orthopaedic aspects of cerebral palsy. She has co-edited two textbooks on musculoskeletal medicine and authored numerous book chapters and article reviews.

WALTER W. HUURMAN, M.D.
Pediatric Orthopaedic Surgery

Walter W. Huurman, M.D., is professor emeritus of Orthopaedic Surgery and Pediatrics at the University of Nebraska College of Medicine. He received his M.D. degree from Northwestern University and completed his orthopaedic residency at the U.S. Naval Medical Center in Oakland, California. Dr. Huurman completed training in pediatric orthopaedic surgery at the A.I. duPont Institute. A board certified orthopaedic surgeon, Dr. Huurman has served on the editorial boards of the American Academy of Pediatric Orthopaedics in Review, and the Journal of Pediatric Orthopaedics. He has served as associate editor of the Journal of Bone and Joint Surgery and on the editorial review boards of the Journal of the American Academy of Orthopaedic Surgeons, and Clinical Orthopedics and Related Research. He is an oral examiner for the American Board of Orthopaedic Surgery. He is a member of the Pediatric Orthopaedic Society of North America, the American Academy of Orthopaedic Surgeons, the American Academy of Pediatrics, and the Orthopaedic Research Society. His focus includes the juvenile spine, clubfoot, and juvenile hip disease, as well as editing pediatric publications. Dr. Huurman retired with the rank of Captain from the U.S. Navy in 1996 after serving in the Viet Nam and Gulf Wars and to professor emeritus status on July 31, 2006.
OPERATION WALK

TEAM NEBRASKA

ON THE ROAD TO ANTIGUA

WE ARE EXCITED TO ANNOUNCE THAT THIS FALL, DR. KEVIN GARVIN AND 16 OTHER HEALTHCARE PROVIDERS WILL BE TRAVELING TO ANTIGUA, GUATEMALA, ON THE FIRST OPERATION WALK–NEBRASKA MISSION.
DAY ONE:

Volunteer ambassadors were extremely important due to the language and political barriers. Teams from each of the four surgical cases were completed to make sure everything ran smoothly. Some of these cases were also eager to assist the team members with any unrequired equipment that was not provided by the hospital. (For more information on Operation Walk missions, see the upcoming mission in Antigua.)

GRATEFUL—EVERYONE WAS VERY KIND, INQUISTIVE, AND EAGER TO DO WHATEVER THEY COULD,” said Peterson. “They are definitely vital to a trip of this nature, and their assistance was invaluable.”

Day three was another full surgical day, with a follow-up clinic held in the afternoon. The goal of each initial trip is to see patients at three months to follow-up if possible, but definitely once a year if follow-up is difficult. Ideally, the doctors will see patients in follow-up when they return to their area (prior to the actual mission) and select possible patients for the following year’s trip.

DAY THREE:

This was the third and final full surgical day. Also on day four, the clinic at the orthopaedic hospital is a big deal. (In July of this year, Dr. Garvin and Peterson), the patients, their families, and the overall experience was given to the team. Everyone was just so grateful that we were there. It made you feel good—heat all the hard work we were doing was really worth it.”

DAY FOUR:

The last day was pretty uneventful. There was no surgery. A final check was performed on patients and discharge was done. Then it was time for everyone to repack and go home.

DAY FIVE:

In July of this year, Dr. Garvin and Peterson joined Canadian team members on a trip to Antigua to scout the area for the upcoming mission in the fall. How post-op exams on patients from a previous trip, obtain x-rays, and complete pre-op exams on possible patients for the next mission, and begin the full-circle process all over again.

If you would like more information about how you can support Operation Walk–Nebraska, contact Susan Siebler at ssiebler@unmc.edu or (402) 559-4251.

“BEING ABLE TO COMPLETE 60 TOTAL JOINTS IN THREE DAYS, AND KNOWING YOU HAVE INCREASED THE QUALITY OF LIFE FOR SO MANY PATIENTS WHO OTHERWISE WOULD HAVE FACED A LIFETIME OF SUFFERING, WAS A REWARDING AND MOTIVATING EXPERIENCE,” SAID DR. GARVIN. “WE ARE DEFINITELY LOOKING FORWARD TO OUR UPCOMING MISSION IN ANTIGUA.”
THE 7.0 MAGNITUDE EARTHQUAKE THAT RAVAGED THE NATION OF HAITI ON JANUARY 12, 2010, OCCURRED APPROXIMATELY 25 MILES WEST OF THE CAPITAL CITY OF PORT-AU-PRINCE AND LASTED ONLY ABOUT 35 SECONDS, BUT LEFT A PATH OF DEATH AND DESTRUCTION THAT THE WORLD WILL LIKELY NEVER FORGET. IT’S SOMETHING THAT ORTHOPAEDIC SURGEONS DR. MIGUEL DACCARETT AND SEAN MCGARRY WILL NEVER FORGET EITHER.

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LENDING A HELPING HAND IN HAITI

Ruins of the Haitian Presidential Palace following the January 12, 2010 earthquake.

Dr. Daccarett had to use a manual hand reamer for intramedullary femoral and tibia nailing.

Dr. Daccarett and McGarry, both assistant professors in the Department of Orthopaedic Surgery at UNMC, recently traveled to Haiti and utilized their skills to help survivors of the horrible tragedy.

Dr. Daccarett (shown left) was among the first wave of volunteers sent to Haiti through UNMC and Medi-Share. He was part of a 13-member team of healthcare workers including six physicians and seven nurses that deployed to Port-au-Prince on January 23rd. For some it was their first time volunteering in a situation of this kind; for others, like Dr. Daccarett, they had experience volunteering in Third World countries or during other disasters. His past experiences volunteering with both a natural disaster and man-made violence in his native country of Colombia, and during the aftermath of the 9/11 terrorist attacks in New York, braced him for what was to come.

The earthquake had caused major damage to the infrastructure of Port-au-Prince, and the surrounding areas. Many landmarks were significantly damaged or destroyed, as well as many homes, schools and hospitals, crippling the country’s medical infrastructure.

The team of volunteers began work at L’Hôpital de la Communauté Haïtienne shortly after their arrival. There were roughly 100 patients and only 10 beds. Another 100 patients with nonsurgical injuries were being treated in tents outside the hospital that were used primarily as a skilled nursing facility.

“There was really no organization at that point. No strategy,” said Dr. Daccarett. “Before long, an administrator from Kansas City took control, organized a meeting, divided everyone into teams, and named department heads. Soon after that, teams began scouting patients for surgery and prioritizing cases. That’s a hard call to make when everyone needs surgery.”

During that week they performed more than 30 operations on 19 patients.

Dr. Daccarett recalled one of his most memorable patients, a 17-year-old high school student who was the only survivor when the school she was in collapsed. She was rescued three days after the earthquake.
One of the most satisfying things we were able to accomplish was to get every one of those patients out of their beds and outside the hospital. On February 20th, Dr. McGarry (shown right) traveled to Haiti through Medi-Share and the University of Miami. Their team of about 20 physicians included Dr. Daccarett, an orthopaedic surgeon, and orthopaedic trauma surgeon. Dr. McGarry’s team of about 20 physicians included Dr. Daccarett, an orthopaedic surgeon, and orthopaedic trauma surgeon.

Dr. McGarry and his team were able to help several spinal injury patients get outside to enjoy some fresh air for the first time in weeks. "One of the most satisfying things we were able to accomplish was to get every one of those patients out of their beds and outside the hospital," McGarry said. "We were using Home Depot head lamps," McGarry said with a chuckle. "You learn whatever capacity they can, no matter what status or who should do what," said Dr. Daccarett. "Everyone simply stepped in where needed and did whatever job that was needed, including Army and marine corps, and three sports medicine surgeons acting as scrub techs and helping with surgery. Everyone just came together without a single quarrel about who should do what or who should begin when."

"Dr. Daccarett marveled at how well everyone got along," McGarry said. "There were no fights, no arguments about 'status' or who should do what," said Dr. Daccarett. "Everyone simply stepped in where needed and did whatever job that was needed, including Army and marine corps, and three sports medicine surgeons acting as scrub techs and helping with surgery. Everyone just came together without a single quarrel about who should do what or who should begin when."
Your feedback counts. Simply go to www.UNMCOrthoInMotion.com
The Department of Orthopaedic Surgery and Rehabilitation’s Orthopaedic Residency Training Program at UNMC is affiliated with the following hospitals: Children’s Hospital and Medical Center, Omaha, and Bergan Mercy Medical Center. Located in metropolitan Omaha, our residency program provides an outstanding educational experience, a safe town with affordable living, and an enriched social environment.

The program is directed by Matthew Mormino, M.D., associate professor of orthopaedic surgery at UNMC. The program includes training in all nine orthopaedic subspecialties:

- Hand
- Foot and Ankle
- Major Joint Reconstruction
- Oncology
- Pediatric Orthopaedic Surgery
- Shoulder and Elbow
- Spine
- Sports Medicine
- Trauma

Our orthopaedic residents are involved in daily patient care as well as important research activities during their intensive training. As part of The Nebraska Medical Center, the University Hospital is a Level I Trauma Center, and our orthopaedic surgery residents play an integral role on the hospital trauma team.

ABOUT THE PROGRAM:

The UNMC Department of Orthopaedic Surgery and Rehabilitation’s Orthopaedic Residency Training Program is affiliated with the following hospitals: Children’s Hospital and Medical Center, Creighton University Medical Center, and Bergan Mercy Medical Center. Located in metropolitan Omaha, our residency program provides an outstanding educational experience, a safe town with affordable living, and an enriched social environment.

The program received full accreditation by the Residency Review Committee of the Accreditation Council for Graduate Medical Education (ACGME) in 2009, with the next review coming in 2013. The program curriculum addresses the six core competencies outlined by the ACGME for Resident Education:

- Patient Care
- Interpersonal and Communication Skills
- Professionalism
- Medical Knowledge
- Systems-Based Practice
- Practice-Based Learning and Improvement

Likewise 80-hour work week restrictions have been met in our residents’ schedules. Overall, the addition of new attending staff and changes to the curriculum improved an already excellent residency training program.

Of all the men and women who have completed their orthopaedic surgical training through the Nebraska program, more than half are now practicing in the state or the Midwest. The remaining physicians are practicing around the country and overseas. Doctors throughout the region regard UNMC as a source of continuing education where they can learn the latest techniques for diagnosis, treatment, and prevention of bone and joint diseases.
Omaha residents are proud of their city’s reputation for superior health care, agriculture, telemarketing and high-tech businesses, and the affordable quality of life. Omaha is home to the headquarters of five Fortune 500 companies, including Berkshire Hathaway, Inc., Union Pacific, ConAgra Foods, Peter Kiewit Sons, Inc. and Mutual of Omaha. There are also four Fortune 1000 companies headquartered here, which include TD Ameritrade, West, Valmont Industries, and Werner Enterprises.

Outside of work, residents can enjoy a variety of social activities including many wonderful restaurants and nightclubs, several sporting events, numerous music and arts venues, and various social gatherings held by the residents and their families throughout the year.

Continuously in a state of growth and revitalization, Omaha strives to provide new and unique venues. Most recently, Destination Midtown was unveiled—a premier urban environment located in the heart of Midtown Omaha—that offers a vibrant and distinct atmosphere, with many unique shops, restaurants, and housing options.

Omaha is also well known for the historic Old Market, Qwest Center Omaha, Joslyn Art Museum, Holland Performing Arts Center, Bemis Center for Contemporary Arts, Durham Western Heritage Museum, and many more wonderful theatre and arts facilities.

We tout a claim to fame for the Nebraska Cornhuskers, College World Series, Creighton University basketball, Omaha Royals baseball, three hockey teams and the annual Cox Classic, amongst others. In addition, the Qwest Center Omaha will once again host the U.S. Olympic Swimming Trials in 2012.

If you enjoy the outdoors, Omaha’s world-famous Henry Doorly Zoo is a great place to start. Other local outdoor features include the beautiful Lauritzen Gardens, Omaha’s Botanical Center near the Missouri River, Memorial Park and its fabulous rose gardens, or Zorinsky and Cunningham lakes located in west Omaha. The Omaha area also features many city and state parks, dozens of jogging and biking trails, family entertainment and water parks, championship golf courses, and several other lake and recreation areas.

Each year residents get together for the infamous Crawfish Boil, Oktoberfest, Halloween, Christmas and New Years. There is an annual Welcome BBQ for incoming residents and various other events such as flag football and intramural basketball throughout the year.
OF ALL OF THE MEN AND WOMEN THAT HAVE COMPLETED THEIR ORTHOPAEDIC RESIDENCY TRAINING THROUGH THE NEBRASKA PROGRAM, MORE THAN HALF ARE NOW PRACTICING IN THE STATE OR THE MIDWEST. THE FOLLOWING IS A LIST OF ALL DEPARTMENT ALUMNI SINCE THE ORTHOPAEDIC RESIDENCY PROGRAM WAS ESTABLISHED IN 1971. THE ACCOMPANYING MAP SHOW THE LOCATIONS OF OUR RESIDENTS IN THE UNITED STATES, ACCORDING TO THE DEPARTMENT’S MOST RECENT RECORDS.

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MEET THE RESIDENTS

CLASS OF 2011

Michael J. Carlson, M.D.
Hometown: Green River, WY
College: Brigham Young University
Medical School: Medical College of Wisconsin
Area of clinical/research interest: Orthopaedic sports medicine, joint arthroplasty
Activities/hobbies: Basketball, football, playing guitar, water sports

Michael S. Dee, M.D.
Hometown: Ogden, UT
College: Weber State University
Medical School: University of Utah
Area of clinical/research interest: Sports, shoulder and elbow, trauma
Activities/hobbies: Spending time with family and enjoying the outdoors

Jason M. Erpelding, M.D.
Hometown: Grand Forks, ND
College: University of North Dakota
Medical School: University of North Dakota School of Medicine
Area of clinical/research interest: Hand and upper extremity
Activities/hobbies: Hunting, fishing, traveling

Daniel E. Firestone, M.D.
Hometown: Lincoln, NE
College: Nebraska Wesleyan University
Medical School: University of Iowa College of Medicine
Area of clinical/research interest: Hand and upper extremity
Activities/hobbies: Music, technology, family, faith, fitness

Eric M. Samuelson, M.D.
Hometown: Grand Island, NE
College: University of Nebraska - Lincoln
Medical School: UNMC College of Medicine
Area of clinical/research interest: Sports
Activities/hobbies: Running, hiking, biking

CLASS OF 2012

Nicholas S. Aberle, II, M.D.
Hometown: Bismarck, ND
College: University of North Dakota
Medical School: University of North Dakota School of Medicine
Area of clinical/research interest: Orthopaedic sports medicine, total joint arthroplasty, trauma
Activities/hobbies: Biking, football

Lucas J. Burton, M.D.
Hometown: Orleans, IN
College: Vanderbilt University
Medical School: Vanderbilt University School of Medicine
Area of clinical/research interest: Hip and knee arthroplasty
Activities/hobbies: Golf

CLASS OF 2013

Anne E. Kriem, M.D.
Hometown: Glasgow, MT
College: Concordia College, Moorhead, MN
Medical School: Creighton University
School of Medicine
Activities/hobbies: Hockey, basketball, skiing, hiking, biking

Eric M. Samuelson, M.D.
Hometown: Grand Island, NE
College: University of Nebraska - Lincoln
Medical School: UNMC College of Medicine
Area of clinical/research interest: Sports
Activities/hobbies: Running, hiking, biking

Nate E. Sneddon, M.D.
Hometown: Lincoln, NE
College: Brigham Young University
Medical School: UNMC College of Medicine
Area of clinical/research interest: Total joint arthroplasty
Activities/hobbies: Running, hiking, skiing, Haker football

Jeremy F. Toomey, M.D.
Hometown: Newport, RI
College: Montclair College
Medical School: University of Nevada School of Medicine
Area of clinical/research interest: Sports, shoulder & elbow, trauma
Activities/hobbies: Basketball, woodworking, getting outside, family

CLASS OF 2014

Khalid A. Azzam, M.D.
Hometown: Cairo, Egypt
College: University of Cairo, Egypt
Medical School: University of Cairo, Egypt
Area of clinical/research interest: Hip replacement
Activities/hobbies: Swimming, homebrewing

Kevin E. Lindgren, M.D.
Hometown: Jackson, WY
College: University of Wisconsin
Medical School: Medical College of Wisconsin
Area of clinical/research interest: Sports, adult reconstruction, trauma
Activities/hobbies: Home brewing, golf, softball

Nolan R. May, M.D.
Hometown: Rapid City, SD
College: University of Nebraska - Lincoln
Medical School: University of Nebraska - Lincoln
Area of clinical/research interest: Sports medicine
Activities/hobbies: Sports, running, music, hanging out with friends

David P. Minges, M.D.
Hometown: White Cloud, MI
College: Creighton University
Medical School: Creighton University
Area of clinical/research interest: Sports medicine
Activities/hobbies: Sports, running, music, hanging out with friends

2010 INCOMING RESIDENTS

CLASS OF 2015

John C. Frank, M.D.
Medical School: University of Arkansas for Medical Sciences College of Medicine

Todd J. Goddard, M.D.
Medical School: University of North Dakota School of Medicine and Health Sciences

Brent R. Hood, D.D.
Medical School: Des Moines University - Osteopathic Medical Center

Andrew J. Saiteri, M.D.
Medical School: University of Iowa Roy J. and Lucille A. Carver College of Medicine
RECENT POST-GRADUATE FELLOWSHIPS

After completing their training at Nebraska, residents move on to the next stage of their training. Many opt to continue their education by choosing one of many fellowship opportunities around the country. For some, going directly into a practice opportunity is the right choice. Our most recent graduates and the fellowship or practice opportunities they chose are listed here.

2010 GRADUATES:

RYAN M. ARNOLD, M.D.: Fellowship Atlanta Sports Medicine & Cartilage Reconstruction Fellowship, Atlanta Sports Medicine and Orthopaedic Center, Atlanta, GA

KURT T. BORMANN, M.D.: Fellowship Traveling Fellowship, AO International Trauma Fellowship, Hannover Medical School, Hannover, Germany, Sept. - Oct. 2010; Shoulder and Elbow Fellowship, North Shore Hospital, Auckland, New Zealand, Dec 2010 - July 2011

GUSTAVO X. CORDERO, M.D.: Fellowship Orthopaedic Trauma Fellowship, University of Pittsburgh Medical Center, University of Pittsburgh, Pittsburgh, PA

MICHAEL J. SHEVLIN, M.D.: Practice West Idaho Orthopedics and Sports Medicine, Caldwell, ID

2009 GRADUATES:

ERICA BURNS, M.D.: Shoulder and Elbow Fellowship, University of Washington Medical Center, Seattle, WA

CASEY JOHNSTON, M.D.: Sports Medicine Fellowship, Minnesota Sports Medicine, Minneapolis, MN

BRIAN KLEIBER, M.D.: Foot and Ankle Fellowship, Washington University Medical Center, St. Louis, MO

JUSTIN SIEBLER, M.D.: Orthopaedic Trauma Fellowship, Orlando Orthopaedic Institute, Tampa, FL

Left to right: Drs. Gustavo Cordero, Ryan Arnold, Michael Shevlin, and Kurt Bormann

Left to right: Drs. Casey Johnston, Justin Siebler, Brian Kleiber, and Erica Burns
Your feedback counts. Simply go to www.UNMCOrthoInMotion.com
The Orthopaedic Registry to Monitor Treatment Outcomes is now active at UNMC, Children’s Hospital and The Veteran’s Administration Hospital, with over 3300 surgery subjects enrolled who have undergone total joint replacement, revision joint surgery, shoulder surgery, surgical treatment for osteogenesis imperfecta, or treatment for Whiplash Associated Disorders (WAD). Any pre- or post-surgical patient who is seeing a UNMC orthopaedic surgeon may be included in the database. Patients fill out routine questionnaires regarding their health, quality of life and functional status, preoperatively and at regular post-operative intervals. If the patients are unable to return, they are contacted by phone and questionnaires mailed to their home.

Evaluation of current practice through the collection, interpretation and analysis of outcomes data including patient questionnaires, clinically-obtained assessment and measurements, and retrospective medical record reviews (including radiographs), ultimately leads to advancements in patient care through the establishment of improvement objectives and an increase in generalized knowledge that can be presented or published to share findings with the orthopaedic community.

In addition to studies being utilized in the outcomes database, there are a variety of clinical studies being performed in the department. Currently there are 24 active IRB approved research studies being done involving 15 faculty members and 20 residents. In addition, 19 studies were completed in 2008-2009. As a result of these studies, multiple posters, abstracts and presentations were accepted at the annual meetings of both the American Academy of Orthopaedic Surgeons and the Mid-America Orthopaedic Association, which provides us the opportunity to share and compare findings with other institutions.
THE FOLLOWING IS A LIST OF ALL OUTCOMES AND CLINICAL STUDIES THAT HAVE TAKEN PLACE IN THE DEPARTMENT FROM 2008 TO PRESENT.

ACTIVE STUDIES:
- Early Operative Experience of the Fassier-Duval Telescopic Rod System for Children with Osteogenesis Imperfecta
- Incidences of Spondylosis and Spondylolisthesis in Children with Osteogenesis Imperfecta
- Functional Outcomes of Intramedullary Nail Fixation of Humerus Shaft Fractures: Anterior vs. Posterior Approach
- Acute Bracing of Humerus Shaft Fractures
- Functional Outcomes of Intra-articular Distal Humerus Fixation Through an Extensor Mechanism-Sparing Posterior Approach
- Orthopaedic Registry To Monitor Treatment Outcomes
- Evaluation of Functional Outcomes of Mini Open Rotator Cuff Repair without Acromioplasty
- Outcomes of Total Hip Replacement Utilizing Oxidized Zirconium Femoral Heads on Cross-Linked Polyethylene
- Functional Outcomes Following a Quad Snip Approach in Knee Revision Surgery
- Why Are Total Hip Arthroplasties Revised?
- Clinical Results of Unreamed Tapered Stems with Total Hip Arthroplasty in Patients Ages 50 Years or Younger
- Orthopaedic Registry to Monitor Treatment Outcomes
- Linkage Analysis and Gene Mapping of Familial Spinal Disorders (Scoliosis, Scheuermann’s Kyphosis, Spondylolisthesis, Lumbar Disc Disease, Osteoporosis)
- CS3G Multi-center Retrospective and Prospective Observational Data Registry for Clinical and Radiographic Outcomes of Spinal Surgery Comparing Instrumentation and Procedures
- The Treatment of Progressive Early Onset Spinal Deformities: A Multi-center Outcome Study
- Long-term (24 to 27 year) Follow-up after Total Hip Arthroplasty Using a Tapered Tri-bail Component Inserted without Cement
- Vertical Expandable Prosthetic Titanium Rib Humanitarian Use Device
- Results of Total Knee Arthroplasty Revision for Rotational Malalignment
- Horseback Riding and/or Motorcycle Riding After a Total Hip Arthroplasty
- Local Anesthesia versus Conscious Sedation in Closed Reduction of Distal Radius Fractures
- Distinguishing Communal versus Pathologic Phylocoxae. Species in Cases of Fracture Nonunion After Internal Fixation
- Clinical Results of the Anatomic Compression Arthrodesis Technique with Anterior Tension-Bone Plate Augmentation for Ankle Arthritis
- Surgical Treatment Outcomes for Whiplash Associated Disorder
- Factors That Influence Medical Students’ Choice of Residency

LABS AND EDUCATIONAL OPPORTUNITIES

THE DEPARTMENT ALSO HOLDS ON-GOING CADAVER LAB RESEARCH PROJECTS AND EDUCATIONAL SESSIONS ABOUT ONCE EVERY SIX WEEKS. THE GIFT OF AN ANATOMICAL DONATION ALLOWS OUR ORTHOPAEDIC SURGEONS TO DEVELOP AND PRACTICE NEW AND HIGHLY-REFINED TECHNIQUES THAT BENEFIT LIVING PATIENTS WITHOUT THE ADDITIONAL RISK. THESE SURGICAL CADAVER LABS ARE NOT ONLY INVALUABLE EDUCATIONAL OPPORTUNITIES FOR OUR FACULTY AND RESIDENTS, THEY ARE OFTEN OPEN TO OTHER COMMUNITY PHYSICIANS AS WELL.
When people think of great things that Nebraska is known for, the usual names come to mind: Berkshire Hathaway (synonymous with Warren Buffett), ConAgra Foods, Union Pacific, Mutual of Omaha, and of course the Huskers, just to name a few.

What people might not know is that Omaha is also home to one of the world’s largest, most active and best-equipped university-based testing facilities for knees, hips and other orthopedic implants; increasingly recognized as such by the national and international orthopedic implant technology field, standardization organizations, and the FDA. The Orthopaedics Biomechanics and Advanced Surgical Technologies Laboratory is part of the Department of Orthopaedic Surgery and Rehabilitation at the University of Nebraska Medical Center.

As director of the lab, Hani Haider, Ph.D., spearheads the work at the 5,500-square-foot facility in the Scott Technology Center just south of the UNO Pacific Street campus. The team is guided clinically by orthopaedic surgeons led by Kevin Garvin, M.D., chairman of the department.

Engineers and physicians are working together not only to physically test orthopaedic implants, but also to design better ways to implant them into the body. Here, they are not only using the latest techniques, they are actively creating some of them.

Cutting-edge in-vivo testing of orthopaedic implants is performed in the lab with a suite of finite element and various other innovative testing machines. Many of these devices were designed by Professor Haider, particularly the Instron-Stanmore Knee Simulator, which mimics the wear and tear of knee implants, replicating with great fidelity the myriad of instantaneous forces, torques, motions and rotations that a knee undergoes in the body, simulating prolonged periods of clinical use.

The lab has three of his simulators, which are unique from those being used in the rest of the world because Professor Haider has personally upgraded his invention with dozens of design and control improvements. With the data gathered from these advanced testing methods, Professor Haider and his team are helping to pioneer new testing methods, which in turn help implant designers create a new generation of orthopaedic implants, designed to suit the modern patient.

“By creating better, longer-lasting implants, we will significantly increase the quality of life for patients undergoing joint replacement surgery,” said Dr. Garvin, “and drastically reduce the number of revisions being performed annually – a statistic which has been consistently rising in recent years as more patients are undergoing joint replacement earlier in life.”

Throughout the 10 years since Professor Haider has joined the faculty at UNMC, the lab has secured more than 30 research and testing contracts from industrial companies, commercial testing houses, and others that lack the state-of-the-art simulators.

The innovative work on wear testing of joints being done in the lab here in Nebraska, is helping to set national and international standards for the testing of new and existing systems. Some of the data and performance criteria from these experiments have already influenced the latest international testing standards, such as those for new replacement wear, constraint and standard and specific determination of range of motion.

“This is not blue-sky research; it is translational and very real, so many of the implants we test here end up with FDA or equivalent European approval for wide clinical use internationally,” said Professor Haider, who has earned wide-ranging influence as a member of various international committees and scientific boards. In 2010 alone, Professor Haider has been appointed as a consultant/investigator of the Biomedical Engineering Committee of the American Academy of Orthopedic Surgeons and has received the ASTMM International Manning Hornitzel Award, which recognizes the most honored member of the committee on Mechanical Behavior of Surgical Material and Devices in the general interest category to whom has contributed to the standards development and/or related activities.

Knee joints, Professor Haider explained, must withstand a dynamic compressive force of many times a person’s weight occurring more than once in each walking step. Because of how closely the muscles ligament connects to the joint, the act of squating and similar postures creates enormous pressure – up to six or seven times a person’s body weight.

If the joint does fail, it must be repaired, often by replacing the weight-bearing surface of the joint. Professor Haider’s lab is also at work on a system that provides unprecedented feedback to a surgeon during these potentially difficult surgeries.
Computer-Aided Orthopaedic Surgery: An experimental prototype working saw to trim knee joints for the installation of a joint implant and its virtually reality representation.

An age-old adage

MODELS THE THEORY BEHIND A NOVEL COATING FOR TOTAL JOINT IMPLANTS

A common issue in joint replacement surgery is the rate at which orthopaedic implants wear, which can lead to subsequent health issues and often the need for revision surgery. When the joint surfaces rub together, it causes friction and can release small particles into a patient’s bloodstream. This wear and tear happens because surfaces used on today’s orthopaedic implants are too soft and lack the ability to stay wet, but Dr. Fereydoon Namavar, professor and director of the department’s Nano-Biotechnology Laboratory, is working to improve implant surfaces.

With orthopaedic implants, it would be ideal for the surfaces to be opposites, explained Dr. Namavar, with one being hydrophilic (water-attracting) and the other being hydrophobic (water-repelling).

"If both surfaces were wet, they would stick together and drastically increase friction," Dr. Namavar said. "But, when you have these opposites together, you have lower friction and smoother motion on the surface, which ultimately results in prolonged life of the joint implant."

His inspiration came one day when he heard his mother-in-law complaining that her cubic zirconia always fogged up when wet. Immediately, he knew he had found his substance – a material that is hard and can also maintain hydrophilic properties. With this in mind he began to design a new implant coating, but in order to create the most effective joint surface, Dr. Namavar wanted to alter the properties of his cubic zirconia coating to attain maximum wettability.

This article is an adaptation of a story that previously appeared in the Fall 2009 issue of Pride of Place, a biannual publication published by the University of Nebraska Foundation.
MIMICS PROPERTIES OF LINKER PROTEINS TO ENHANCE BONE GROWTH

Dr. Namavar and his team (in collaboration with Professor Renat Sabirianov) determined through extensive quantum-mechanical calculations and molecular modeling that the unique pyramidal nanostructures in Dr. Namavar’s coating have a charge distribution complementary to cell adhesion and bone growth. Surface in respect to protein size, Dr. Namavar’s coating features pyramidal nanostructures that are of similar size range as the proteins, they create an environment that the proteins are more attracted to. Furthermore, Dr. Namavar’s artificial implant surface in respect to protein size, Dr. Namavar’s coating features pyramidal nanostructures that are of similar size range as the proteins, they create an environment that the proteins are more attracted to. Moreover, the proteins are more attracted to the proteins, they create an environment that the proteins are more attracted to. Furthermore, Dr. Namavar’s artificial implant surface in respect to protein size, Dr. Namavar’s coating features pyramidal nanostructures that are of similar size range as the proteins, they create an environment that the proteins are more attracted to. Furthermore, Dr. Namavar’s artificial implant surface in respect to protein size, Dr. Namavar’s coating features pyramidal nanostructures that are of similar size range as the proteins, they create an environment that the proteins are more attracted to.

"When a drop of water hits a lotus leaf, it rolls off the surface, washing away dirt and dust," Dr. Namavar said. "To our knowledge it is unparalleled in any academic institution in the United States and is comparable or better than most systems used by high technology companies," Dr. Namavar said.

Tests done in collaboration with John Jackson, Ph.D., of the department of pathology and microbiology; and Graham Sharp, Ph.D., of the department of genetics, cell biology and microbiology; further validated Dr. Namavar’s findings. "It seems that our pyramidal nanostructures have a charge distribution, which the cells find hospitable," he said. "This was an unexpected development and one we were thrilled to encounter."

Their work, published in the journal *Nature* on March 1, has gained an electric charge by focusing on electron microscopy of a single atomic layer of pure cubic zirconia showing pyramidal nanostructures created using a special ion-beam-assisted-deposition (IBAD) process. During this process, a substance is exposed to a large amount of ions – atoms that are accelerated toward the substrate.

In orthopaedic terms, explained Dr. Namavar, this leads not only to prolonged life of orthopaedic materials such as titanium, titanium oxides, or even hydroxyapatite (HA). The IBAD combines evaporation with concurrent ion beam bombardment, creating multi-nano-layer films possessing combined properties of super-hardness and complete wetting behavior, Dr. Namavar said. "In essence, this will make it easier for the artificial implant to survive within the human body. These coatings will actually reduce the probability of bacterial formation on the joint surface, as well as promote bone growth and adhesion of the artificial implant to the living bone."

"Utilizing billions of energetic ions as an ionic hammer, we have forged pyramidal nanostructure 'smart' surfaces that boost anti-infective properties in response to the detection of infectious agents, and also exhibit superior adhesion and growth properties for bone marrow cells as compared to traditional orthopaedic materials. In essence, this will make it easier for the artificial implant to survive within the human body. These coatings will actually reduce the probability of bacterial formation on the joint surface, as well as promote bone growth and adhesion of the artificial implant to the living bone."

"By reducing the number of revision surgeries that patients need due to wear, loosening, infection, or joint failure," Dr. Garvin said, "we would help to take stress off a healthcare system that is already overburdened."

In the orthopaedic field, a coating that is biocompatible and has excellent wear characteristics is crucial. The IBAD process has emerged as a promising technique for the development of high-performance biomedical coatings. The IBAD process provides an opportunity to deposit functional layers on various substrates, including metals, alloys, and polymers. The IBAD process has been successfully applied to deposit biomedical coatings such as titanium, titanium oxides, and hydroxyapatite (HA).

According to Dr. Namavar, the IBAD process has several advantages over traditional coating methods. The IBAD process allows for the deposition of high-quality layers with controlled microstructure and properties. The IBAD process also enables the deposition of multilayered structures, which can provide enhanced performance compared to single-layered coatings.

The IBAD process has been used to deposit various biomedical coatings, including titanium, titanium oxides, and hydroxyapatite (HA). These coatings have been evaluated in vitro and in vivo for their biocompatibility, wear resistance, and osteoconductivity. The IBAD process has been shown to produce high-quality layers with controlled microstructure and properties, which can provide enhanced performance compared to single-layered coatings.

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COATING DISSOCIATION RISKS WITH TITANIUM NITRIDE COATED TOTAL HIP REPLACEMENT SYSTEMS

Haider, Hani, Weisenburger, Joel N. and Garvin, Kevin L.

INTRODUCTION:
Titanium nitride (TiN) coatings are sometimes applied through pressure vapor deposition to femoral heads and acetabular liners. This coating is typically desirable to have sufficient hardness and therefore may resist abrasion and reduce overall wear, or at least not prohibitively compromise them. It is also desired to demonstrate an osteoblastic barrier against metal ion release, making the coated metal-on-metal (MOM) total hip replacement (THR) more suitable for patients with metal ion sensitivity. Such coatings are already commercially available in Europe. This study compared the longevity in vitro of coated and uncoated MOM THR implants supplied by the same implant vendor (and coated by a commercial third party).

MATERIALS AND METHODS:
An extended 5 million cycle (Mc) in vitro wear test was conducted on a hip simulator (AMTI, Boston) shown in Figure 1. Six MOM THR system specimens comprising CoCr femoral heads (44mm diameter), acetabular liners, and acetabular shells (Figure 2) were tested. Three of the six head and liner pairs were coated in TiN and the remaining three were uncoated (control). The specimens were mounted and aligned, and were lubricated with bovine serum diluted with deionized water to have 20 g/l protein concentration. The lubricant was continuously circulated and kept at 37°C. The THR specimens were subjected to the loading and rotations of the walking cycle as specified in ISO 14242-1, type M for 5 Mc. The loading and rotations were continually observed to ensure consistency with the desired waveform. The femoral head and acetabular liner interfaces were carefully decaled gravimetrically, and the lubricant was changed at 0, 0.25, 0.5, and every 0.5 Mc afterwards.

RESULTS:
Over 5 Mc, the uncoated heads displayed a wear rate of 1.84 ± 0.18 mg/Mc, while the TiN-coated femoral heads wore at 1.53 ± 0.18 mg/Mc. Wear of the uncoated and coated metal acetabular liners were 1.35 ± 0.11 mg/Mc and 1.56 ± 0.18 mg/Mc, respectively. The wear of each specimen is shown in Figure 3, and the average wear of each type combined head and liner wear is shown in Figure 4.

DISCUSSION:
Our simulator results confirm small wear overall for MOM THRs; however, we did find extreme “run-in” wear on TiN-coated specimens. The higher wear observed on the coated specimens was likely due to the loss of the coating, where coating debris particles may have caused third body wear evidenced by higher levels of scratching on coated components.

The eventual loss of the TiN coating on all three coated specimens is of concern. It is possible that the coating process suffered imperfections which resulted in poor adhesion to the substrate or perhaps resulted in the application of the wrong coating, where the coating was lost. The results found here echo the results of previous Total Knee Research (TKR) wear simulation tests in which coated TiN-coated femoral components, all of which lost a portion of the coating on the medial condyle.

It is the understanding of the authors that such coatings are currently used clinically in European femoral replacements, and the results here suggest benefit from more thorough testing, such as is done in Nebraska.

REFERENCES:
BONE PRESENCE BETWEEN THE CENTRAL PEG'S RADIAL FINS OF A PARTIALLY-CEMENTED, PEGGED ALL-POLY GLENOID COMPONENT SUGGEST FEW RADIOLUCENCIES

INTRODUCTION:

Since its evolution, total shoulder arthroplasty (TSA) has become an effective treatment for primary glenohumeral arthritis as measured by shoulder specific and general health specific outcome scores. Yet, cemented all polyethylene glenoid component loosening remains a problem. Radiolucencies surrounding cemented all polyethylene glenoid components may be present as early as the recovery room and suggest suboptimal cementing technique. This also presents that cemented induced thermal necrosis may contribute to osteocyte death and radiolucent lines.

In an attempt to decrease cementalization, Wirth et al., developed a cemented all polyethylene component for use in canines. In their model, the central peg offered a radiographically proven and histologically proven bone growth between the radial fins of the peg, which allowed the glenoid component to be designed in bone. A component for utilization in humans was developed using a central radial fins component, with minimal cement for the peripheral 3 pegs. This component was designed in bone, with no cement present. Since its evolution, total shoulder arthroplasty (TSA) has become an effective treatment for primary glenohumeral arthritis as measured by shoulder specific and general health specific outcome scores. Yet, cemented all polyethylene glenoid component loosening remains a problem. Radiolucencies surrounding cemented all polyethylene glenoid components may be present as early as the recovery room and suggest suboptimal cementing technique. This also presents that cemented induced thermal necrosis may contribute to osteocyte death and radiolucent lines.

METHODS:

All 48 shoulders replaced with a total shoulder prosthesis in the canine model were included in the study. Book glow-in-the-dark wires were inserted into the cancellous bone of the humeral head, served as a radiographic marker for bone presence. Radiographic images were obtained with a standard axillary view as well as a conventional axillary view. A 5.5-year-period of hip surgery was analyzed. Blinded to the patient’s identity, the surgeon performed a standard axillary view as well as a conventional axillary view. A 5.5-year-period of hip surgery was analyzed. Blinded to the patient’s identity, the surgeon performed a standard axillary view as well as a conventional axillary view. A 5.5-year-period of hip surgery was analyzed. Blinded to the patient’s identity, the surgeon performed a standard axillary view as well as a conventional axillary view. A 5.5-year-period of hip surgery was analyzed. Blinded to the patient’s identity, the surgeon performed a standard axillary view as well as a conventional axillary view.
Table III: Results

| Patients | 61 | Shoulder | 35 | Follow Up | 43 MONTHS | SST | 10.3 | Modified Lazarus Score | 0.45 | Central Peg Compartments with Bone | 4.5 | Shoulders with Bone in All compartments | 23 |

DISCUSSION

glenoid component loosening remains a major concern. Despite the component described in this report’s widespread use in humans, limited literature exists regarding its outcomes with radiographic studies confined to plain radiographs. The purpose of this study was to assess bone between the radial fins of a hybrid glenoid component’s central peg as well as for overall radiolucencies with thin cut CT and plain radiography.

Radiolucencies that surround glenoid components are cause for concern. One report demonstrated a nearly 20% incidence of radiolucent lines in cemented glenoids within 3 weeks of surgery, and many have reported the same radiolucent appearance in recovery room radiographs. Grrtanen et al. demonstrated the six initial radiographic lucencies to be further dependent upon the glenoid design, finding initial radiolucencies in 37% of femoral components and 5% of pegged components. Bone cementing techniques have suggested reduced initial lucencies present in females cemented components, but lucencies have still been shown to progress. Recent studies have confirmed a higher survival rate for pegged components compared to keeled.

Neer suggested that initial radiolucencies were attributable to poor cementing. Modern cementing techniques have shown slight decreases in loosening, but it has been shown that radiolucent lines are still present and are progressive. A 2004 study by Chuttani et al. demonstrated that heat production during methylmethacrylate curing is enough to result in thermal necrosis of bone. This necrosis may be a cause or contributor of immediate and/or progressive radiolucent lines. In their study, greater than two grams of cement led to significant thermal necrosis.

Figure 7: More bone between the radial fins of the central peg correlates with better (lower) modified Lazarus scores. Note: x-axis maximum is 10 for simplicity, maximum is 16 but highest score was 9 in this study.

CONCLUSIONS

Primary total shoulder arthroplasty for primary glenohumeral osteoarthrosis utilizing minimal glenoidal peripheral peg cement and autologous reamings placed between radial fins of the central peg was shown to be lower in CT scanning compared to keeled components. Better bone presence was imparted between radial fins of the central peg as well as for overall radiolucencies with thin cut CT and plain radiography.

MATERIALS AND METHODS:

48 total hip replacement system specimens of 14 different contemporary THR designs and/or material or size combinations (total) were tested. The specimen groups were as follows:

<table>
<thead>
<tr>
<th>Eighteen Metal-on-UHMWPE (MOP) THR</th>
<th>61</th>
</tr>
</thead>
<tbody>
<tr>
<td>Twelve 36mm head size, six of which had a CoCr coating on the femoral head, the other six were conventional UHMWPE liners.</td>
<td></td>
</tr>
</tbody>
</table>

Six 44mm head size, three of which had highly crosslinked (HXL) liners, the other three liners were conventional UHMWPE.

<table>
<thead>
<tr>
<th>Twelve 36mm head size Metal-on-Metal (MOM) THR</th>
<th>61</th>
</tr>
</thead>
<tbody>
<tr>
<td>Three standard and three TiN coated specimens (shown opposite).</td>
<td></td>
</tr>
</tbody>
</table>

Six Ceramic-on-Plastic (COP) THR (shown opposite)

Three 32mm head size Biolox forte ceramic heads with conventional UHMWPE liners.

Three 44mm head size Cerametal (ceramic shell over metal implant) with conventional UHMWPE liners.
Twelve Ceramic-on-Metal (COM) THRs (shown opposite)

All Biolox Delta heads, CoCrMo metallic liners

- Six 36mm head size of high and low clearance (HC, LC)
- Six 28mm head size, also of two clearances

All THR specimens were tested on a multi-station hip simulator (AMTI, Boston). The specimens were lubricated with bovine serum diluted to contain 20 g/L protein concentration, maintained at 37°C. The specimens were identically subjected to the loading and rotations of the walking cycle as specified in ISO 14242-1 [2] at 1 Hz for 5 million cycles (MC). The liners (and heads where specified) were cleaned and gravimetrically weighed [3] (to a resolution of 10 μg) at intervals 0, 0.25, 0.5, and every 0.5MC afterward.

RESULTS:
The metal-on-plastic (MOP) standard 36mm size liners showed a wear rate 44.5 ± 4.46 mg/MC.

The 44 mm size MOP hips wore at a higher rate of 72.0 ± 2.81 mg/MC with conventional UHMWPE and at a lower 14.2 ± 3.57 mg/MC rate with highly crosslinked UHMWPE.

The coated CoP heads paired with the conventional polyethylene resulted in a higher 55.6 ± 4.26 mg/MC wear rate, and the coating was seen to wear away from the metal heads.

For ceramic-on-plastic (COP), the larger size hips wore at a higher rate than the smaller size (44mm: 77.5 ± 8.17 mg/MC, 32mm: 33.1 ± 4.66 mg/MC) over 5MC.

For the 36mm size ceramic-on-metal (COM) hips, the wear rates of the metastable HC and LC liners were the lowest of all, showing no wear (0.00 ± 0.118 mg/MC and 0.0001 ± 0.0004 mg/MC, respectively). All three TiN coated THRs displayed a loss of coating in the articulating region which progressively increased in size.

The averaged combined wear rate of the heads and liners of the standard metal-on-metal (MOM) THRs was 8.53 ± 4.07 mg/MC. The coated versions wore at a higher rate of 3.19 ± 0.281 mg/MC. All three 28mm COM HC and one LC liner exhibited “break-away” wear in that they would lose several milligrams (HC: 5.99mg, 6.37mg, 8.50mg; LC: 10.22mg) after showing nearly no measurable wear (HC: 0.905 ± 0.467 mg/MC, 28mm LC: 0.422 ± 0.982 mg/MC).

DISCUSSION AND CONCLUSIONS:
Wear of MOP and COP THRs was confirmed to be higher in the larger diameter sizes. Results confirmed lower wear for hard-on-hard bearing couples (MOM, COM) except where coating failure (if any) was observed. 36mm Low Clearance COM bearings had the best of the four COM types tested, showing no measurable wear and no “break-away” wear [4]. MOP THRs showed better wear performance when UHMWPE was used. No pitting, delamination, or any unusual wear mechanisms were observed on any specimens in the articulating region (except when coating loss had occurred). Wear rates and phenomena were successfully characterized for different material couples and different design size combinations with this simulator setup, and using 20g/L protein concentration of diluted serum lubricant.

REFERENCES:
HEALED CUFF REPAIRS IMPART NORMAL SHOULDER SCORES IN THOSE 65 YEARS OF AGE AND OLDER

Edward V. Fehringer, MD; Junfeng Sun, PhD; Jonathon Cotton, MD; Michael J. Carlson, MD; and Erica M. Burns, MD

INTRODUCTION

Rotator cuff tear prevalence increases with advancing age. The shoulders of older patients with intact rotator cuffs have better scores than those with full-thick rotator cuff tears. It is important to understand whether full-thick rotator cuff tear repair is warranted in older patients when their shoulders function well despite untreated tears or even improve with nonsurgical treatment, especially because the incidence of retear after surgical repair is higher in this population. It is currently unclear whether older patients with healed full-thickness tear repairs have similar scores as those who have intact rotator cuffs. Moreover, it is unclear whether patients with healed repairs have better scores than those who have full-thickness tears but have never undergone repair.

We therefore asked whether: (1) in patients 65 years of age and older, shoulders with rotator cuff repairs that remained intact ("healed") would have Simple Shoulder Test (SST) scores and Constant scores similar to those of individuals with intact rotator cuffs ("no tear"); (2) shoulders with concomitantly treated tears ("tear, but no repair") would have scores that were worse than those of shoulders with healed repairs and without tears, (3) those with healed repairs would have scores greater than those with untreated repairs.

MATERIALS AND METHODS

We retrospectively reviewed all 51 patients (54 shoulders) treated by mini-open rotator cuff repairs for chronic full-thickness tears in patients 65 years of age and older (Group I) (from January 1, 2008, to January 1, 2009). Minimum follow-up was 1 year (mean, 2.7 years; range, 1-5 years). Data were collected after patients were invited to participate. Among the 54 rotator cuff repairs, we studied 41 shoulders (51 isolated supraspinatus tears, one isolated subscapularis tear, 12 supraspinatus and infraspinatus tears, four three-tendon tears). We excluded 12 patients (12 shoulders).

All patients underwent a standard plain radiographic evaluation (true anteroposterior [AP] in internal rotation, true AP in external rotation, and axillary) before surgery. As well, on MRI, the rotator cuff was assessed. The studies were performed with a 1.5-T MRI scanner, a health history report, and a rotator cuff ultrasound.

We recruited Group II (with poster recruitment at our medical center. Our goal with this group was to determine the prevalence of full-thickness rotator cuff tears in patients 65 years of age and older and correlate the findings with shoulder comfort, function, and patient comorbidities. A secondary goal was to provide baseline shoulder functional status of patients 65 years of age and older, with and without full-thickness rotator cuff tears. All were studied with the same questionnaires and shoulder scores as those in Group I. For Group II, 104 subjects 65 years of age or older were recruited to obtain 200 shoulders because eight volunteers had undergone shoulder surgery in one shoulder; thus, the majority were bilateral examinations. Full-thickness rotator cuff tear prevalence was 29% (44 of 200) with a 95% confidence interval (25.9%-32.5%). Nine patients had bilateral tears. The other 23 tears were in patients who had a unilateral tear.

We compared the shoulders with healed repairs (33 of 42 of Group I) with the subset of Group II shoulders that did not have tears ("no tear"; 156 of 200). We also compared those with healed repairs with the subset of Group II shoulders that had treated but were not repaired ("tear, but no repair"); 44 of 200). The groups had similar gender and race compositions (Table 1). The "no tear" group was younger (p = 0.048) than the "healed" group and younger (p = 0.001) than the "tear, but no repair" group.

Table 1. Demographics information about Group I

<table>
<thead>
<tr>
<th>Variable</th>
<th>Healed (N=33)</th>
<th>Not Healed (N=9)</th>
<th>p-value (test)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gender: Male (%)</td>
<td>19 (57.6%)</td>
<td>8 (88.9%)</td>
<td>0.012 (Fisher’s Exact test)</td>
</tr>
<tr>
<td>Race: White (%)</td>
<td>32 (97.0%)</td>
<td>9 (100%)</td>
<td>0.00 (Fisher’s Exact test)</td>
</tr>
<tr>
<td>Age: mean (SD)</td>
<td>72.7 (5.1)</td>
<td>72.4 (5.2)</td>
<td>0.92 (two sample t test)</td>
</tr>
</tbody>
</table>

All surgery was performed by one surgeon (EVF). No shoulder underwent arthroscopic evaluation. Concomitant acromioplasties, distal clavicle surgery, and lateral surgery were not performed. Eleven shoulders had concomitant tear excision of the intertubercular groove and/or the pectoralis major tendon repair for concomitant long head of the biceps splitting, tearing, and/or instability. Simple Number 2 braided polyester sutures, bone tethers, and bone tunnels were used for repairs. A half-inch osteotomy was used to make tethers. Sutures were placed as tags through the tendon lixiviation with Number 5 Mayo needles, and the sutures were subsequently routed into the bony troughs and out through the lateral humeral cortex with Number 3 Mayo needles without power equipment. Sutures were tied over lateral humeral cortical bridges. Side-to-side sutures were added depending on tear configuration and shape. All repairs were performed under general anesthesia with a concomitant regional interosseous anesthetic.

Shoulders in Groups I and II were examined 12 to 60 months postoperatively with ultrasound to assess their rotator cuff status. Defects were noted as the absence of the normal tissue echoes and failure of the tissue to move appropriately with defined humeral movements. We used a GE Healthcare Logiqbook (Milwaukee, WI) with a 4- to 10-MHz linear probe for ultrasonography. Full-thickness tears were measured from anterior to posterior at the footprint. The surgeon who performed the repairs in Group I also performed all testing and ultrasounds of all patients.

RESULTS

The "no tear" and "healed" groups had similar SST and Constant scores. The "tear but no repair" group had lower SST score and Constant scores than the "healed" group (p = 0.000) and (p = 0.000), respectively) and the "no tear" group (p = 0.000) and (p = 0.000). (Table 3). The same relationships for shoulder scores held after adjusting for potential confounders age, gender, and race (Table 4). Nine rotator cuffs (from nine patients) had retears. Although the sample size is small, that no Group I subgroups (healed or unrepaired) were similar in age, gender, and race (results not shown). Those with healed repairs had higher SST (p = 0.000) and Constant (p = 0.000) scores than those with unrepaired repairs (Table 3).

Table 3. Estimated effects of covariates on SST as one (multiple linear regression)

<table>
<thead>
<tr>
<th>Variable</th>
<th>Estimated Effect</th>
<th>Standard Error</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age</td>
<td>-0.015</td>
<td>0.029</td>
<td>0.60</td>
</tr>
<tr>
<td>Gender (female vs male)</td>
<td>-0.59</td>
<td>0.30</td>
<td>0.05</td>
</tr>
<tr>
<td>Race (Non-White vs White)</td>
<td>1.73</td>
<td>1.34</td>
<td>&lt;0.0001</td>
</tr>
<tr>
<td>No Tear vs Tear</td>
<td>1.75</td>
<td>0.40</td>
<td>0.0001</td>
</tr>
<tr>
<td>Healed vs Tear No Repair</td>
<td>2.34</td>
<td>0.53</td>
<td>&lt;0.0001</td>
</tr>
</tbody>
</table>

Table 4. Estimated effects of covariates on Constant Murley scores (multiple linear regression)

<table>
<thead>
<tr>
<th>Variable</th>
<th>Estimated Effect</th>
<th>Standard Error</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age</td>
<td>-0.22</td>
<td>0.19</td>
<td>0.26</td>
</tr>
<tr>
<td>Gender (female vs male)</td>
<td>-0.81</td>
<td>2.88</td>
<td>&gt;0.0001</td>
</tr>
<tr>
<td>Race (Non-White vs White)</td>
<td>4.0</td>
<td>8.8</td>
<td>0.65</td>
</tr>
<tr>
<td>No Tear vs Tear</td>
<td>11.6</td>
<td>2.7</td>
<td>&lt;0.0001</td>
</tr>
<tr>
<td>Healed vs Tear No Repair</td>
<td>15.5</td>
<td>3.5</td>
<td>&lt;0.0001</td>
</tr>
</tbody>
</table>

Table 5. SST scores and Constant scores of Group I

<table>
<thead>
<tr>
<th>Group</th>
<th>Healed (N=33)</th>
<th>Not Healed (N=9)</th>
<th>p-value (test)</th>
</tr>
</thead>
<tbody>
<tr>
<td>SST Score median (range)</td>
<td>85 (66, 98)</td>
<td>71.5 (24, 98)</td>
<td>84 (24, 100)</td>
</tr>
<tr>
<td>Constant Score median (range)</td>
<td>88 (66, 100)</td>
<td>82 (24, 100)</td>
<td>84 (24, 100)</td>
</tr>
</tbody>
</table>

No Tear repair group is significantly different from the Tear group (p = 0.000) and No Repair group (p = 0.000) (testing one way ANOVA) for SST and Constant scores. The Tear Repair group has significantly lower Constant score than Healed group (p = 0.000) and No Tear group (p = 0.000) (testing Wilcoxon Rank Sum test).
Discusssion:

Few absolutes exist with rotator cuff disease. However, one that is appropriate is that rotator cuff tear prevalence increases with increasing age. Moreover, rotator cuff tears or failures to heal after repair may be more likely in aged patients. Given that shoulders of older patients with intact rotator cuffs have better scores than those with full-thickness cuff tears, it is important to understand whether older patients with healed full-thickness tear repairs have similar scores as those who have intact rotator cuffs. Moreover, it is unclear whether patients with healed repairs have better scores than those with full-thickness tears but have never undergone repair. We therefore asked whether patients 65 years of age and older, shoulders with rotator cuff repairs that remained intact would have SST and Constant scores similar to those of individuals with intact rotator cuffs.

This study has several important limitations. First, it is retrospective because our questions were asked after repairs had been performed. Yet, our goal was simply to look at shoulders with and without healed repairs and compare them with a group of tear repairs and without tears. Second, the surgeon who performed all examinations, including the ultrasounds, was also the one who performed the repairs. Although potential for surgeon bias exists, our goal was not to determine if integrity or failure at repair; rather, we wanted to study healed and untreated shoulders and compare those with shoulders of their peers. This bias could have influenced the ultrasound examination as to whether a cuff was healed or not healed, which would influence our findings. Third, Group II may not have represented a true cross-section of the 65-year or older population. Yet, it was a valid attempt to study this group without an examiner bias. Fourth, we did not attempt to quantify muscle atrophy, fatty infiltration, and retraction on MRI scans as a result of many variables, including multiple examiners. Yet, these measures involve many variables that would weaken the study. Fifth, arthroscopic labrum was not performed in any shoulder. Based on the studies supporting excellent clinical outcomes with arthroscopy at the time of repair, we decided not to perform them. Sixth, there is a difference between chronologic age and physiologic age, as Potter reminds us. Some patients who are 65 years of age and older, are in excellent health and have issues that are worthy of repair. Chronicologic age is clearly not the only variable to consider in the treatment of rotator cuff diseases. Finally, as a result of the lack of a pilot study and relevant published literature, particularly for this age group, we did not do a power calculation beforehand to study this. Therefore, the negative results we observed may be a false negatives as a result of lack of power. In addition, we did not adjust for multiple comparisons because we consider our study to be hypothesis-generating. Although we do not believe this reduces the importance of our findings, the limitations may diminish the value of this attempt to determine whether the shoulders of patients 65 years of age and older with healed rotator cuff repairs score better than those of their peers with and without surgical treatment. We found no difference in SST for Constant scores between the “healed” group and the “no tear” or essentially “normal” group. Moreover, the “tear or no repair” group had lower SST and Constant scores than the “healed” group and the “no tear” group. The same relationships for shoulder scores held for adjusting for potential confounders age, gender, and race. Although the sample size is small, the two Group I subgroups (healed or unhealed) were similar. Hartman et al. were the first to use ultrasound to study rotator cuff integrity of tear repairs and reported 80% of their repairs were intact when the tear was confirmed to the supraspinatus at a minimum of 2 years after repair. However, isolated supraspinatus tears were also in patients who were younger. The average age of the patients with recurrent tears was older than that of those with a healed repair. Shoulders with healed repairs were more functionally worse than those that had intact repairs. We also noted in our study Galatz et al. also successfully studied shoulders with ultrasound after repair, measuring tears in the transverse dimension. However, their average age at the time of surgery was 61 years. Balken et al. reported complete healing in 71% of 67 of radiographic supraspinatus tears were repaired based on either MRI or CT arthrography. However, they noted, on average, patients with a healed tendon were 10 years younger than those in the tendon that did not heal.

In patients 65 years of age and older, we found comparable SST and Constant scores in shoulders with healed rotator cuff repairs and in untested shoulders with intact rotator cuffs.

Introduction:

Stiffness following total knee arthroplasty (TKA) is among the more common complications following TKA, with a reported prevalence of 1.1% to 6.9%. The treatment of stiffness can range from aggressive physical therapy to revision arthroplasty. Isolated arthrolysis and tibial liner exchange have been found to be an unreliable technique for improving range of motion. Other authors have reported many successes with either arthroscopic or a modified open debridement and release of both components. The purpose of our study was to evaluate the outcomes of a cohort of patients who had revision of a well-fixed, asymptomatic TKA for symptomatic stiffness.

Materials and Methods:

Following approval by the Institutional Review Board, we reviewed the institutional total joint registry for all patients having revision of a TKA from 1997 to 2006. Any patient with a diagnosis of postarthroplasty stiffness and an MRI arthrography or ultrasound of a single component was selected from the registry. We identified 31 knees in 30 patients who met the inclusion criteria. The cohort consisted of 20 males and 11 females with a mean age of 62 years (range, 32 to 81 years) at the time of revision. All patients were evaluated with Knee Society Score and radiographs at the preoperative visit, prior to revision and at yearly and final follow-up intervals. Radiographs were evaluated for implant loosening, change in joint line, compartmental stiffness, and change in the Insall-Salvati ratio.

Statistical analysis was performed using paired t-tests to compare the preoperative arc of motion to the postoperative arc of motion and the postoperative Knee Society scores to the preoperative values. A logistic regression analysis was performed to determine if age, gender, body mass index (BMI), radiographic evidence of loosening of either or both components, prior revision surgery, or change in the Insall-Salvati ratio, change in joint line, or length of time from primary surgery to revision surgery were predictive of the postoperative arc of motion.

Results:

Two patients died of unrelated causes before having two years of follow-up, and one patient was lost to follow-up leaving 32 patients followed for a mean of 54.5 months (range, 34 to 134 months). The mean arc of motion improved from a mean of 51.6° (range, 10 to 90°) to a mean of 98.1° (range, 50° to 130°) (p < 0.0001). The postoperative arc of motion improved in all but one of the patients. The arc of motion increased by 30° to 75° (24.3% of patients) The mean preoperative flexion score was similar to the 15.5° (range, 10 to 27°) to a mean of 88.1° (range, 50° to 100°) (p < 0.0001). The postoperative arc of motion increased in 43° to a mean of 100° (p < 0.0001). Postoperative flexion was > 90° in 40% (12 of 30) of patients. The Knee Society knee score improved from a mean of 32 points to 60.5 points (p < 0.0001) to a mean of 82.1 points (p < 0.0001). The Knee Society function score improved from 41.6 points to 56.3 points (p < 0.0001). The regression analysis found no relationship between age, gender, body mass index, or past revision surgery and whether a patient achieved a tuberosa epitrochlearis for perioperative pain management, history of previous revision, change in the Insall-Salvati ratio, change in joint line, or length of time from primary surgery to revision surgery were predictors of the postoperative arc of motion.

Complications and re-operations are listed in Table 1. In total, 17 of the 35 patients (51%) required no additional intervention for stiffness including nine manipulations under anesthesia (MUA), seven of the 35 patients (20%) required one type of the operation (including an MUA) or sustained at least one complication. Three patients with follow-up of more than two years (9%) required revision of one or both components including smaller deep infection, one for osteosynthesis of the nonunion of a periprosthetic fracture.
DISCUSSION

The aims of TKA as a challenging clinical problem. Patients are often disoriented and complain of significant pain. Gait studies evaluating activities of daily living have found the swing phase of gait requires 67° to 90° of flexion to clear the foot. Successful stair ascent requires 83° while descending requires 92° to 100°.

Many treatment options have been reported in the literature with variable results. Revision surgery provides more predictable results when a clear diagnosis for the cause of stiffness can be made and corrected intraoperatively (loosening, sepsis, or implant malalignment). Patients in whom a clear diagnosis cannot be made have had less predictable outcomes. In our analysis we attempted to define a single factor responsible for a stiffness. However, in almost all cases in this study, multiple factors may have contributed to stiffness were identified and thus an analysis may be an over simplification of what is often a complex clinical scenario.

We evaluated a cohort of patients having revision TKA for stiffness with well-fixed components. Often these patients have suboptimal bone stock, and soft tissue balancing. We believe the best treatment option for these patients is a complete femoral and tibial revision. Revision of both components allows the surgeon to perform a more thorough soft tissue debridement both anteriorly and posteriorly while optimizing component size, alignment, and soft tissue balance. Further, retention of either the femoral or tibial components or both may limit the surgeon’s ability to use more constrained polyethylene inserts, as was deemed necessary in 13 of the 35 knees in this series.

We found significant improvements in flexion, extension and total arc of motion following revision. We also found the Knee Society scores, while still poor following revision, were significantly improved in all components between preoperative and postoperative scores. Few studies have been published evaluating the outcomes of revision TKA for stiffness. The results have generally been favorable. The results of this study are comparable to those of Van Loon et al, who published the results of six knees revised for recurrent stiffness with no identifiable cause other than soft tissue contracture.

The rate of complication in this study was substantial, with nearly half of patients either requiring an additional intervention for stiffness or sustaining a complication and many requiring multiple interventions and/or sustaining multiple complications. Both patients and surgeons considering revision TKA for stiffness should be aware of the complexity of the procedure and the inherent risks of this intervention.

Table 1. Complications and Re-Operations

<table>
<thead>
<tr>
<th>CASE</th>
<th>COMPLICATION(S)</th>
<th>ELAPSED TIME FROM REVISION (MONTHS)</th>
<th>TREATMENT</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Arthrofibrosis</td>
<td>8</td>
<td>Arthroscopic release, manipulation</td>
</tr>
<tr>
<td>2</td>
<td>Deep infection</td>
<td>12</td>
<td>Irrigation and débridement, polyethylene exchange, primary patellar tendon repair, and medical gastrointestinal flu</td>
</tr>
<tr>
<td>3</td>
<td>Persistent infection, septic arthroplasty</td>
<td>34</td>
<td>Removal of implants, placement of antibiotic spacer</td>
</tr>
<tr>
<td>4</td>
<td>Revascularized implants and placement of antibiotic spacer</td>
<td>38</td>
<td>3rd-stage débridement, extensor tendon transfer</td>
</tr>
<tr>
<td>5</td>
<td>Periprosthetic femur fracture</td>
<td>81</td>
<td>Open reduction internal fixation</td>
</tr>
<tr>
<td>6</td>
<td>Skin breakdown over plate</td>
<td>7</td>
<td>Irrigation and débridement of wound, removal of fracture hardware</td>
</tr>
<tr>
<td>7</td>
<td>Femoral fracture with non-union</td>
<td>8</td>
<td>Repeat OREF, revision femoral component</td>
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<td>8</td>
<td>Severe heterotopic ossification, arthrofibrosis</td>
<td>52</td>
<td>Revision heterotopic bone, primary patellar tendon repair and polyethylene liner exchange</td>
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<td>9</td>
<td>Chronic pain</td>
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<td>Tunnelled epidural</td>
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<td>10</td>
<td>Arthrofibrosis</td>
<td>81</td>
<td>Manipulation</td>
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<td>11</td>
<td>Persistent pain in pseudo-hip</td>
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<td>Manipulation</td>
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<td>12</td>
<td>Traumatic pseudo-hip</td>
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<td>13</td>
<td>Acute postoperative infection</td>
<td>a1</td>
<td>Irrigation and débridement, polyethylene exchange, primary patellar tendon repair, and medical gastrointestinal flu</td>
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<td>Manipulation</td>
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<td>15</td>
<td>Acute postoperative infection</td>
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<td>Irrigation and débridement, polyethylene exchange, primary patellar tendon repair, and medical gastrointestinal flu</td>
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<td>8</td>
<td>Secondary manipulation</td>
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<td>22</td>
<td>Asymmetric loosening of femoral and tibial components</td>
<td>47</td>
<td>Revision TKA, all components</td>
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<td>24</td>
<td>Arthrofibrosis</td>
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<td>Arthroscopic release</td>
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<td>25</td>
<td>Arthrofibrosis</td>
<td>a1</td>
<td>Manipulation, tunneled spinal</td>
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<tr>
<td>26</td>
<td>Arthrofibrosis</td>
<td>a1</td>
<td>Manipulation</td>
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<td>27</td>
<td>Persistent infection</td>
<td>a1</td>
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<td>Arthroscopic release</td>
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<td>Hamstring disruption, quadriceps atrophy</td>
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<td>Quadriceps tendon repair</td>
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<tr>
<td>35</td>
<td>Persistent infection</td>
<td>2</td>
<td>Arthroscopic release, tunneled spinal</td>
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In conclusion, we have found that the revision TKA for stiffness provided a significant improvement in the postoperative arc of motion and Knee Society scores. However, the risk of complication and necessity of repeat procedures were high. We believe these data support the practice of revision of both femoral and tibial components in patients with a debilitating, stiff TKA who have failed non-operative management and have been fully counseled about the risk of complications.

CONCLUSIONS

Irrigation and débridement for the treatment of an acute hematogenous infection was associated with improvement in the majority of patients (90% survivorship at 2 years) with non-staphylococcal infections, in particular, having a lower failure rate (96% survivorship at 2 years) (Figure 1). The mortality rate among this subset of patients was notably high.

Figure 1: Survivorship curve with death as the endpoint.

Figure 2: Survivorship curves showing survival of patients infected with a staphylococcal organism (Staph) as opposed to a non-staphylococcal organism (Nonstaph).
CAPTURING WEAR CHARACTERISTICS VIA FRICTION MEASUREMENT DURING TESTING ON A MULTI-STATION HIP SIMULATOR

Hader, Hani1; Wesenburger, Joel N.1; Naylor, Malcolm G.1; Schroeder, David W.2; White, Bruce F.3; and Garvin, Kevin L.1

1. Department of Orthopaedic Surgery and Rehabilitation, University of Nebraska Medical Center, Omaha, NE, USA
2. AMTI, Inc., Watertown, MA, USA
3. Biomet, Inc., Warsaw, IN, USA
4. University of Durham, UK

INTRODUCTION:
With the boom in metal-on-metal hip resurfacing and hard-on-hard total hip replacements (THR) with extremely low wear, obtaining accurate tribological measurements becomes difficult. Characterizing THR friction can help, especially if the progress of such friction can be tracked during wear tests. Friction measurement can also be used as a tool to study the effects of acetabular liner deformation during insertion, and possible femoral head "bumping." This study presents estimates of friction during extended THR wear testing.

MATERIALS AND METHODS:
Five million cycle (Mc) wear tests were performed on the same size THR, but with different material combinations, on a twelve-station hip simulator (AMTI, Boston). Friction of the articulating surfaces was measured using a novel technique presented previously [1], based on equilibrium of forces and moments measured using the simulator’s six degrees of freedom (DOF) load cell on each station.

The 44mm size (femoral head diameter) THR samples included 6 metal-on-metal (MOM) (3 TiN-coated and 3 uncoated), 6 MOM resurfacing (3 standard and 3 with small pockets for lubrication transport), and 3 ceramic-on-UHMWPE (COP) THRs. All were lubricated with diluted bovine serum to contain 20 g/L protein concentration at 37°C, and subjected to the walking cycle loading and rotations of ISO 14242-1 [2].

RESULTS:

The conventional and MOM THRs displayed steadily decreasing friction factors of 0.045±0.009 and 0.046±0.003 over 5 Mc, explained by the stability of wear rates of both these MOM types (72.0±2.81 mg/Mc and 14.2±3.57 mg/Mc, respectively). However, during the first 0.5 Mc the conventional MOM friction factor rose from 0.047±0.004 to 0.057±0.004 while high wear was occurring (161±10.8 mg/Mc). The TiN-coated and uncoated MOMs displayed decreasing friction factors of 0.126±0.017 and 0.099±0.003, respectively. The high standard deviation for the coated THRs was due to a casting variation on one specimen which caused a large amount of scratching on its articulating surfaces. This single specimen had a friction factor of 0.260 at 0.028 Mc. By 1 Mc, the TiN coating worn away on the other two coated specimens (friction factors at 1 Mc: coated 0.081±0.036, uncoated 0.050±0.014). Over the 5 Mc test, averaged friction factors for the coated and uncoated THRs were 0.097±0.003 and 0.099±0.004, respectively.

The standard and "pocketed" MOM resurfacing THRs displayed initial friction factors of 0.58±0.009 and 0.096±0.006 respectively, which increased to the same level at 2 Mc (0.89±0.003 and 0.098±0.004, respectively). No difference in wear was detected between the two resurfacing head types (wear rates over 2 Mc: standard 3.3±1.25 mg/Mc; pocketed 2.2±1.76 mg/Mc), but curiously, both types exhibited an equal level of scratching and scuffing on their articular surface. By the end of 5 Mc, the standard resurfacing components displayed a moderately lower friction factor than the pocketed design (0.08±0.012 and 0.07±0.020, respectively). Although the pocketed design wear was less (not statistically significant, p = 0.05). Finally, the three COP THRs exhibited high UHMWPE liner wear over 2 Mc (97.4±4.08 mg/Mc), which slowed to 72.3±6.10 mg/Mc at 5 Mc. The friction factor also decreased from 0.091±0.026 to 0.090±0.020 over the same period. Toward the end of the test the friction factor increased again to 0.088±0.004 by 5 Mc, coincident with a small increase of wear from 3.39±0.39 mg/Mc between 2 Mc and 4.5 Mc to 77±2.62 mg/Mc between 4.5 Mc and 5 Mc of the ceramic femoral head.

DISCUSSION:
The initially-decreasing friction factor for MOM and COP THR is coincided with a possible "bedding-in" period where the UHMWPE liner conformed to the femoral head. The high initial friction measured on the TiN-coated MOM THRs was evidence of a failing coating, and even different head design in which specimens would fail first. In the case of the pocketed resurfacing specimens, it is possible that the pockets of this design marginally increased the friction through viscous shear and fluid transportation into the joint, thereby marginally improving wear durability.

REFERENCES:
ORIGIN OF BIOCOMPATIBILITY OF IBAD ENGINEERED NANOSTRUCTURES
Ferry N. Namavar, ScD; Renat Sabirianov, PhD; Alexander Rubinshtein, PhD; John Jackson, PhD; Graham Sharp, PhD; Roxanna Namavar, DDS; Hans Heizmann, PhD; Edward Fehringer, MD; and Kevin Garvin, MD
Department of Orthopedic Surgery and Rehabilitation, University of Nebraska Medical Center, Omaha, Nebraska

INTRODUCTION:
Mechanism of cell adhesion (role of adhesive proteins)

The essential role of extracellular adhesive proteins such as fibronectin (FN), vitronectin, and osteopontin in cell adhesion, spreading and migration on the implant material surface has been established by a number of research groups [1] (and references cited therein). The adhesive proteins contain the cell interaction binding RGD amino acid sequence motif and mediate the cell adhesion to the surface of the implant [2]. In other words, for cells, the role of the anchor on the implant surface is crucial. Thus, the adhesion of these proteins to the solid surface is a key factor in cell adhesion and bone formation on an implant surface. The physicochemical properties of the implant surface are essential for the adhesion, growth, and migration of cells. The development of a nanostructured surface facilitates biologically controlled cell adhesion.

Phenomenological concept of the adhesive protein attachment on the solid implant surface

The physical adhesion of the proteins to the surface is determined by complex intermolecular interactions. Among them, non-covalent electrostatic and van der Waals interactions are the strongest [3]. In fact, these forces determine the strength and selectivity of the protein adhesion. The effective ranges of these interactions are on the order of nanometers. While van der Waals forces are strong enough to interact on distances of 3-10 nm, the electrostatic interactions in aqueous electrolyte solutions at physiological concentrations can be effective up to approximately 2-3 nm.

The role of static and electrostatic complementarity in protein-protein interactions and formation of protein complexes

It is well known that forming a functional protein-protein (or other macromolecular) complex requires the presence of complementary noncovalent interactions between proteins and surfaces. The static and electrostatic complementarity of the nanostructured surface is responsible for the enhanced physical adsorption of proteinaceous adhesive proteins, as compared to the increased cell adhesion.

EXPERIMENTAL PROCEDURES:
We have synthesized 2 (an ultra-hydrophilic [4], hard, pure (without chemical stabilizer) submicron (diamond simulant) film with a roughness of a few to 20 nm using IBAD, which combines physical vapor deposition with concurrent ion beam bombardment from an ion gun [5]. In a high vacuum environment, condensation films can be deposited onto substrates. These films are then “stitched” to the orthopaedic implant materials using different nanostructures (5 to 50 nm grain size) characteristics that affect the wettability [6], roughness, and mechanical properties of the coating [7].

We have studied the adhesion survival and growth of bone marrow stromal cells, human OMA-AD cells, on the surfaces of engineered nanocrystalline ultra hydrophilic hard oxides successfully fabricated by IBAD. The stoichiometric oxide ZrO2 was derived from the bone marrow of a female C57Bl/6 mouse by repeated cryolysation at the osteoclast level of a long-term bone marrow culture.

RESULTS AND DISCUSSION:
We have clearly shown (Figure 1) that IBAD nano-engineered ceramic coatings are superior to bulk hydroxyapatite (HA), not only in comparison to cell adhesion and growth, but also with mechanical properties [8] and biological stability [9]. The growth of a bonearrow mesenchymal stromal cell line, OMA-AD, on pure substrates is approximately 300% higher than that on orthopaedic materials. These films are then “stitched” to the orthopaedic implant materials using different nanostructures (5 to 50 nm grain size) characteristics that affect the wettability [6], roughness, and mechanical properties of the coating [7].

Figure 1: Growth of OMA-AD on nanocrystalline hydrophilic submicron coatings produced by IBAD process compared with bulk HA, CoCr and culture plates. The amount of fluorescence produced is directly proportional to the number of viable cells.
The smooth substrate surface (or surface with micro-grains of inorganic material) does not show the substantial variation of the potential across its surface. On the other hand, the nanostructured surfaces show a significant variation in the charge state and as a result the electrostatic potentials of surfaces of different coordination, i.e. at the edges, vertices, steps, and other imperfections. Based on the formation of covalent bonds in transition metal oxides, the surface termination results in the appearance of dangling bonds. The atoms at the vertices and edges of the nano-pyramids have a larger number of dangling bonds than the atoms on the smooth surface. This suggests that these sites have partially localized charges at these sites.

**Figure 5.** Schematic presentation of the possible attachment-graft orientation of one of the central fragments of the adhesive FN protein (the upper part) to the nanostructured surface (the bottom part) of the solid substrate (cubic zirconia). The fragment contains the RGD amino acid sequence to which is bound the integrin cell receptor. The protein fragment is shown with its electrostatic surface potential (blue and red colors correspond to localization of the positive and negative partial charges, respectively). The solid substrate is shown with its charge density distribution presented by the bar. The hillocks of the substrate surface are negatively charged (red). The double arrow shows the favorable electrostatic interaction between protein fragment and substrate.

Based on our first-principle quantum-mechanical calculations [10] for the ZrO2 pyramidal nanostructure with three-fold symmetry, we find there is indeed a substantial charge transfer across the surface. We use ZrO2 tetrahedron cluster terminated by (111) planes. Calculations were performed using Gamma point and (ecutoff=3.50 eV). Our calculation suggests that the vertex of the nano-pyramid has localized charges while the slopes and bottom of the pyramid have a significantly lower surface charge density. Based on our calculations, the potential difference in our specific case of the pyramidal surface is approximately a few tenths of a volt, similar to the surface of protein. Thus, the adhesive protein may find a good match. For both surfaces, the electrostatically attractive interaction with the surface of the cubic zirconia is shown schematically in Figure 5. In this figure, the fragment of protein attaches to the nanostructured surface by forming a positive cluster of charges at the vertex of ZrO2 pyramid, which is negatively charged in this case. The strong electrostatic attraction between the protein and the substrate should be observed in this interaction. This interaction can be significant due to the reduced solvent permittivity in the region between interacting surfaces. Combination with the effect of steric complementarity and the above-mentioned additional mechanisms specific to the super-hydrophilic surface of ZrO2 favorable electrostatic interactions provide enhanced protein adsorption on the nanostructured surface.

**CONCLUSIONS**

We have shown that, based on the quantum-mechanical calculations [10] the surface of the nanostructured ZrO2 can have significant electrostatic potential variations between points with different curvatures. This potential variation is comparable to that observed on the surface of adhesive proteins. Thus, the nanostructured surfaces with localized charges on sharp hillocks may have enhanced protein adhesion, superior to the smooth surfaces which lack such charges.

We are proposing a phenomenological concept that may explain the enhanced adhesion of cells to the engineered nanostructured surfaces compared to a conventional smooth surface. This concept considers steric and electrostatic (complementarity) between interacting adhesive proteins and the surface. The steric fit concept emphasizes the van der Waals component, while the electrostatic fit is a long range electrostatic component of the above interactions. A rather large and heterogeneous electrostatic field induced on the nanostructured non-conducting material surface can be responsible for the enhanced physical adsorption of mediating adhesive proteins, and as a result, enhanced cell adhesion.

**REFERENCES**


**HIGHLY CROSSLINKED UHMWPE IN TKA—DOES VITAMIN-E-STABILIZED POLYETHYLENE ADDRESS OUR CONCERNS?**

1. University of Nebraska Medical Center, Omaha NE, 68198-3898, USA.  
   E-mail: haider@unmc.edu
2. Exponent Inc., Philadelphia, PA
3. Case Western Reserve University, Cleveland, OH
4. Biomat Inc., Warsaw, IN

**INTRODUCTION**

Concerns about reduced strength, fatigue resistance, and oxidation of highly crosslinked ultra high molecular weight polyethylene (UHMWPE) have limited the acceptance of this material for total knee replacement (TKR). It was hypothesized that these concerns could be alleviated if the UHMWPE was blended with vitamin E. It was expected that this treatment would substantially improve its wear performance and resistance to oxidative degradation without compromising its mechanical properties. This study tested the above-mentioned hypothesis as a way to investigate the mechanical properties and wear of both conventional and highly crosslinked vitamin E-doped UHMWPE tibial inserts.

**MATERIALS AND METHODS**

UHMWPE was machined from anisotropic molded GUR 1093 bar stock, crosslinked with 100 Gy and then doped with vitamin E. This material was compared to anisotropic molded GUR1050 UHMWPE. Both materials were gamma irradiation sterilized as for clinical use. Thirty-six samples (18 of each material) were used in the study. The samples were prepared to simulate knee components and evaluated for crack growth rate and oxidation index measurements. Fatigue crack propagation (measured from images) and the cyclic stress intensity factor, K, of both materials were measured (using ASTM E647-05 as a guide) before and after accelerated aging (ASTM F2003-02).

Fourteen samples (dividing the two material types into six sub-groups representing non, 2 weeks, and 4 weeks of accelerated aging) were fatigue tested for crack growth rate and oxidation index measurements. Fatigue crack propagation measurements were made on images, and both crack growth rates, drive and the cyclic stress intensity factor, K, of both materials were measured (using ASTM E647-05 as a guide) before and after accelerated aging.

Knee simulator testing evaluated wear of each material for 5 million walking cycles under force control. Eight PS knees (4 TKR samples of each material) were tested for in vitro knee simulator testing using a 6-station AMTI knee simulator. Statistical differences in all metrics were evaluated for significance with ANOVA (p < 0.05).

**Figure 1:** A highly crosslinked vitamin-E-doped UHMWPE tibial bearing insert (left) and a conventional one (right) after wear testing.
RESULTS
After 4 weeks of accelerated aging, the control material showed elevated oxidation, loss of small punch mechanical properties and decreased fatigue crack growth resistance. In contrast, the vitamin-E-stabilized material had minimal changes in these properties.

Figure 2: Small punch test results for aged and non-aged specimens from the conventional and E-Poly groups.

Figure 3: da/dn vs. √K for all study groups. No gross delamination or fracture of the tibial inserts was observed, and inserts of both types showed almost linear wear. Further, the vitamin-E-stabilized material exhibited 85% reduction in wear for both the CR and PS designs (p < 0.05, ANOVA).

Figure 4: (Left) Wear (measured as weight loss) of conventional UHMWPE tibial components (open symbols) and highly crosslinked vitamin-E-doped UHMWPE tibial components (solid symbols) over a 5-million-cycle test of the PS TKR design. (Right) Summary of the all the wear results.

DISCUSSION:
The vitamin E highly crosslinked UHMWPE tibial bearings reduced overall wear by 85% when compared to conventional tibial bearings of the same design, without any compromise (indeed, there might have even been some improvement) in the mechanical properties of the bearing material. Such level of wear reduction should translate to worthy clinical significance in preventing osteolysis. Highly crosslinked UHMWPE stabilized with vitamin E appears to be promising for use as a bearing surface in TKR.
NAVIGATION IN TKA: ARGUMENTS AGAINST THE USE OF NAVIGATION.

Garvin, K.L.; Barrera, O.A.; and Haider, H.

INTRODUCTION:
Computer-aided orthopaedic surgery (CAOS) and navigation technology for orthopaedics has been around for over 20 years. While it may provide fewer outliers in implant alignment compared to conventional pins, only a very small percentage of orthopaedic surgeons in the US have adopted navigation. This paper speculates on the reasons why navigation has not taken off and why it may not be ready for extensive use in 2010.

Some of the reasons listed in this paper are not (yet) supported by peer-reviewed literature, as no directly supporting literature could be found; however, they are real and we mention them here because they are relevant to what many surgeons already do and feel during total knee replacement (TKA) surgery.

ANATOMIC INVASIVENESS:
The placement of pins to hold navigation reference points results in direct damage to soft tissues around and to the bone itself, raising stress and increasing risk of future fracture. An example of this can be seen in Figure 1 below, in which an elderly female suffered a fatal condyle fracture through the hole left by a pin placed for the navigation reference frame. This kind of complication is directly related to navigation.

CAOS OR CHAOS?:
It is quite possible that surgeons and staff get in the way of the extra red and black tools that take up precious access to the field. There are other subtle but real problems, such as increased risk of infection and dislocation of the surgical teams etc.

LONGER SURGICAL TIME:
Surgical time can increase because of testing and setting up of the system before the surgery, registration/calibration of the navigated jig and instrument, digitization of the bones, bone registration, developing with the system user interface to move to the next patient, and others.

Dutton et al. [1] evaluated 108 consecutive randomized patients. CAOS averaged 107 minutes versus 83 minutes for conventional TKA (p<0.001). This difference in time adds up over the course of a day in the OR and it requires the surgeon's attention.

MORE (NOT LESS) INSTRUMENTATION IS NEEDED:
Instead of simplifying surgery by reducing the number of instruments, new instrumentation is added (e.g., pointer, stylus, navigated alignment tools, etc.). Moreover, if the surgery needs to be converted to conventional (e.g., due to fatal navigation system failure), the conventional set of manual jigs has to be available anyway.

NAVIGATION MORE COMPLEX?:
Increased instrumentation makes the surgery more complex and the learning curve is significant. Proper use of navigation often requires knowledge of the correct anatomical landmarks; adds more steps and different instruments, and introduces a new learning curve.

ARE MORPHED/GENERATED BONES ACCURATE?:
Some concerns have been raised about the accuracy of morphed/generated bone models. Misnavigations systems are non-image based, and thus use morphed bone models as actual ends. These models assume non-deformed anatomy, and the surgeon may need to supervise the computer's surgical plan in the case of a patient with abnormal anatomy.

INACCURACIES OR DISTORTION OF THE MEASUREMENTS:
Inaccuracies or distortion of the measurements can also occur. The operating room lighting interferes with infrared transmitters and field deformation of electromagnetic systems can result from ferromagnetic surgical instruments.

COST OF NAVIGATION:
The increased cost of navigation is also a factor of great interest and has been studied. Novak et al. [2] developed a decision-analysis model to estimate the cost-effectiveness of navigation in TKA, and they concluded that, “Computer-assisted surgery is potentially a cost-effective or cost-saving addition to TKA. However, the cost-effectiveness is sensitive to variability in the cost of computer navigation systems, the accuracy of alignment achieved with computer navigation, and the probability of a revision TKA with malalignment.”

For Slover et al. [3], “Computer navigation is least likely to be cost-effective in treatment in health care improvement in centers with a low volume of joint replacements, where its benefits are most likely to be realized.”

CLINICAL BENEFITS ARE UNPROVEN:
Up to now, there have not been studies documenting improved results using navigation. A manuscript by Bauwens, K. et al. [4] that included 33 studies (11 randomized and 22 prospective) showed that alignment of the medial facet did not differ between the navigated and a conventional group. Navigated groups had a lower risk of malalignment at critical thresholds of >3° and >2°, but not >4°. "No firm conclusions could be made on functional outcomes or complication rates, and surgical time was lengthened 2.3 times on average by navigation. Since no studies document better clinical results or fewer complications, at this time with the current technology, should navigation be used for routine TKA?"

CONCLUSION:
Navigated orthopaedic surgery requires new skills and an increasing curve, increases operating time, and ends up being more costly. While it slightly improves alignment of the femoral component in the coronal and sagittal planes, it may or may not improve the tibial alignment or rotational alignment of either component. Additionally, based on the published studies evaluating the current technology, it should not be used for routine TKA.

For navigation to be a successful approach for orthopaedic surgery it must be faster, easier, cheaper and better, and at this time it is not. Since no studies document better clinical results or fewer complications, the mandatory question remains: With the current technology, should navigation be used for routine TKA?

REFERENCES:
RESULTS

The average stored file size (without compression) for all 8 procedures was only 2.73 Mb. No significant difference between the two subjects was found on actual bone cutting time (mean 579 vs. 642 s, p=0.099), but Subject 1 (S1) was faster than Subject 2 (S2) in total time, which included cutting, reshaping of the bone, and implantation (mean 719 s vs. 958 s, p=0.0035). Surface area/time ratio revealed marginally (but not significantly) higher cutting efficiency for S1 compared to S2 (mean 16 mm²/s vs. 13 mm²/s, p=0.004). The analysis did not show significant differences in the posterior chamfer cut (mean 9.6 mm, p=0.005). The analysis of trajectory of the saw showed less repositioning of motion and less variability for S1 compared to S2 (average total length of trajectory was 8.6 mm, sd=2.3 mm vs. 8.9 mm, sd=4.4 mm), and longer paths in between cuts (average 39° vs. 33° of the total trajectory).

DISCUSSION

The small and thus very manageable set of data files had resulted from recording time and variability information as opposed to the large, cumbersome and inconvenient sequence of digital images associated with video recording techniques common in this field. The coherence test used here is intended to mean the ease of automatic (i.e., computer-aided) processing and interpretation of the data. The numerical data here is easy to analyze computationally and interpret with statistical tools, without a huge burden of human manual (e.g., video) analysis. The incorporation of data logging and analysis routines neither compromised quality nor frequency of the CAOS system real-time tracking, rendering or simulation functions. The system and methods characterized different subjects without additional instrumentation, cost, time, awareness of (or distraction to) the user.

This method can also be used to characterize different surgical techniques, or operating room efficiency. For example, observing the time spent at different locations along the feeding axis indicated that significant time was (consistently) spent at the initiation of each cut (Fig. 2), implying that users had more difficulty creating the initial groove in the bone when cutting freehand.

The vast amount of computer-logged data provides excellent navigation system errors in surgery is untapped and yet to be fully utilized. As navigation becomes more popular in orthopedic surgery, more importance will be placed on location of bone, instruments, and joints can be logged. Beyond documentation and analysis of surgical skills, the data can be used for training and optimization of bone-cutting approaches and whole surgical plans, as well as input for robotics (teaching the robot where to cut). It can also be used to compare different surgical techniques for later correlation with long-term clinical outcomes results.

Assessment of a larger number of surgical techniques and surgical skills through real-time motion recording of navigated or freehand instrumentation "HAP Paul Award." CRS 2008.

REFERENCES


MATERIALS AND METHODS

Two chief orthopedic surgery residents were required to cut the five distal cuts on eight synthetic femurs to approximate the same TKR femoral implant. They used a computer-aided orthopedic surgery (CAOS) navigation system without compromising its real-time tracking, rendering, or simulation functions. The stored data can be played back as a realistic 3D simulation of the complete bone cutting in real-time. The dimensions of our new technique and its sensitivity had been previously validated by tracking surgical instrumentation attached to a robotic arm which served as a reliable actuator and moved the instrumentation along controlled paths.[4] In this study, instead of evaluating the motions of the robots, the system was used to evaluate the surgical skills of actual orthopedic residents in our hospital.

INTRODUCTION

The hand skill of the surgeon while cutting bone during orthopaedics is an important factor which influences a surgical outcome. Askilfully performed surgery is 75% decision making and 25% dexterity.[1] For some specialties, such as orthopedics (and especially minimally invasive surgery), dexterity becomes even more important.[2] Current surgical & assessment methods have yet to mature, and tend to require additional instrumentation, cast and cost. These issues can be overcome, however, by a novel method we propose here which quantitatively and three-dimensionally records the motion of surgical instrumentation for the purpose of documentation, surgical-skill assessment, and safety analysis. Targeting similar objectives to [3], the method proposed in this study uses a existing Computer Aided Orthopedic Surgery (CAOS) navigation system without compromising its real-time tracking, rendering, or simulation functions. The stored data can be played back as a realistic 3D simulation of the complete bone cutting in real-time. The dimensions of our new technique and its sensitivity had been previously validated by tracking surgical instrumentation attached to a robotic arm which served as a reliable actuator and moved the instrumentation along controlled paths.[4] In this study, instead of evaluating the motions of the robots, the system was used to evaluate the surgical skills of actual orthopedic residents in our hospital.

PERFORMANCE IN MOTION

ASSESSMENT OF ORTHOPAEDIC SURGEONS’ DEXTERITY (HAND-SKILLS): A NEW TECHNOLOGY BORN IN NEBRASKA, TESTED ON RESIDENTS

Barrera, O.A.; Hartman, C.W.; Konigsgberg, B.S.; Garvin, K.L. and Haidec, H.

[Image 79x545 to 170x763]

[Figure 1: Calculation of angular and offset errors. An auxiliary axis on each plane (white) is used to calculate offset errors in distances (dz', = dy', as well as the inherent sequence of digital images associated with video recording techniques common in this field. The coherence term used here is intended to mean the ease of automatic (mathematical) processing and interpretation of the data. The numerical data here is easy to analyze computationally and interpret with statistical tools, without a huge burden of human manual (e.g., video) analysis. The incorporation of data logging and analysis routines neither compromised quality nor frequency of the CAOS system real-time tracking, rendering or simulation functions. The system and methods characterized different subjects without additional instrumentation, cost, time, awareness of (or distraction to) the user.

This method can also be used to characterize different surgical techniques, or operating room efficiency. For example, observing the time spent at different locations along the feeding axis indicated that significant time was (consistently) spent at the initiation of each cut (Fig. 2), implying that users had more difficulty creating the initial groove in the bone when cutting freehand.

The vast amount of computer-logged data provides excellent navigation system errors in surgery is untapped and yet to be fully utilized. As navigation becomes more popular in orthopedic surgery, more importance will be placed on location of bone, instruments, and joints can be logged. Beyond documentation and analysis of surgical skills, the data can be used for training and optimization of bone-cutting approaches and whole surgical plans, as well as input for robotics (teaching the robot where to cut). It can also be used to compare different surgical techniques for later correlation with long-term clinical outcomes results.

Assessment of a larger number of surgical techniques and surgical skills through real-time motion recording of navigated or freehand instrumentation "HAP Paul Award." CRS 2008.

REFERENCES


MATERIALS AND METHODS

Two chief orthopedic surgery residents were required to cut the five distal cuts on eight synthetic femurs to approximate the same TKR femoral implant. They used a computer-aided orthopedic surgery (CAOS) navigation system without compromising its real-time tracking, rendering, or simulation functions. The stored data can be played back as a realistic 3D simulation of the complete bone cutting in real-time. The dimensions of our new technique and its sensitivity had been previously validated by tracking surgical instrumentation attached to a robotic arm which served as a reliable actuator and moved the instrumentation along controlled paths.[4] In this study, instead of evaluating the motions of the robots, the system was used to evaluate the surgical skills of actual orthopedic residents in our hospital.

INTRODUCTION

The hand skill of the surgeon while cutting bone during orthopaedics is an important factor which influences a surgical outcome. Askilfully performed surgery is 75% decision making and 25% dexterity.[1] For some specialties, such as orthopedics (and especially minimally invasive surgery), dexterity becomes even more important.[2] Current surgical & assessment methods have yet to mature, and tend to require additional instrumentation, cast and cost. These issues can be overcome, however, by a novel method we propose here which quantitatively and three-dimensionally records the motion of surgical instrumentation for the purpose of documentation, surgical-skill assessment, and safety analysis. Targeting similar objectives to [3], the method proposed in this study uses a existing Computer Aided Orthopedic Surgery (CAOS) navigation system without compromising its real-time tracking, rendering, or simulation functions. The stored data can be played back as a realistic 3D simulation of the complete bone cutting in real-time. The dimensions of our new technique and its sensitivity had been previously validated by tracking surgical instrumentation attached to a robotic arm which served as a reliable actuator and moved the instrumentation along controlled paths.[4] In this study, instead of evaluating the motions of the robots, the system was used to evaluate the surgical skills of actual orthopedic residents in our hospital.

PERFORMANCE IN MOTION

ASSESSMENT OF ORTHOPAEDIC SURGEONS’ DEXTERITY (HAND-SKILLS): A NEW TECHNOLOGY BORN IN NEBRASKA, TESTED ON RESIDENTS

Barrera, O.A.; Hartman, C.W.; Konigsgberg, B.S.; Garvin, K.L. and Haidec, H.

[Image 79x545 to 170x763]
Your feedback counts. Simply go to www.UNMCOrthoInMotion.com
VISITING SPEAKERS ENHANCE RESIDENT EDUCATION

EACH YEAR THE DEPARTMENT OF ORTHOPAEDIC SURGERY AND REHABILITATION HOSTS SEVERAL VISITING SPEAKERS WHO PRESENT SEMINARS FOR ORTHOPAEDIC FACULTY, RESIDENTS, STAFF, AND PRACTICING SURGEONS IN THE AREA. BRINGING IN SPEAKERS WHO SHARE THEIR KNOWLEDGE AND EXPERTISE ON A VARIETY OF TOPICS IS A LARGE PART OF PROVIDING A WELL-ROUNDED EDUCATIONAL EXPERIENCE FOR OUR RESIDENTS. PRIVATE CONTRIBUTIONS FROM ALUMNI AND FRIENDS TO THE DEPARTMENT’S DEVELOPMENT FUND ALLOW US TO CONTINUE TO BRING GUEST SPEAKERS WHO OFFER NEW AND INNOVATIVE IDEAS IN SURGICAL TECHNIQUES, RESEARCH TOPICS, AND PATIENT CARE.
Gifts from orthopaedic alumni and friends, foundations and corporations, and department faculty all support the department’s mission by providing vital resources for resident education, scientific research, and various other programs within the department. Private gifts make a day-to-day difference in the educational opportunities we are able to provide for our orthopaedic residents, the cutting-edge research we perform in our laboratories, and the excellent treatment we are able to offer our patients.

Some people choose to support the department’s annual fund (department-wide fund) that is used primarily for resident education; others choose to specify their gift to be utilized for scholarships, research, library resources, or laboratory equipment, for example.

The following honor roll lists the names of individuals and organizations that supported the Department of Orthopaedic Surgery Rehabilitation during the calendar years 2008 and 2009.

On behalf of the department’s faculty, residents, staff, and patients who benefit from your private contributions, we extend our most sincere thanks for your vital support.

HONOR ROLL OF CONTRIBUTORS 2008-2009

Up to $999
Stuart L. Battist
Joseph A. Byrd
Steven R. Casswell
Jeffrey P. Davick, M.D.
Jeffrey M. Farber, M.D.
Kristine Gottula
R. M. Jacobsen, M.D.

$1,000 - $9,999
Harold W. Andersen
David E. Brown, M.D.
Kenneth J. Cavanaugh, M.D.
Michael P. Clare, M.D.
Paul J. Duwelius, M.D.
George J. Emodi, M.D.

$5,000 - $9,999
Sandra Anderson
UNMC Physicians
Omaha, NE

*Denotes two separate donations.
GRANTS, FUNDS, AND ENDOWMENTS:
LINKING MEDICAL EDUCATION, SCIENTIFIC INNOVATION, AND PATIENT CARE

THE SUCCESS OF ANY ACADEMIC MEDICAL CENTER RELIES ON LINKING THE THREE PRIMARY FUNCTIONS OF EDUCATION, RESEARCH AND PATIENT CARE. OUR DEPARTMENT HAS A NATIONAL REPUTATION FOR EDUCATING OUTSTANDING SURGEONS, AND OUR RESEARCH PROGRAM IS GARNERING NATIONAL ATTENTION AS WELL. BY COMBINING OUR RESOURCES IN THESE TWO AREAS, WE ARE ABLE TO OFFER THE LATEST TECHNIQUES AND MOST ADVANCED DIAGNOSIS AND TREATMENT FOR OUR PATIENTS. IN ADDITION TO RESEARCH RELATED TO PATIENT CARE, DEPARTMENTAL FACULTY MEMBERS ARE DOING RESEARCH IN BASIC SCIENCE, BIOMECHANICAL ENGINEERING, COMPUTER SIMULATION, AND NANO-BIOTECHNOLOGY.

The following list shows the names, sources and funding of grants the department has received from 2008 through early 2010:

**PEER-REVIEWED:**

**OTIS GLEBE FOUNDATION**

“Navigated Freehand Bone Cutting for Knee Replacement” $132,000

**NATIONAL INSTITUTE OF HEALTH**

**NATIONAL INSTITUTE OF AGING**

“Stem Cell Quality Assays, Correlation with Aging/Health” $1,388,125

**KERRY PROSTHESIS FUND**

“Development of the Munroe Meyer Institute Multi-disciplinary Clinic Serving Pediatric Patients Who Require a Prosthetic Device due to Anatomical Loss as a result of Trauma, Disease, or Congenital Conditions.” $24,500

**INDUSTRY:**

**BIOMET, INC.**

“An In-Vitro Wear Durability Study of the Biomet Ceramic-on-Metal Total Hip Replacement System” $65,000

**BIOMET, INC.**

“Evaluation of a New Highly Crosslinked UHMWPE Stabilized with Vitamin E for Posterior Stabilized Total Knee Replacements” $110,000

**SPINEMEDICA CORPORATION**

“A Pre-Durability Study of Cervical Spine TDR Prototypes” $22,000

**EXACTECH, INC.**

“Wear Testing of Total Knee Replacement Implants. Cutting Edge Know-How and Support, From the University to the Implant Manufacturing Industry to Help Patients” $63,000

**ARTHREDX, INC.**

“Determining the Fatigue Strength of Novel Femoral and Tibial Unicompartmental Cartilage Replacement Knee Components” $32,622

**EXACTECH, INC.**

“Effect of Proximal Slope on Wear of Bearings” $30,000

**ESKA IMPLANTS**

“Titanium, Polyethylene Hip Replacement” $90,000

**ARTHREDX, INC.**

“Design and Implementation of Novel Testing Methodology for Durability of Novel Partial Tibial Femoral Cartilage Replacement Components” $62,000

**ARTHREDX, INC.**

Phase II: “Determining the Fatigue Strength of Novel Partial Femoral and Tibial Unicompartmental Cartilage Replacement Knee Components” $86,63
ENDOWMENTS AND DONATIONS:

Endowed funds provide perpetual resources for a variety of education and research activities. When an individual establishes an endowed fund through the University of Nebraska Foundation to benefit the Department of Orthopaedic Surgery, the principal of the fund is invested and the earnings from the invested endowment provide spendable earnings for assistantships, resident education, equipment and technology purchases, library resources, seed money for scientific research projects, and much more.

The department also maintains several non-endowed funds at the University of Nebraska Foundation in Omaha. Some funds have been established by generous individuals for specific purposes, while the department’s Development Fund is a department-wide, unrestricted resource used primarily for resident training activities, such as supporting residents who present research projects at national meetings, bringing renowned speakers to campus to share their knowledge with residents, faculty, and staff, and helping to make resident graduation a memorable celebration. Although this fund is not large or endowed, it provides vital, flexible resources to support a variety of resident education and faculty-related projects.

Jackson Benice, M.D. Education and Research Fund
- Resident education, research, and related activities

James R. Neff, M.D. Musculoskeletal Fund
- Establishment of James R. Neff, M.D., Chair of Musculoskeletal Oncology

The Nebraska Arthritis Outcomes Research Center
- Local, national, and international support of the Nebraska Arthritis Outcomes Research Center

L. Thomas and Herman Johnson Excellence Fund
- Faculty support/professorship

Dr. Foster Matchett Research Assistantships
- Research assistantships

Frank P. Stone Professorship of Orthopaedic Surgery
- Faculty support/professorship

H. Winstott Orr Memorial Research Fund
- Research and teaching supplies and materials

James R. Neff, M.D. Children’s Orthopaedic Center and Molecular Genetics Fund
- Orthopaedic surgery and rehabilitation

Jean Brug Jardon Endowment Fund
- Residents library and teaching resources

Robert C. Hendler, M.D. Fund
- Center for Excellence in Muscular Skeletal Diseases

Robert G. Volf, M.D. Research Fund
- Research and education

The Chapin Endowment Memorial Fund
- Orthopaedic research support

Orthopaedic Oncology Research Development Fund
- Orthopaedic research support

Christina M. Hixson
- Establishment, initial fund for research in Orthopaedic Surgery and Rehabilitation Medicine

Dr. Richard and Kathryn Petras
- Orthopaedic Research Fund (academic research)

Wayne and Eileen Ryan
- Orthopaedic Research Development Fund

Cannady Orthopaedic Surgery and Rehabilitation Fund
- Department Development Fund

John E. Connolly Resident Excellence Fund
- Resident funds

Orthopaedic Surgery Department Development Fund
- Department Development Fund

TOTAL OF ENDOWMENTS/DONATIONS: GREATER THAN $10,000,000

Those who contributed to the Department of Orthopaedic Surgery Development Fund during calendar years 2008 – 2009 are included in the department’s Honor Roll of Contributors listed on page 87.
FULL-TIME FACULTY ACTIVITIES

UNMC DEPARTMENT OF ORTHOPAEDIC SURGERY AND REHABILITATION

FULLTIME FACULTY ACTIVITIES (2008-EARLY 2010)

KEVIN L. GARVIN, M.D.

Research Interests:
- Adult reconstruction
- Prevention and management of musculoskeletal infections

Refereed Articles:
- Soo, YL; Chen, PJ; Huang, SH; Shi, TJ; Tsai, TY; Chou, WH; Lin, YC; Wang, SC; Chang, SL; Wang, G; Cheung, CL; Sabirianov, RP; Mei, VN; Nanavar, F; Haider, H; Garvin, K; Lee, JF; Lee, HY; Chu, PP: Local Structures Surrounding Zr in Nanocrystalline Stabilized Cubic Zirconia Structure-Origin of Phase Stability. J Appl Phys, 104, December 2008.

Book Chapters & Reviews:

Honors, Awards & Offices Held:
- Board Member (elected), Council of Orthopaedic Residency Directors (CORD), American Orthopaedic Association, 2009-2012.
- Board of Specialty Societies (BOS) Executive Committee representative from the Hip Society, American Academy of Orthopaedic Surgeons, 2009-2012.
- American Top Doctors, Castle Connolly Medical Ltd. 2007-2008; 2009-2010.
- Best Doctors in America, 2002-2010; 2009-2010.
- Promoted to assistant professor, Department of Orthopaedics and Rehabilitation, UNMC, July 1, 2008.
- Member, Orthopaedic Trauma Association, 2008-present.
- Member, UNMC Trauma Review Committee, 2008-present.
- Orthopedic Trauma Association, 2008-present.
- Kelso’s Choice Award Winner, American Registry, 2008.
- Mark Dietrich, M.D.

Research Interests:
- Sports-related injuries
- Hip arthroscopy
- Arthroscopic knee and shoulder reconstruction

Research Interests:
- Sports-related injuries
- Hip arthroscopy
- Arthroscopic knee and shoulder reconstruction

Research Interests:
- Osteogenesis imperfecta and metabolic bone disease

Refereed Articles:

Book Chapters & Reviews:

Honors, Awards & Offices Held:
- One World Health Center, Omaha, NE
- Chairman-elect, Executive Committee, March 2010-present.
- Board of Directors, March 2008-present.
- Board of Directors, Children’s Hospital and Medical Center
- Executive Committee, January 1, 2009-2010.
- Quality and Patient Safety Committee, 2008-present.
- President of Medical Staff Services, Children’s Hospital and Medical Center, 2008-2010, ex officio;
- Children’s Hospital and Medical Center Medical Staff Committee:
- Ethics Committee, 2010-present
- Clinical Service Chief, 2009-present
- Information Technology Oversight Committee, 2009-present
- Alfred Health Committee, 2010-present
- Bylaws Committee, 2006-present
- Credentials Committee, 2008-present
- Surgical Services Committee, 2008-present
- Infection Control Committee, 2008-2009
- Pharmacy and Therapeutics Committee, 2008-present

Appointed to the Board of the US Bone and Joint Decade Serving as the liaison representative of the American Academy of Pediatrics and co-chairman of the Pediatric Strategic Planning Group, 2009 & 2010.

Best Doctors in America, 2002-2010; 2009-2010
- Special Professional Achievement award, AOA/Faculty Honors Commission, UNMC College of Medicine, Omaha, NE, March 26, 2009
EDWARD V. FEHRING, M.D.

Research Interests:
- Rotator cuff tears and their association with aging and other co-morbidities
- Shoulder socket reconstruction in shoulders with arthritis

Refereed Articles:
ANTHONY J. LAUDER, M.D.

Research Interests:
Hand and wrist

Refereed Articles:

Book Chaps & Reviews:

MATTHEW A. MORMINO, M.D.

Research Interests:
Clinical outcomes in orthopaedic oncology

Refereed Articles:

Honors, Awards & Offices Held:
Passed the 2009 Research Classification Examination, AOSA certified through 2019
Best Doctors in America 2007-2008, 2009-2010
Program Committee Chairman, Midwest Orthopaedic Association Annual Meeting 2007-2008
Board Member, Mid America Orthopaedic Society 2006-2010

FERYDOON NAMAVAR, SC.D.

Research Interests:
Application of nanotechnology in total joint arthroplasty.
Controlling the bone growth, 2) Development of orthopaedic implant surfaces for short and long-term applications, 3) Reducing the wear of orthopaedic implants and revision surgery.

Refereed Articles:
Siedler, J.; Hasley, B., and Morrow, M.; Functional Outcomes of Davis Zone III Soft Tissue Treated Nonoperatively J Orthopaedic Trauma. May 2010

Book Chaps & Reviews:

SEAN V. MCGARRY, M.D.

Research Interests:
Clinical outcomes in orthopaedic oncology

Refereed Articles:

Honors, Awards & Offices Held:
Passed the 2009 Research Classification Examination, AOSA certified through 2019
Best Doctors in America 2007-2008, 2009-2010
Program Committee Chairman, Midwest Orthopaedic Association Annual Meeting 2007-2008
Board Member, Mid America Orthopaedic Society 2006-2010

SCOTT E. NYSTROM, M.D., PH. D.

Research Interests:
Cold intolerance after hand trauma
Microvascular surgery
Surgical treatment of chronic pain in the head and neck otitis

Refereed Articles:
Fremans, M.; Centano, C.; Hand, M.; and Nystrom, A; Chronic Whiplash and Central Sensitization: An Evaluation of the Role of Myofascial Trigger Points in Pain Modulation. 23(4), April 2009

SUSAN A. SCHERL, M.D.

Research Interests:
Pediatric orthopaedic trauma; especially femur fractures
Non-accidental pediatric orthopaedic trauma
Neuromuscular disorders
Medical student and resident education

Refereed Articles:

Tina G. Krabill, DPT, PT

American Academy of Orthopaedic Surgeons

2008-2009

Elected to the State Board of Directors and the AAMC Council of Delegates. The College is the foundation of the American Medical Association (AMA). The American Academy of Orthopaedic Surgeons (AAOS) is the only national medical society devoted exclusively to the specialty of orthopaedic surgery.

2009-2010

Chair of the Second District

2008-2010

Director of the American Academy of Orthopaedic Surgeons (AAOS) for the Second District

2010

Vice President of the American Academy of Orthopaedic Surgeons (AAOS)

2010

President of the American Academy of Orthopaedic Surgeons (AAOS)

2010

EURONICINE therapies

2010

Tina G. Krabill, DPT, PT

American Academy of Orthopaedic Surgeons

2008-2009

Elected to the State Board of Directors and the AAMC Council of Delegates. The College is the foundation of the American Medical Association (AMA). The American Academy of Orthopaedic Surgeons (AAOS) is the only national medical society devoted exclusively to the specialty of orthopaedic surgery.

2009-2010

Chair of the Second District

2008-2010

Director of the American Academy of Orthopaedic Surgeons (AAOS) for the Second District

2010

Vice President of the American Academy of Orthopaedic Surgeons (AAOS)

2010

President of the American Academy of Orthopaedic Surgeons (AAOS)

2010

EURONICINE therapies
Left to right: Recent graduates, Drs. Ryan Arnold, Kurt Bormann, Gustavo Cordero, and Michael Shevlin, all geared up for a round of golf at the Players Club at Deer Creek during this year’s graduation events (June 2010).

Left to right: Orthopaedic residents Drs. Nolan May (HOI), Khalid Aziz (HOII), Eric Samuelevon (HOIII), and Kevin Lindgren (HOII), with 2010 graduates Drs. Kurt Barnam, Michael Shevlin and Ryan Arnold and orthopaedic resident Dr. Ryan Hess (HOIV), at the 2010 graduation banquet held at the Omaha Country Club in June.

In 2009, Dr. Susan Scherl was chosen by the American Orthopaedic Association (AOA) to be a 2010 AOA – ASG (Austrian, Swiss, German) Traveling Fellow. Beginning in April of this year, she spent four weeks touring orthopaedic institutions throughout Austria, Switzerland and Germany. This photo was taken at the Pediatric Orthopaedic Clinic in Basel, Switzerland, with (left to right) British Fellow Dr. Raghuram Thanoe, Dr. Susan Scherl, Dr. Fritz Hefli (Chief of Orthopaedics at the University Children’s Hospital in Basel, Switzerland), and American Fellow Dr. Scott Steimmann.

Dr. Brian Adams (left), professor in the Department of Orthopaedics and Rehabilitation and program director of the hand surgery fellowship at the University of Iowa, with Dr. Timothy Fitzgibbons, foot and ankle specialist at GIRO Ortho Specialists and UNMC orthopaedic volunteer clinical associate professor, at the 2010 annual graduation post-golf barbecue. Dr. Brian Adams was the department’s 2010 graduation visiting speaker.

Left to right: John Wiebelhaus, B.S./Clinical Research Associate, Christine Julian, M.A., Stan Vogel (husband of Mary Peterson), Mary Peterson, R.N., Dana Schwarz, R.N., clinical research coordinator, Amie Ruffcorn, R.N., and Mitzi Johnson, B.S., orthopaedic surgery clinic manager, at the 2010 graduation banquet held at the Omaha Country Club in June.
PEDIATRIC ORTHOPAEDIC STAFF:

ORTHOPAEDIC BIOMECHANICS AND NANO-BIOTECHNOLOGY LAB STAFF:
Left to right: Travis Jackson, Osvaldo Andres Barreto, Kevin Swierczek, Robert Jacobberger, Joel Weisenburger, Tyler Lee, and Jennifer Bruce. Not pictured: Utsav Pokharel.

ORTHOPAEDIC ACADEMIC STAFF:
Left to right, Front row: David Staiert, Pat Running, Susan Sielbar, Blue Bolaban, and Mike Ghit. Back row: Geri Miller, John Wiebelhaus, Tami Jenson, and Dana Meyer. Not pictured: Blaen Rooney, Christine Pracht, and Dana Schwarz.

ORTHOPAEDIC CLINIC STAFF: