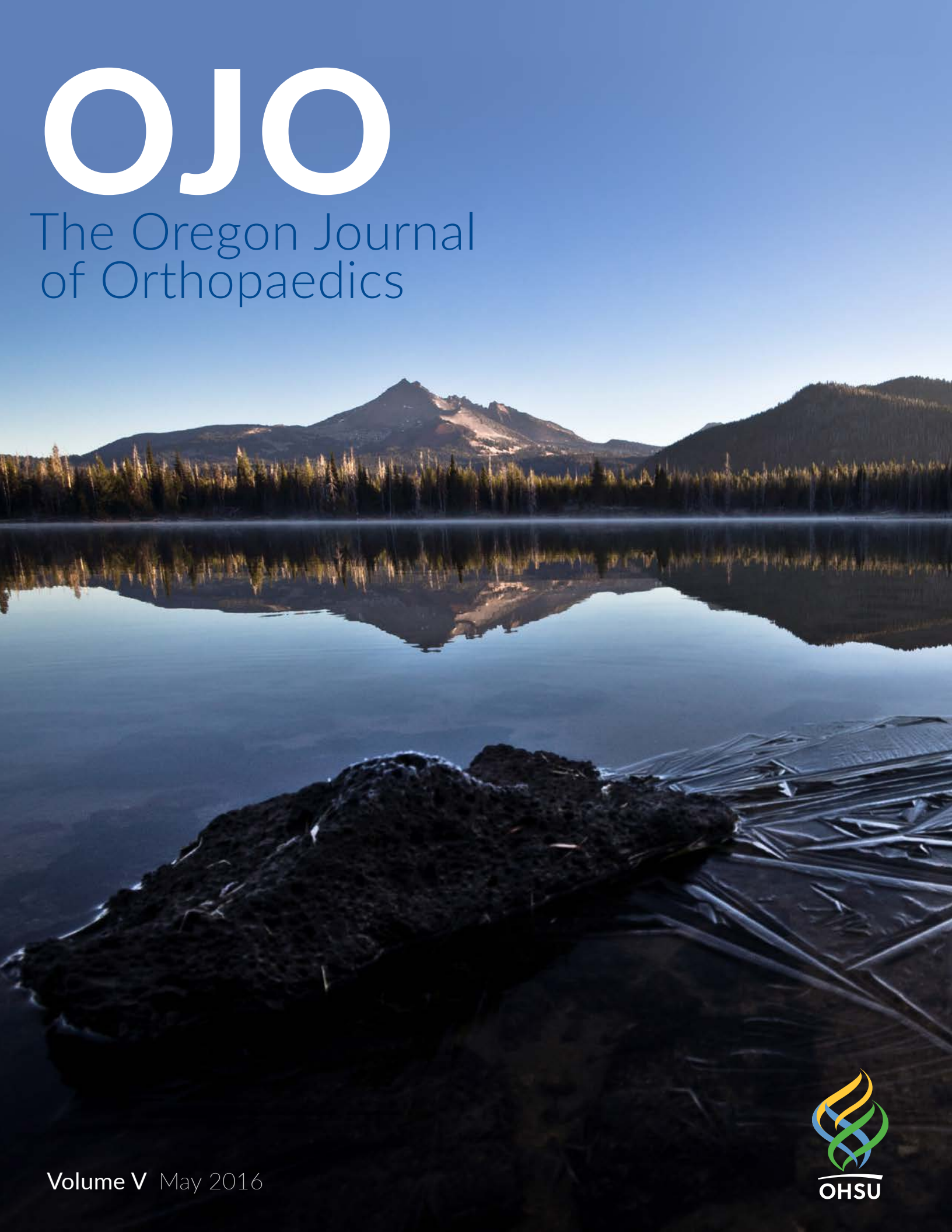
OJO

The Oregon Journal of Orthopaedics



Volume V May 2016

OHSU

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Letter from the Editors

Welcome to the fifth volume of *The Oregon Journal of Orthopaedics*. We would like to take this opportunity to thank all those who contributed to the progression and evolution of this journal, which is only possible through the hard work and dedication of those involved. In this volume we speak to Dr. Jung Yoo about his painting, and we will get an update on the OHSU trauma service from Dr. Brad Yoo. We also welcome three new faculty members: Drs. Jacqueline Munch, Omar Nazir, and Clifford Lin. Dr. Munch, a 2013 OHSU orthopaedic resident alumna returns to Oregon after completing her sports fellowship at The Hospital for Special Surgery in New York. Dr. Nazir is a welcome addition to the upper extremity faculty after completing his fellowship last year at OHSU. Clifford Lin joined the orthopedic spine faculty at OHSU after completing his residency and fellowship at University of Toronto in Ontario, Canada. The program is excited to welcome these new faculty members.

As always, we continue to showcase the outstanding contributions to orthopedic research from the Oregon orthopaedic community in our research section that includes selected abstracts and published articles from the past year.

The alumni from the class of 2013 are featured in this year's alumni update. They give us an update on their careers from fellowship to their current practices, and catch us up on their family lives. We would like to congratulate the upcoming graduation of our chief residents, the OHSU class of 2016. We wish them the best in their future endeavors and thank them for the many contributions that they have made to resident and medical student education. Abstracts from their senior projects are featured in a dedicated section, honoring their contributions to the department.

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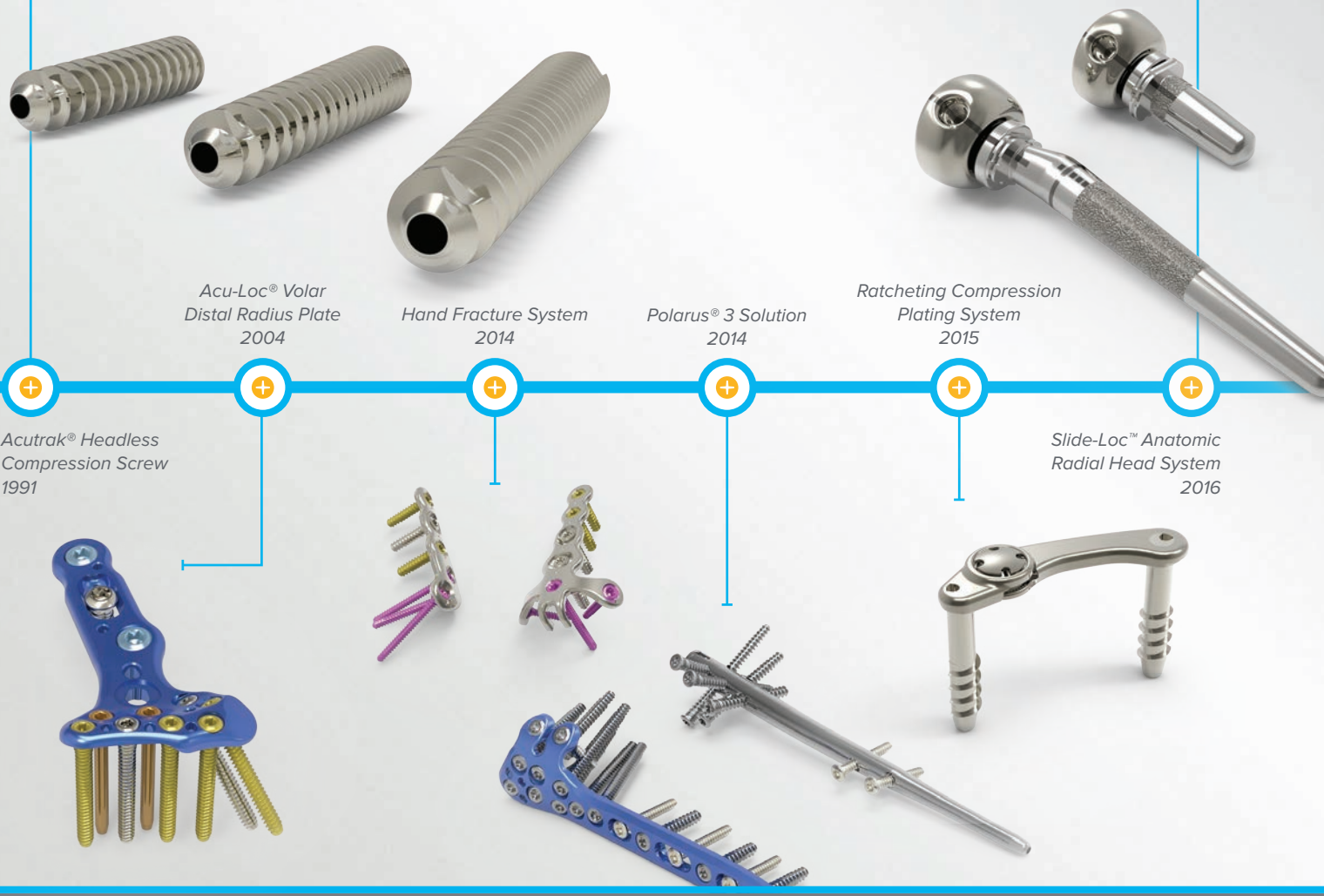

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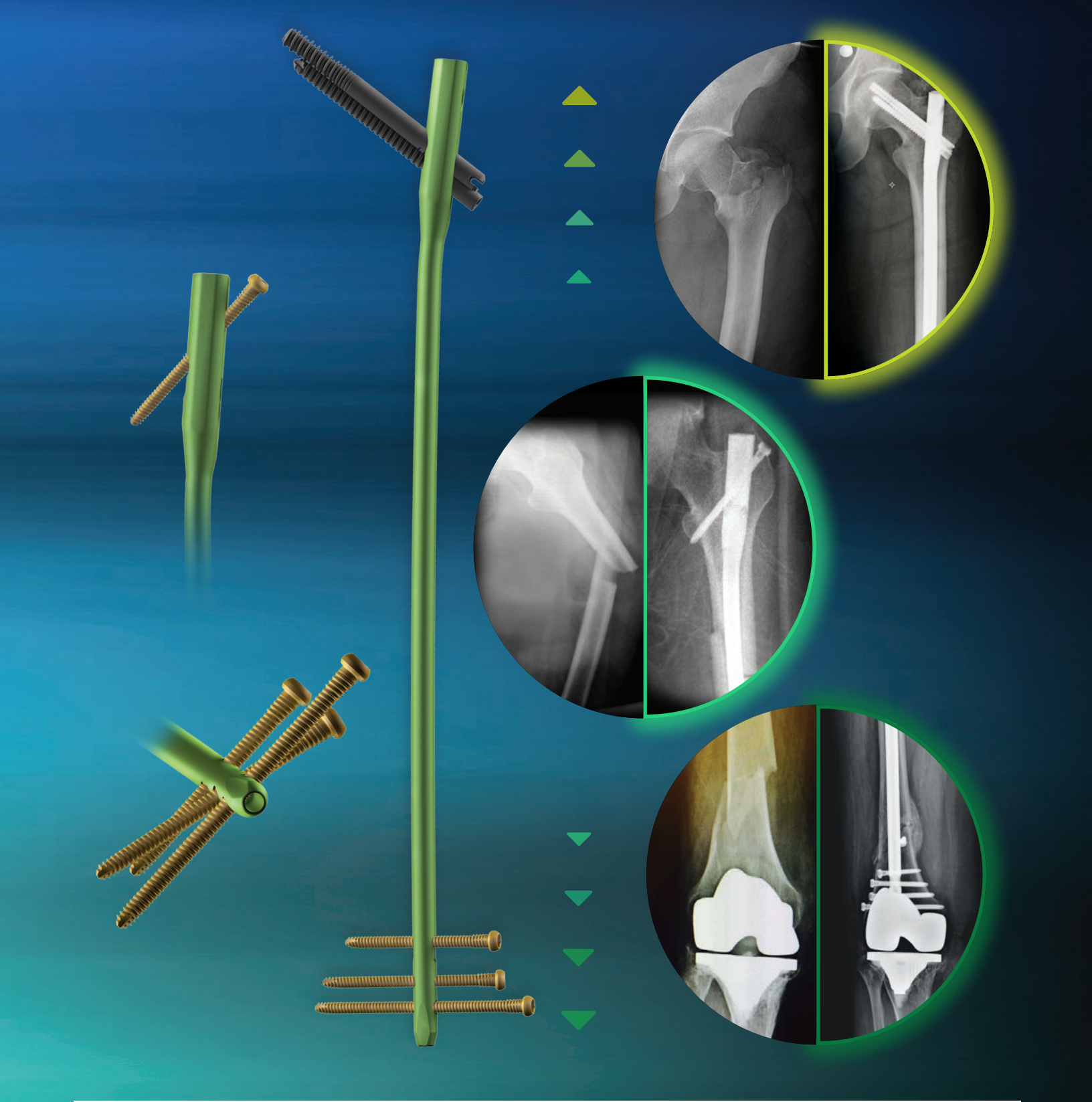

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Letter from the OHSU Chairman

There is a chapter in *Tao Te Ching* that I find enlightening, Lao Tzu spoke these words:

"When the Master governs, the people are hardly aware that he exists.
Next best is a leader who is loved. Next, one who is feared. The worst is one who is despised.
If you don't trust the people, you make them untrustworthy.
The Master doesn't talk, he acts. When his work is done, the people say,
"Amazing: we did it, all by ourselves!"

Who are the leaders? Is it the president of the university? Is it the dean or the chair?

Whom I see are you, who work quietly and diligently without recognition, bravado or fanfare. I realize that you are the leaders who make everything better. You are the ones who help each of us be more and accomplish more. You are my colleagues, my residents, my MA's, my PA's, my administrators … so many of you, un-noticed and underappreciated. My gratitude to you for being that leader!

Sincerely,

Jung Yoo, MD
Chair and Professor
OHSU Department of Orthopaedics & Rehabilitation

Letter from the OHSU Program Director

Dear Colleagues:

We are very proud to present you with the fifth edition of *The Oregon Journal of Orthopaedics*. In marking this milestone, we recognize that what may have started as a small surprise in your mailbox has now become a beautiful annual update on the state of Orthopaedic Surgery in Oregon. Each year we have seen articles on the history of our field, the growth of medical care, and the progress of surgical research. We've seen residents grow from early learners to leaders in their orthopaedic groups around the state, and the connection from the early giants of orthopaedics to the current intern classes become real. This fifth edition is no different, and we hope it once again exceeds your expectations.

Milestones have become an important component of education; we use them yearly with both medical students and residents to ensure they are making progress toward becoming independent physicians. There are milestones for development of communication skills and professionalism. There are also milestones for the treatment of degenerative hip and knee arthritis, ACL disruption, diabetic foot care, hip fractures, and pediatric septic hip, in addition to 11 other orthopaedic diseases. We even have milestones for production of a research project. Milestones are important to set goals to reach and look ahead, but also to look back and see how far one has traveled. These Orthopaedic Residents have traveled far year after year to formulate a plan for this Journal, develop articles, collect research, build a budget, and produce a beautiful publication. Looking back at a five year collection of OJO builds pride and satisfaction. Congratulations to each of the many residents who have traveled these miles the first five years in order to produce each edition.

We expect the next five years to be similarly productive. Each of our hospitals and clinics statewide are setting new goals and new milestones to reach in the future. Milestones have become an important target for the Performance Excellence movement. Our patients depend on us not only reaching these milestones, but setting new goals for each New Year. So for a few brief moments, we encourage you to read through this edition of OJO and reflect back upon the milestones you have crossed in your pathway to Orthopaedics, and to set some new milestones to reach for next year. We will be setting our own goals for the next edition of OJO as soon as this lands in your mailbox.

Sincerely,

Darin Friess, MD
Residency Program Director

Good Samaritan Regional Medical Center Orthopedic Surgery Residency Program

Letter from the Program Director

The Samaritan Health Services Orthopedic Residency Program is excited to move in to 2016 and welcome a new class of orthopedic residents. Last June, we graduated our first class of chief residents who both went on to pass their Step 1 Board examination and are both looking to move forward with their careers in 2016. One resident is currently completing a trauma fellowship and will move on to private practice after that. The other will move on to serve in Ethiopia for a two year medical mission after a year working in general practice. Since their departure, we have added a great group of three new interns who have been working hard to represent the orthopedic program in all departments during their internship training. We look forward to them moving on and each becoming an integral part of our orthopedic team. This June, we are excited to be graduating our second class and are proud of each of our Chief Residents for earning a fellowship in their desired field. We are excited for them to continue on in their training and to continue to be a part of our orthopedic community once out in practice.

One of the biggest changes to take place over this academic year in our program is our work towards ACGME accreditation as the American Osteopathic Association and ACGME have decided to move towards a single accreditation system for medical graduates. We have been working hard to complete the application in order to be a part of this exciting change. When in full effect in July 2020, the new accreditation will allow our program to graduate osteopathic and allopathic residents who demonstrate achievement of common milestones and competencies. As a part of this change, we have implemented new surgical simulation labs with the help of our friends at OHSU and Acumed. We plan to continue these labs in order to develop and teach important surgical skills from fracture fixation to arthroscopy.

Now that we are in our sixth year of developing our orthopedic program, we have enjoyed our continued relationships with Oregon Health and Science University, Shriners Children's Hospital, and Legacy Emanuel Medical Center. A new rotation for our senior residents with Dr. Bruce Le in Visalia, California has had great reviews from our residents and has been instrumental to the continued development of their arthroscopic skills. As a community based orthopedic residency program, we rely on these hospitals to provide our residents with core training in Level I trauma, pediatric orthopedics, and orthopedic oncology. We are very grateful to the faculty at each of these sites for their continued dedication to teaching our residents.

We are also proud of our residents continued work in the area of research. As a newer program with a growing research department, we have been working to offer increased research support in order to produce more original studies from our institution. We commend our residents for the work to start their projects from the ground up, including working on developing funding for larger projects. As in years past, we had some of our residents present posters at various national meetings this past year as well. We hope to continue these efforts to expand our research accomplishments and are excited to see the projects in the works for our junior residents.

As we look to the close of the academic year, we are proud to graduate our second class, and are excited to welcome our new interns. As a program, we feel blessed by the continued hard work, dedication, and commitment our residents have to one another and to the residency program. We are thankful to each and every staff and faculty member who have been a part of the continued growth of our program and the education of our residents. The quality of surgeons our program produces is a direct reflection of the commitment of its teachers. For this, I am grateful to everyone who has given the time and effort to be a part of developing the young surgeons our program has graduated and will graduate in the future.

Sincerely,

Luis Vela, DO, FAOA
Program Director
Orthopedic Surgery Residency, Samaritan Health Services

Adult Reconstruction

Thomas Huff, MD

Kathryn Schabel, MD

Foot & Ankle

James Meeker, MD

Infectious Disease

Penelope Barnes, MBBS, MRCP, FRCPath, PhD

Orthopaedic Oncology

Yee-Cheen Doung, MD
Associate Clinical Medical Director

James Hayden, MD, PhD
Quality Director

Pediatrics

Matthew Halsey, MD

Podiatry

Trish Ann Marie Otto, DPM

Physical Medicine & Rehabilitation

Hans Carlson, MD

Nels Carlson, MD

Research / Basic Science

Brian Johnstone, PhD
Director, Research

Lynn Marshall, ScD

Spine

Clifford Lin, MD

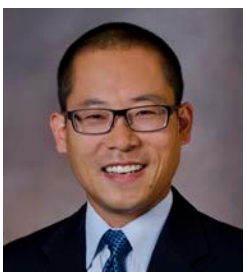
Robert Hart, MD

Jayme Hiratzka, MD
Director, Spine Fellowship

Jung Yoo, MD
Chairman

Trauma

Darin Friess, MD
Director,
Trauma & Residency Education
Vice-chairman



Brad Yoo, MD

Sports Medicine (Primary Care)

Rachel Bengtzen, MD

James Chesnutt, MD

Douglas McKeag, MD

Melissa Novak, DO

Ryan Petering, MD
Co-Program Director,
Sports Medicine Fellowship

Charles Webb, DO
Director,
Sports Medicine Fellowship

Sports Medicine (Surgical)

Dennis Crawford, MD, PhD
Director, Sports Medicine

Andrea Herzka, MD

Jacqueline Munch, MD
Associate Program Director

OHSU

Upper Extremity

Adam Mirarchi, MD
Co-Director,
Hand Fellowship

Robert Orfaly, MD

Omar Nazir, MD

Portland VA Medical Center Faculty

Jesse McCarron, MD
Chief of VA Orthopaedics

Ted Vigeland, MD

Lucas Anissian, MD, PhD

Mark Berkson, MD

Michael Aiona, MD
Chief of Staff, Program Director

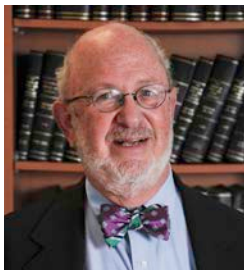
Jeremy Bauer, MD

Charles d'Amato, MD
Director of Spinal Deformity

J. Krajbich, MD, FRCS(C)

Ellen Raney, MD

Dennis Roy, MD
Director of Education



Michael Sussman, MD

Michelle Welborn, MD

Legacy Emanuel Hospital

Doug Beaman, MD
Foot & Ankle

Britton Frome, MD
Hand/Upper Extremity

Richard Gellman, MD
Orthopaedic Traumatologist
Foot & Ankle

Steve Madey, MD
Hand/Upper Extremity

Corey Vande Zandschulp, MD
Orthopaedic Traumatologist

Amer Mirza, MD
Trauma/Adult Reconstruction

Kaiser Permanente, Pediatrics Faculty

Stephen Renwick, MD

Ronald Turker, MD

Brett Andres, MD

McPherson Beall III, MD

J. Brad Butler, MD

James Davitt, MD

Alec Denes Jr, MD

Paul Duwelius, MD

Edwin Kayser, MD

Jason Kurian, MD

Edward Lairson, MD

Hans Moller III, MD

Rosalyn Montgomery, MD

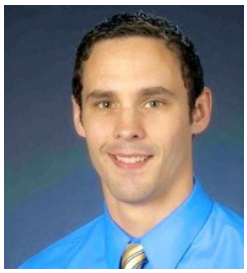
Linda Okereke, MD

Rolf Sohlberg, MD

Venessa Stas, MD

Robert Tennant, MD

Sports Medicine Primary Care Fellows



Jordan Edwards, MD

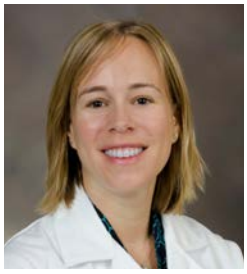
Joshua Lenhof, MD

Spine Fellows

Christopher Kong, MD

Ngoc-Lam Nguyen, MD

Hand Fellow

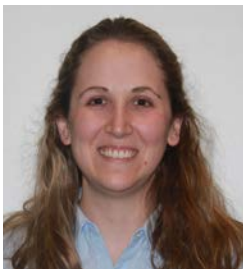


Jennifer Wozniczka, MD

PGY-5 Class

Jake Adams, MD

Hometown: Elkridge, UT
Medical School: University of Utah School of Medicine
Fellowship Plans: Adult Reconstruction - Mayo Clinic, Scottsdale, AZ



Kirsten Jansen, MD

Hometown: Florissant, MO
Medical School: University of Missouri - Kansas City School of Medicine
Fellowship Plans: Adult Reconstruction - Indiana University

Tom Kowalik, MD

Hometown: Seattle, WA
Medical School: Dartmouth Medical School
Fellowship Plans: Trauma & Adult Reconstruction -
1. Dr. Paul Duwelius; Orthopedic + Fracture Specialist, Portland, OR
2. Sydney Australia Arthroplasty & Trauma

Jared Mahylis, MD

Hometown: Gillette, WY
Medical School: University of North Dakota School of Medicine & Health Sciences
Fellowship Plans: Shoulder & Elbow - Cleveland Clinic

Farbod Rastegar, MD

Hometown: San Diego, CA
Medical School: University of Chicago, The Pritzker School of Medicine
Fellowship Plans: Spine - Cleveland Clinic

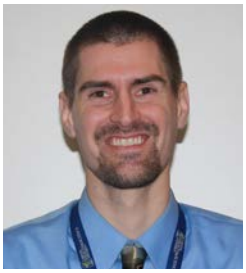
PGY-4 Class

John Cox, MD
Hometown: Gallup, NM
Medical School: University of New Mexico School of Medicine
Fellowship Plans: Adult Reconstruction – Scripps Health, San Diego, CA

Ryland Kagan, MD
Hometown: Portland, OR
Medical School: Albany Medical College
Fellowship Plans: Adult Hip and Knee Reconstruction and Hip Preservation - University of Utah

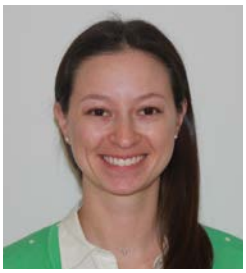
Joseph Langston, MD
Hometown: Dallas, TX
Medical School: Texas Tech University Health Science Center
Fellowship Plans: Adult Reconstruction – Melbourne Orthopaedic Group, Melbourne, Australia

Michael Rose, MD
Hometown: Mansfield, TX
Medical School: Duke University School of Medicine
Fellowship Plans: Sports Medicine - Steadman Hawkins Clinic, Denver, CO

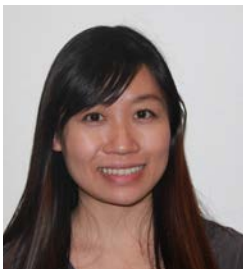


Ryan Wallenberg, MD
Hometown: Medford, OR
Medical School: Creighton University School of Medicine
Fellowship Plans: General

PGY-3 Class



Hannah Aultman, MD
Hometown: Portland, OR
Medical School: Tufts University School of Medicine
Fellowship Plans: Undecided



Karlee Lau, MD
Hometown: Plano, TX
Medical School: University of Texas Southwestern School of Medicine
Fellowship Plans: Undecided

Dayton Opel, MD
Hometown: Sheboygan, WI
Medical School: University of Wisconsin School of Medicine
Fellowship Plans: Undecided

Derek Smith, MD
Hometown: Topana, CA
Medical School: Columbia University School of Medicine
Fellowship Plans: Undecided

Benjamin Winston, MD
Hometown: Denver, CO
Medical School: University of Colorado School of Medicine
Fellowship Plans: Undecided

PGY-2 Class

Courtney Bell, MD
Hometown: Roseburg, OR
Medical School: Oregon Health & Science University
Fellowship Plans: Undecided

Elizabeth Lieberman, MD
Hometown: Lake Oswego, OR
Medical School: Oregon Health & Science University
Fellowship Plans: Undecided

Shanjean Lee, MD
Hometown: Newport Beach, CA
Medical School: Duke University
Fellowship Plans: Undecided

Peters Otlans, MD
Hometown: Lakewood, WA
Medical School: Boston University
Fellowship Plans: Undecided

Travis Philipp, MD
Hometown: Olathe, KS
Medical School: Oregon Health & Science University
Fellowship Plans: Undecided

PGY-1 Class

Taylor Lara, MD
Hometown: Memphis, TN
Medical School: University of Tennessee Health Science Center
Fellowship Plans: Undecided

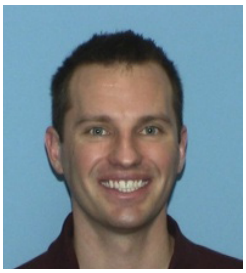
Nikolas Baksh, MD
Hometown: Lancaster, PA
Medical School: Case Western University
Fellowship Plans: Undecided

Duncan Ramsey, MD
Hometown: Dallas, TX
Medical School: University of Texas School of Medicine at San Antonio
Fellowship Plans: Undecided

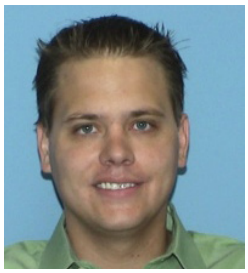
David Putnam-Pite, MD
Hometown: Santa Cruz, CA
Medical School: Oregon Health & Science University
Fellowship Plans: Undecided

Grant Sun, MD
Hometown: Reno, NV
Medical School: University of Utah
Fellowship Plans: Undecided

Orthopaedic Surgery Residents



Jason Malone, DO
PGY-5
Fellowship: Pediatrics
Phoenix Children's Hospital



Blake Obrock, DO
PGY-5
Fellowship: Sports Medicine
University of New Mexico

Kelli Baum, DO
PGY-5
Interest: Adult Reconstruction
Wake Forest University

Ryan Callahan, DO
PGY-4
Interest: Foot/Ankle

Craig Gillis, DO
PGY-4
Interest: Hand/Upper Extremity

Andrew Nelson, DO
PGY-4
Interest: Sports Medicine

Doug Blaty, DO
PGY-3
Interest: Spine

Jun Kim, DO
PGY-3
Interest: Joints/Spine

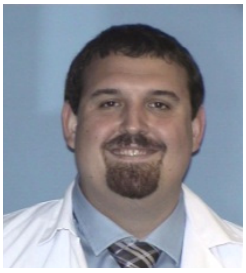
Stefan Yakel, DO
PGY-3
Interest: Trauma/Spine

Orthopaedic Surgery Residents

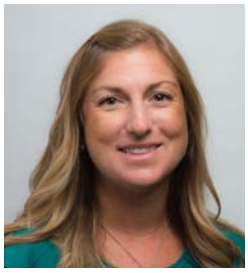
Tim Degan, DO
PGY-2
Interest: General Orthopedics

Brian Scrivens, DO
PGY-2
Interest: Adult Reconstruction

Heidi Smith, DO
PGY-2
Interest: Sports Medicine



Eric Krohn, DO
PGY-1
Interest: Undecided



Jennifer Sharp, DO
PGY-1
Interest: Undecided

Mark Williams, DO
PGY-1
Interest: Undecided

Dr. Jung Yoo - painter

As many of you know, I have been painting all my life. Art is a uniquely human activity that embodies joy of our perception and understanding. Cézanne thought that Nature is the first master of a painter. However, a painter unlike a photographer struggles with the objective reality and the aesthetic transformation of that reality. He wrote, "One is neither too scrupulous and sincere, nor too subjected to nature; but one is more or less master of his model, and especially of his means of expression."

I am predominantly a landscape and still life painter and I tried to balance that tension between the visual reality and the creative reality. This becomes easier when you realize that everything about the painting is a different reality. We take a four-dimensional world into a two-dimensional one. This is why I try not to paint three-dimensional perspective into my paintings. It seems more honest to the creative reality of an artist.

Most people think that I paint because it is relaxing and takes pressure off my professional life. Unless you have devoted a significant part of your life to art, you do not know that the creative process is full of tension and struggle. Recently, I have taken up some portrait work. I did it as an aesthetic exercise. However, as I paint someone's face for hours, I realized that I was painting not only a face but their personality and thoughts, as well. I feel as if I touch a little bit of their soul in the process. I paint because there are only few things, such as art, music and math, which can transcend our everyday experience and reach for something greater, something even ethereal.

Trauma Update

By Brad Yoo, MD

Like Portland and OHSU, the orthopaedic trauma service continues to experience exciting growth in patient care, education, and research. Our team provides tertiary patient care at one of only two level I trauma centers in Oregon. In 2015, the orthopaedic team performed over 1000 fracture-related surgeries, treated over 600 open fractures, and accepted 400+ referrals for acute and subacute fracture care. It is a privilege to be able to treat the injured citizens of Oregon.

The high volume of trauma patients creates an ideal environment for residents and fellows to learn fracture and soft tissue care among the critically injured. To promote further education, the faculty hosts case conferences, literature reviews, and in-training preparation throughout the academic year. Quality control conferences are held on a monthly basis to improve patient care and patient safety. The residents are able to practice fracture reduction and instrumentation techniques in the university's VirtuOHSU lab, with the trauma faculty serving as lab moderators. The VirtuOHSU lab has been a rewarding research resource as well. Radiographic and cadaveric investigations regarding contemporary issues in fracture surgery can be accomplished only through the generosity of the body donation program. We are grateful for their support as well.

This was a year of several exciting changes. Congratulations to Dr. Friess, who was recently elected as departmental vice chairman. Dr. Friess graduated from his residency at Case Western University Hospital System in 2005, and completed his orthopaedic trauma fellowship at Hennepin Memorial Hospital under the tutelage of Dr. Peter Cole in 2006. He is an invaluable member of the department, serving as residency director and a crucial liaison between department and hospital administration. Dr. Brad Yoo, not to be commonly mistaken as Dr. Jung Yoo's offspring, was elected as chief of orthopaedic trauma at OHSU. He graduated from the R. Adams Cowley Shock Trauma Center in 2005, and completed his orthopaedic trauma fellowship from the University of Washington in 2006. Dr. Yoo joined the department in 2014, having spent the prior 8 years as faculty at the University of California, Davis Medical Center, one of the busiest level I trauma centers in that state. Joann Deutsche RNP, is another critical member of the trauma team. As an experienced nurse practitioner, Nurse Deutsche evaluates and treats both non-operative and post-operative patients with fracture or soft tissue injury. Dr. Justin Haller will join the trauma team in 2016 following the completion of his orthopaedic trauma fellowship at the University of Washington. He completed his residency at the University of Utah, another top tier level I trauma facility. OHSU is excited to bring him aboard. With the growth and access of the orthopaedic trauma service, we will be even more capable than ever to provide routine and tertiary fracture care to the citizens of Oregon and beyond.

Introduction to PROMIS - Patient Reported Outcomes Measurement Information System

By: Paxton Gehling

No longer the sole purview of clinical research, outcome measures are becoming an ever more vital part of day-to-day clinical orthopedic practice. Beginning on April 1, 2016 the Department of Health and Human Services (DHHS) Centers for Medicare and Medicaid Services rolled out the Comprehensive Care for Joint Replacement model, which for the first time will tie orthopedic outcomes with reimbursement in limited service areas - including the Portland/Hillsboro/Tigard metro area. Though currently of narrow scope, outcome-payment bundling is expected to become a significant factor in orthopedics across subspecialties and practice models.

In an effort to improve outcome monitoring and develop a robust data registry, we have begun a new outcomes tracking program. At Oregon Health and Sciences University (OHSU) Department of Orthopaedics and Rehabilitation trauma clinic at Cornell West, we have implemented a streamlined and adaptable outcome tracking program using the Patient Report Outcomes Measurement Information System (PROMIS) developed by the National Institute of Health (NIH). This free and powerful platform is specifically designed to maximize clinical outcome data, while minimizing survey fatigue. This is achieved through a wide array of fixed-length short form surveys, and computerized adaptive tests (CAT) - which independently tailor each questionnaire in response to the survey taker's previous answers. These surveys and CATs cover a wide range of topics in general health, as well as social and psychological wellbeing. These new surveys are backed by a co-developed project - PROsetta Stone, which has established equivalency between many PROMIS questionnaires and their commercially available counterparts.

In our clinic, we have collected outcomes from over 900 unique clinic visits using two different survey sets. The first uses two short CAT question banks, to determine the extent to which pain interferes with activities of daily living (PROMIS Bank v1.1- Pain interference), and to evaluate physical function and mobility (PROMIS Bank v1.1 - Phys Func Samples w Mobility Aid). On average, this composite questionnaire delivers 12 questions and takes 5 minutes to complete. The second survey is a 10 question general health survey (PROMIS SF v1.1 - Global Health) favorably comparable to other ubiquitous pay-per-use general health short form questionnaires.

Administration of these questionnaires is streamlined, and fits easily into the workflow of our busy orthopedic trauma clinic. Patients are invited to complete the questionnaire on one of three pre-loaded limited-access iPad tablets after being roomed by our medical assistants or research staff. We encourage patients to complete the questionnaires independently, but offer technical assistance with the devices when necessary. The tablets are collected at the end of each clinic visit, and cleaned before being used by the next eligible patient. The de-identified collected data is automatically uploaded to secure servers maintained by PROMIS in association with Northwestern University. At the end of each clinic day, these scores are manually entered into the attending physician's notes.

As this program matures, we look forward to several additional developments which will improve the ease of both collection and analysis. However, even at this early stage PROMIS is proving to be a powerful, adaptable, and easily implemented data collection solution.

New Faculty Spotlight:

A Q&A session with Jacqueline Munch, MD, orthopaedic sports medicine surgeon at OHSU

By: Ben Winston, MD

How has the first year of your practice gone?

The first year of practice is an amazing time of a surgeon's career. I developed a very deep gratitude for those who took the time to teach me while meticulously caring for their own patients. I also realized just how many items can be on an academic surgeon's plate, which gave me a profound respect for those who juggle multiple professional passions sustainably.

What have been the greatest challenges of your practice thus far?

I found myself challenged by the task of teaching residents as I grew into my own style of operating and instructing. Dr. Darin Friess asked me to become the Simulation Director for the residency program, which helped a great deal with that challenge: I could funnel my enthusiasm for teaching into the simulation environment with seemingly endless potential, while taking my time a little more in the clinical setting.

What has been most unexpected in your transition from OHSU resident to faculty member?

I realized very quickly that, as a resident, I was never burdened with saying "no" to my patients. If a patient wanted surgery, but I didn't consider it to be a viable option, I could defer to my attending surgeon. Now, the responsibility is all mine. I was surprised to find that it is much more difficult to carefully convince a patient that surgery should not be performed than to convince most patients that it will help. It is an art of communication to earn and keep the patient's trust, even while I am taking a course of action that is in disagreement with their thought process.

What aspect of orthopedic sports surgery are you most interested in?

I am very interested in joint instability: kneecap and knee dislocations, shoulder dislocations, and elbow laxity. I have a particular interest in patellofemoral (kneecap) instability, and have been collaborating with multiple other centers around the country to study this problem and the best ways to treat it. The patellofemoral joint is very complex, and it historically has proven elusive with respect to strategies for managing the problems that arise. Our treatment options are changing as our surgical techniques and understanding of the anatomy improve, and this area of orthopaedic surgery is ripe for study as a result.

What are your goals and aspirations for the sports service at OHSU?

I hope that we can collaborate closely with our primary care sports partners to provide excellent team coverage and patient care for all types of patients, from the very young athletes who are testing their limits to the older athletes who are maintaining their fitness while preserving their joints. Our physical therapists do a wonderful job rehabilitating patients after surgeries and injuries, and I would like to collaborate with them to better understand the timing and safety of return to sport.

What is your favorite thing about Portland?

Portland is heaven! It is difficult to name one favorite factor. The farmer's markets in the spring and summer are full of delicious items. Berry picking on Sauvie Island is idyllic. I'm a big fan of the extensive parks and trail systems (including the Gorge!), for hiking and trail running with my faithful pup. The mountains and coast are equally close, and I try to take time to enjoy them both, depending on the weather. When I'm staying in town, the food is definitely a draw, too. I'm delighted to call myself a Portlander!

New Faculty Spotlight:

A Q&A session with Omar Nazir, MD, orthopaedic hand and upper extremity surgeon at OHSU

By: Karlee Lau, MD

How have the first six months of your practice gone?

These past few months have represented one of the most unique periods of my life. I have felt a sense of accomplishment after completing my training, trepidation and anxiety before taking my first weekend of call, and satisfaction in seeing my patients get better. I am thankful to have such great partners in the Department of Orthopaedics and Rehabilitation at OHSU. There has been no shortage of offers to help or give advice, both of which have made the transition much easier. Lastly, I feel very lucky to be surrounded by such a competent group of residents who teach me so much every day.

What made you choose to become an orthopedic hand surgeon?

One of the first things that interested me in orthopedics was the variety in both patients and procedures. In a very similar sense, this is also what attracted me to hand surgery. Although specialization can at times limit one's scope of practice, hand surgery is unique in that the scope of care continues to be vast. Arthroscopy, microsurgery, arthroplasty, bony and soft tissue procedures are all prominent parts of my practice. Finally, I enjoy the challenge that accompanies treating a diverse group of individuals, spanning all ages and backgrounds.

What have been the greatest challenges in your transition to OHSU as an attending?

The hurdles I have faced thus far have been typical of any newly minted graduate. Despite the many years of rigorous training and memorization, I quickly realized that many decisions I (and most physicians) make are not simply black or white, but as many shades of grey as there are individual patients. Additionally, because OHSU is the only academic center in the state of Oregon and represents a major referral center for the community, complex cases have been in no short supply.

What current research interest do you have?

In conjunction with the Radiation Oncology Department at OHSU, I am working on a project involving the use of radiation to prevent contracture recurrence following treatment for Dupuytren's disease. I am also interested in functional outcomes following hand surgery. With the help of my partners in the upper extremity service, we will be investigating the impact that various upper extremity procedures have in an individual's ability to resume driving.

What are your goals for the upper extremity service at OHSU?

I look forward to building upon the strong reputation for excellence in hand and upper extremity surgery already set in place by my partners Dr. Robert Orfaly and Dr. Adam Mirarchi. Educating residents is one of the most satisfying facets of my career. I look forward to contributing to the training of the next generation of orthopedic surgeons and hopefully inspiring a few to join me in hand surgery. The addition of another hand surgery fellow to our institution is another goal that I hope to achieve in the upcoming years.

What are your favorite things about Portland?

Where to begin?! First off: the restaurants. A three star meal in Portland is a five star meal in most other cities. I have slowly been eating my way through the city, making a point to try a different restaurant whenever possible. As a Midwest transplant, I have enjoyed taking advantage of all of the unique outdoor activities of the Pacific Northwest; hiking, trail running, and skiing are a few of my favorites. Lastly, when my schedule permits, I enjoy traveling to Seattle and Vancouver B.C. to see friends.

New Faculty Spotlight:

A Q&A session with Clifford Lin, MD, orthopaedic spine surgeon at OHSU

By: Ben Winston, MD

How has the first year of your practice gone?

My first year of practice has been a thrilling and at times daunting experience. There have definitely been highlights and challenges associated with starting as an attending and building a new practice. But I'm lucky to have great colleagues that I can lean on to help me with a difficult case or for some advice. And I've had a great time meeting all the new people and it has really been a fantastic experience so far.

What have been the greatest challenges of your practice thus far?

The biggest challenge for me so far has been to adapting to all the changes at once: a new position, in a new city, new hospital, new country, and a new healthcare system! Even realizing that all the little things that I took for granted when I was training (like the kind of the sucker tips you use) has a big impact on how smoothly and efficiently a procedure goes. I am so grateful for everyone in the department, OR and clinic that has been very welcoming in my new role, supportive in my transition, and tolerant of all my questions and weird "Canadian" requests.

What has been most unexpected in your transition to OHSU?

Everybody's been so nice. Really!

What aspect of orthopedic spine surgery are you most interested in?

I am interested in both minimally invasive surgery and adult spinal deformity - or minimally invasive and maximally invasive surgery, if you will. The interesting part for me is applying minimally invasive techniques to deformity to try to reduce the morbidity and complications that can come with a large deformity surgery.

What are your goals and aspirations for the spine service at OHSU?

I hope to give our department an increased profile in minimally invasive surgery. It's something patients ask about, and in the right context can result in less pain and faster recovery. Academically, I hope to continue to build on the reputation that the spine program has developed, contributing to both research and teaching of residents and fellows. I came from a fellowship that was a combined orthopaedics/neurosurgery program and I definitely see the value in that kind of structure. It's my hope that we can head in that direction at OHSU.

What is your favorite thing (or least favorite thing) about Portland?

Favorite thing: hands down it is the food. My wife is a foodie and so I tag along. We already have a long list of places we want to go and each week we keep hearing of new places to try. Best places so far: Ataula for their tapas, Wei Wei for Taiwanese comfort food, Pok Pok for Thai, HK Café for dim sum, Hot Lips for pizza, Whiskey Library for their library of whiskey, Departure for the rooftop patio...I could go on and on. My least favorite thing about Portland is that everything is in Fahrenheit. I just don't get it.

Survivorship and risk factors for failure of endoprosthetic reconstruction using compressive osseointegration fixation. Kagan R; Adams J; Schulman C; Laursen R; Espana K; Doung Y-C; Hayden J. *J Clin Orthop Relat Res* 2016 (in press).

BACKGROUND

The Compress® uses compressive osseointegration as an alternative to traditional intramedullary fixation. 5, 2-9 and 10 year survivorship and modes of failure have been reported but due to relatively small numbers these studies were limited to identify risk factors of failure

RESEARCH QUESTIONS

1) What is the rate of aseptic mechanical failure and overall failure? 2) Is there improved survivorship based on anatomic location of reconstruction? 3) Is there improved survivorship if the implant survives an initial time period? 4) What patient (age, sex, indication for use, oncologic factors) or implant factors, (antirotation pins) are associated with increased risk of failure?

METHODS

A single center, retrospective review of patients with follow up of, range 1-27 years, mean 49.6 months treated with a Compress® for endoprosthetic reconstructions of the proximal femur, distal femur and proximal tibia. From 1997-2014, 132 Compress devices (72 distal femur, 47 proximal femur and 13 proximal tibial) in 111 patients were identified. Indication for use of the Compress® were pediatric and adult patients requiring lower extremity endoprosthetic reconstruction for primary oncologic reconstruction, revision arthroplasty, prosthetic joint infection, or fracture non-union/mal-union. Survivorship and modes of failure were identified along with patient and implant factors.

RESULTS

6 (4.5%) aseptic mechanical failures of the Compress® were identified. A total of 27 (20.5%) revisions for any reason were identified. 17 revisions were done for infection, 2 periprosthetic fractures above or around an anchor plug were identified, 1 revision for progression of oncologic disease, and 1 removal for a dis-vascular leg. Reconstructions of the distal femur and proximal tibia had an increased risk of aseptic mechanical failure compared to the proximal femur, $p<0.03$. Mean time for failure of aseptic mechanical failure and overall failure was 10.6 months (std. 15.5), and 14.47 months (std. 15.8). 4/6 (66.7%) of aseptic mechanical failures occurred within 1 year, 5/6 (83.3%) within 2 years and 1 late failure at 50 months post op were identified. Age <54 years old was associated with increased risk of overall failure, $p < 0.05$. Radiation was associated with increased risk of overall failure, $p < 0.05$. Age and radiation were not associated with increased risk of aseptic failure. Sex, chemotherapy, surgical indication and the use of antirotation pins were not associated with increased risk of aseptic or overall failure.

CONCLUSION

Overall and aseptic mechanical survivorship was similar to other studies. We identified an increased risk of aseptic failure for reconstructions about the knee. We identified age <54 years and radiation as risk factors for overall failure. This study and others further question the clinical significance for the use of antirotation pins. Our results add to the literature suggesting an increased risk of early failure of this implant.

Emergency department on-call status for pediatric orthopaedics: a survey of the POSNA membership. Smith BG; Kanel JS; Halsey MF; Thometz JG; Rosenfeld SR; Epps HR; McCarthy J. *J Pediatr Orthop* 2015 Mar;35(2):199-202.

BACKGROUND

The emergency room on-call status of pediatric orthopaedic surgeons is an important factor affecting their practices and lifestyles and was last evaluated in 2006.

METHODS

The entire membership of the Pediatric Orthopaedic Society of North America (POSNA) was surveyed in 2010 for information regarding their emergency room on-call status with 382 surveys returned of over 1000 e-mailed to members of POSNA. Detailed information about on-call coverage, support, and frequency was obtained in answers to 14 different questions.

RESULTS

Compared with the prior survey in 2006, the 2010 survey indicated that a higher percentage of pediatric orthopaedic surgeons receive compensation for taking emergency room call; a higher percentage cover pediatric patients only when on-call; and accessibility to operating rooms in a timely manner for trauma cases, although limited, has improved for pediatric patients. Utilization of support staff to meet on-call trauma coverage demands, such as residents, physician's assistants, and nurse practitioners, is becoming more common.

CONCLUSIONS

Concentration of pediatric orthopaedic trauma has increased the coverage demands on pediatric orthopaedists. This has resulted in a change in reimbursement strategies, and allocation of OR time and hospital staffing resources.

Intrathoracic glenohumeral dislocation without fracture of the humerus: a case report and review of the literature. Lin C; Mollon B; Scott C; Brady P; Axelrod TS; Jenkinson RJ. *J Bone Joint Surg* 2016;6(1):1-6.

CASE

A fifty-three-year-old man presented with an intrathoracic glenohumeral dislocation (ITGHD) and associated hemothorax, rib fracture, massive rotator cuff tear, and axillary nerve palsy following an ice hockey injury. Treatment consisted of closed reduction and staged open rotator cuff repair. Despite a substantial injury, the patient recovered nearly normal use of the arm two years postoperatively.

CONCLUSION

ITGHD is an extremely rare entity. This injury should be managed by a multidisciplinary team with anticipation of associated thoracic and vascular injuries. In cases with repairable pathology (e.g., an acute rotator cuff tear), good functional outcomes can be obtained.

Patient satisfaction surveys: an evaluation of POSNA members' knowledge and experience. Halsey MF; Albanese SA; Thacker M. Project of the POSNA Practice Management Committee. *J Pediatr Orthop* 2015 Jan;35(1):104-7.

BACKGROUND

Patient satisfaction surveys (PSS) were originally designed to identify areas in need of improvement in patient interactions for individuals, practices, and institutions. As a result of the Affordable Care Act, the Centers for Medicare and Medicaid Services incorporated PSS into a formula designed to determine the quality of medical care delivered to hospital inpatients; the resultant score and rank will determine subsequent hospital payments. This survey was developed to evaluate POSNA members' knowledge of and experience with PSS.

METHODS

The POSNA Practice Management Committee developed a 14-question survey that was sent to all active and candidate members (850). A total of 229 members responded; and results were tabulated by answer and simple percentages were calculated for each question. Comments were reviewed and grouped by similarity to identify frequency.

RESULTS

A total of 82% of respondents were aware of PSS with 67% stating they were utilized in their setting. Utilization of PSS rarely alters clinical decision making. However, PSS do affect decisions regarding the patient experience; and 45% of respondents believe that PSS have utility with respect to business decisions. Fifty-nine percent of respondents feel that scores can be predictably improved. Less than half the respondents stated that they had a good or excellent understanding of PSS and only 48% believe that PSS are a valid measure of health care quality.

CONCLUSIONS

POSNA members' knowledge of and experience with PSS are not universal or uniform. Although most agree that patient satisfaction does not drive clinical decision making, it does appear to impact business and clinic-flow decisions with the idea that it can be predictably improved. Despite this, members' self-assessed that knowledge is average and it is not clear to the members that patient satisfaction reflects medical quality. On the basis of these findings and as the impacts of PSS become more prominent, efforts to educate the members of POSNA about PSS should be enhanced. Furthermore, research to identify and develop best practices that enhance patient satisfaction and well-being while minimizing costs should be supported.

A prospective study of back pain and risk of falls among older community-dwelling women. Marshall LM; Litwack-Harrison S; Cawthon PM; Kado DM; Deyo RA; Makris UE; Carlson HL; Nevitt MC; for the Study of Osteoporotic Fractures (SOF) Research Group. *J Gerontol A Biol Sci Med Sci* 2016 (in press).

BACKGROUND

Back pain and falls are common health conditions among older U.S. women. The extent to which back pain is an independent risk factor for falls has not been established.

METHODS

We conducted a prospective study among 6,841 community-dwelling U.S. women at least 65 years of age from the Study of Osteoporotic Fractures (SOF). Baseline questionnaires inquired about any back pain, pain severity, and frequency in the past year. During 1 year of follow-up, falls were summed from self-reports obtained every 4 months. Two outcomes were studied: recurrent falls (≥2 falls) and any fall (≥1 fall). Associations of back pain and each fall outcome were estimated with risk ratios (RRs) and 95% confidence intervals (CIs) from multivariable log-binomial regression. Adjustments were made for age, education, smoking status, fainting history, hip pain, stroke history, vertebral fracture, and Geriatric Depression Scale.

RESULTS

Most (61%) women reported any back pain. During follow-up, 10% had recurrent falls and 26% fell at least once. Any back pain relative to no back pain was associated with a 50% increased risk of recurrent falls (multivariable RR = 1.5, 95% CI: 1.3, 1.8). Multivariable RRs for recurrent falls were significantly elevated for all back pain symptoms, ranging from 1.4 (95% CI: 1.1, 1.8) for mild back pain to 1.8 (95% CI: 1.4, 2.3) for activity-limiting back pain. RRs of any fall were also significantly increased albeit smaller than those for recurrent falls.

CONCLUSIONS

Older community-dwelling women with a recent history of back pain are at increased risk for falls.

Hidden blood loss in anterior lumbar interbody fusion (ALIF) surgery. Ju H; Hart R. *Orthopaedics & Traumatology: Surgery & Research* 2016;102:67-70.

BACKGROUND

A retrospective study was performed to determine the factors affecting the total perioperative blood loss during anterior lumbar interbody fusion (ALIF). Measurements of intraoperative blood loss underestimate the true blood loss during surgery. Our research project was to examine the hidden blood loss in lumbar spine surgery. Hidden blood loss in elective knee and hip replacement surgeries range between 100% and 30%. Hidden blood loss was about 40% in posterior spine surgery.

METHODS

The factors analyzed included gender, body mass index (BMI), duration of surgery, type of surgery, aspiration, and number of fusion levels. Estimated blood loss (EBL) was obtained from the clinical records of patients as the blood collected from suctioning and the cumulative weight of the saturated sponges. Actual blood loss (ABL) was calculated from the estimated blood volume and hemoglobin level of patients. Hidden blood loss was calculated as the difference between ABL and EBL.

RESULTS

Seventy-eight consecutive patients who underwent ALIF were reviewed. The average values(mean ± SD) for EBL and ABL were 700.1 ± 562.3 mL and 1150.6 ± 770.0 mL, respectively ($P = 0.001$, Stu-dent's t-test). The hidden blood loss averaged 39.2% of the ABL. According to linear regression analysis, surgical duration, type of surgery, and the inclusion of the L4/5 level were independent factors contributing to the ABL ($P < 0.05$), whereas BMI and gender did not correlate with ABL or EBL.

CONCLUSIONS

ALIF is associated with substantial perioperative hidden blood loss. Length of surgery, type of surgery, and the inclusion of L4/5 in the procedure are significant risk factors for increased blood loss.

Hospital charges associated with "never events": comparison of anterior cervical discectomy and fusion, posterior lumbar interbody fusion, and lumbar laminectomy to total joint arthroplasty. Daniels AD; Kawaguchi S; Contag AG; Rastegar F; Waagmeester G; Anderson PA; Arthur M; Hart RA. *J Neurosurg Spine* 2016;Mar 18:1-5 [Epub ahead of print].

The Centers for Medicare and Medicaid Service (CMS) insists that the costs of managing "never events" like Surgical Site Infection (SSI), Deep Vein Thrombosis (DVT), or Pulmonary Embolus (PE) be borne by hospitals and health care providers, rather than billings to health care payers for additional care required in their management. Data comparing the expected costs of such adverse events in spine and orthopaedic surgery patients have not previously been reported. The California State Inpatient Database from 2008-2009 was utilized for the analysis. All patients with primary procedure codes indicating anterior cervical discectomy and fusion (ACDF), posterior lumbar interbody fusion (PIF), lumbar laminectomy (LL), total knee replacement (TKR) and total hip replacement (THR) were analyzed. Patients with diagnostic or treatment codes for DVT, PE and SSI were selected. Patients with more than one primary procedure code or more than one complication code were excluded. Median charges for treatment from primary surgery through three months post-operatively were calculated. Median inpatient charges for uncomplicated LL was $51,817, compared to $73,432 for ACDF, $143,601 for PIF, $74,459 for THR, and $70,116 for TKR. Charges for patients with DVT ranged from $108,387 (1.5xIndex, TKR) to $313,536 (4.3xIndex, ACDF). Charges for patients with PE ranged from $127,958 (1.8xIndex, TKR) to $284,121 (1.7xIndex, PIF). Charges for patients with SSI ranged from $168,964 (2.4xIndex, TKR) to $385,753 (2.7xIndex, PIF). Adverse events of spinal procedures increase the cost of care substantially. Charges for patients experiencing DVT, PE and SSI in this study ranged from 1.8 to 4.3 times higher than for patients without such complications across five common orthopaedic procedures. Cost projections by health care providers will need to incorporate expected costs of added care for patients experiencing such complications, assuming that the cost burden of such events continues to shift from payers to providers.

Stiffness after pan-lumbar arthrodesis for adult spinal deformity does not significantly impact patient functional status or satisfaction irrespective of proximal endpoint. Hart RA; Hiratzka J; Kane MS; Lafage V; Klineberg E; Ames CP; Line BG; Schwab F; Scheer JK; Bess S; Hamilton DK; Shaffrey CI; Mundis G; Smith JS; Burton DC; Sciubba DM; Deviren V; Boachie-Adjei O; and the International Spine Study Group. *Spine* (in press).

STUDY DESIGN

Prospective, multi-center

OBJECTIVE

To determine if stiffness significantly affects function or satisfaction after pan-lumbar arthrodesis.

SUMMARY OF BACKGROUND DATA

The Lumbar Stiffness Disability Index (LSDI) is a validated measure of the effect of lumbar stiffness on functional activities. Data suggests that patients undergoing fusion of the entire lumbar spine are at greatest risk of functional limitations from stiffness.

METHODS

The LSDI, Short Form 36 (SF-36), Scoliosis Research Society-22 (SRS-22), and Oswestry Disability Index (ODI) were administered pre-operatively and at 2-year minimum follow-up to 103 spinal deformity patients from 11 centers. Patients were separated according to the proximal arthrodesis level; upper thoracic (T2-5) to pelvis (UT-Pelvis) or thoraco-lumbar (T10-T12) to pelvis (TL-Pelvis). Outcome scores were compared using Student's t-test or Tukey-Kramer HSD ANOVA. Regression analysis of final LSDI scores versus SRS-22 Satisfaction scores was performed.

RESULTS

Mean ages, baseline values and final scores of all outcome parameters were statistically equivalent in the 2 groups. Final LSDI scores did not change significantly from baseline in the UT-Pelvis ($p=0.478$) or TL-Pelvis ($p=0.301$) groups. In contrast, highly significant improvements ($p<0.0001$) from baseline were seen in both groups for other health-related QoL measures. The 2-year Satisfaction scores were statistically equivalent in the 2 groups, and the correlation between final LSDI and Satisfaction scores in the entire cohort was not significant ($R2 = 0.013$, $p=0.146$).

CONCLUSIONS

Patients undergoing pan-lumbar arthrodesis for adult spinal deformity did not experience substantial increases in disability due to stiffness of the low back, although they did report significant improvements in other health-related QoL measures. Further, LSDI scores did not correlate with patient satisfaction. There were no significant differences in perceived stiffness effects whether arthrodesis stopped in the thoracolumbar or upper thoracic regions. We hope these results will be useful to spine surgeons and patients during pre-operative planning and discussions.

Presented at the International Society for the Study of the Lumbar Spine annual meeting, 2016

Functional limitations due to lumbar stiffness in adults with and without spinal deformity. Daniels AH; Smith JS; Hiratzka J; Ames CP; Bess S; Shaffrey CI; Schwab FJ; Lafage V; Klineberg EO; Burton D; Mundis GM; Line B; Hart RA; and the International Spine Study Group. *Spine* 2015;40(20):1599-1604.

STUDY DESIGN

Cross-sectional analysis.

OBJECTIVE

To compare Lumbar Stiffness Disability Index (LSDI) scores between asymptomatic adults and patients with spinal deformity.

SUMARY OF BACKGROUND DATA

The LSDI was designed and validated as a tool to assess functional impacts of lumbar spine stiffness and diminished spinal flexibility. Baseline disability levels of patients with adult spinal deformity (ASD) are high as measured by multiple validated outcome tools. Baseline lumbar stiffness-related disability has not been assessed in adults with and without spinal deformity.

METHODS

The LSDI and Scoliosis Research Society-22r (SRS-22r) were submitted to a group of asymptomatic adult volunteers. Additionally, a multicenter cross-sectional cohort analysis of patients with ASD from 10 centers was conducted. Baseline LSDI andSRS-22r were completed for both operatively and nonoperatively treated patients with deformity.

RESULTS

The LSDI was completed by 176 asymptomatic volunteers and 693 patients with ASD. Mean LSDI score for asymptomatic volunteers was 3.4 + / − 6.3 out of a maximum score of 100, with significant correlation between increasing age and higher (worse) LSDI score ($r = 0.30$, $P = 0.0001$). Of the patients with spinal deformity undergoing analysis, 301 subsequently underwent surgery and 392 were subsequently treated nonoperatively. Operative patients had significantly higher preoperative LSDI scores than both nonoperative patients and asymptomatic volunteers (29.9 vs. 17.3vs. 3.4, $P < 0.0001$ for both). For patients with ASD, significant correlations were found between LSDI and SRS-22 Pain and Function subscales ($r = -0.75$ and -0.76, respectively; $P < 0.0001$ for both).

CONCLUSION

LSDI scores are low among asymptomatic volunteers, although stiffness-related disability increases with increasing age. Patients with ASD report substantial stiffness-related disability even prior to surgical fusion. Stiffness-related disability correlates with pain- and function-related disability measures among patients with spinal deformity.

Adverse event recording and reporting in clinical trials comparing lumbar disk replacement with lumbar fusion: a systematic review. Hiratzka J; Rastegar F; Contag AG; Norvell DC; Anderson PA; Hart RA. *Global Spine J* 2015;5:486-95.

OBJECTIVES

(1) To compare the quality of adverse event (AE) methodology and reporting among randomized trials comparing lumbar fusion with lumbar total disk replacement (TDR) using established AE reporting systems; (2) to compare the AEs and reoperations of lumbar spinal fusion with those from lumbar TDR; and (3) to make recommendations on how to report AEs in randomized controlled trials (RCTs) so that surgeons and patients have more-detailed and comprehensive information when making treatment decisions.

METHODS

A systematic search of PubMed, the Cochrane collaboration database, and the National Guideline Clearinghouse through May 2015 was conducted. Randomized controlled trials with at least 2 years of follow-up comparing lumbar artificial disk replacement with lumbar fusion were included. Patients were required to have axial or mechanical low back pain of 3 months' duration due to degenerative joint disease defined as degenerative disk disease, facet joint disease, or spondylosis. Outcomes included the quality of AE acquisition methodology and results reporting, and AEs were defined as those secondary to the procedure and reoperations. Individual and pooled relative risks and their 95% confidence intervals comparing lumbar TDR with fusion were calculated.

RESULTS

RCTs demonstrated a generally poor description of methods for assessing AEs. There was a consistent lack of clear definition or grading for these events. Furthermore, there was a high degree of variation in reporting of surgery-related AEs. Most studies lacked adequate reporting of the timing of AEs, and there were no clear distinctions between acute or chronic AEs. Meta-analysis of the pooled data demonstrated a twofold increased risk of AEs in patients having lumbar fusion compared with patients having lumbar TDR at 2-year follow-up, and this relative risk was maintained at 5 years. Furthermore, the pooled data demonstrated a 1.7 times greater relative risk of reoperation in the fusion group compared with lumbar TDR, although this risk decreased to 1.1 at 5-year follow-up. However, given the lack of quality and consistency in the methods of recording and reporting of AEs, we are unable to make a clear recommendation of one treatment over the other.

CONCLUSIONS

Based on the currently available literature, lumbar TDR appears to be comparable in safety to lumbar fusion. However, due to lack of consistency in reporting of AEs, it is difficult to make conclusions regarding the true safety profile of lumbar TDR. Standardization in AE reporting will significantly improve the reliability of the current literature.

Preoperative epidural spinal injections increase the risk of surgical wound complications but do not affect overall complication risk or patient-perceived outcomes. Zusman N; Munch JL; Ching A: Hart R; Yoo J. *J Neurosurg Spine* 2015;23:652–5.

OBJECT

A lack of information exists on the relationship between preoperative epidural spinal injections and outcomes after spine surgery. There is concern that injections might cause local changes, increasing the infection risk and surgical difficulty. Therefore, the authors explored the relationship between preoperative spinal injections and postoperative outcome.

METHODS

The cohort was comprised of patients who underwent thoracic and/or lumbar arthrodesis during the years 2007–2010 and had complete (preoperatively and 3 months postoperatively) outcome scores. Patients' clinical courses were reviewed to determine the occurrence of major complications within a 30-day postoperative period. Patient perceived outcomes were evaluated using the Oswestry Disability Index (ODI) and the SF-12 (12-Item Short Form Health Survey): mental component summary (MCS) and physical component summary (PCS) scores. Analyses were based on exposure to injections and were performed using chi-square exact tests and paired and unpaired t-tests.

RESULTS

Two hundred eighty patients met the inclusion criteria: 117 patients (41.8%) received and 163 patients (58.2%) did not receive preoperative epidural spinal injections. Overall, the likelihood of complication did not differ with respect to exposure (13.7% injection vs 11.7% noninjection); however, injected patients observed a 7.4-fold risk of developing surgical wound complications over noninjected patients (5.1% vs 0.6%, p = 0.02). Patient-perceived outcomes measures demonstrated no differences between groups. Three months postoperatively, the MCS and ODI scores were similar (MCS: 49.6 ± 11.6 injection vs 47.4 ± 12.8 noninjection; ODI: 35.8 ± 18.0 vs 34.4 ± 19.1). MCS or ODI score improvement (preoperatively compared with 3 months postoperatively) did not vary between groups. Injected patients maintained a 2-point lower PCS score at entry and 3 months postoperatively as compared with noninjected peers (entry: 27.6 ± 8.2 injection vs 29.5 ± 9.3 noninjection, p = 0.09; 3 months: 33.3 ± 8.6 vs 35.7 ± 9.0, p =0.03); the PCS score improvements between injected and noninjected groups were similar (5.7 ± 9.9 vs 6.2 ± 9.7).

CONCLUSIONS

Patients exposed to preoperative epidural injections had similar complication rates to those who never received a spinal injection. However, they had a greater risk of developing wound complications. These complications had no effect on short-term improvements in outcome measures.

A scoring system to predict postoperative medical complications in high risk patients undergoing elective thoracic and lumbar arthrodesis. Munch JL; Zusman NL; Lieberman EG;. Stucke RS; Bell C; Philipp TC; Smith S; Ching AC; Hart RA; Yoo JU. *The Spine Journal* (in press).

BACKGROUND CONTEXT

Various surgical factors affect the incidence of postoperative medical complications following elective spinal arthrodesis. Because of the inter-relatedness of these factors, it is difficult for clinicians to accurately risk-stratify individual patients.

PURPOSE

Our goal was to develop a scoring system that predicts the rate of major medical complications in patients with significant preoperative medical comorbidities, as a function of the four perioperative parameters that are most closely associated with the invasiveness of the surgical intervention.

STUDY DESIGN/SETTING

This study used level 2, Prognostic Retrospective Study.

PATIENT SAMPLE

The patient sample consisted of 281 patients with American Society of Anesthesiologists (ASA) scores of 3–4 who underwent elective thoracic, lumbar, or thoracolumbar fusion surgeries from 2007 to 2011.

OUTCOME MEASURES

Physiologic risk factors, number of levels fused, complications, operative time, intraoperative fluids, and estimate blood loss were the outcome measures of this study.

METHODS

Risk factors were recorded, and patients who suffered major medical complications within the 30-day postoperative period were identified. We used chi-square tests to identify factors that affect the medical complication rate. These factors were ranked and scored by quartiles. The quartile scores were combined to form a single composite score. We determined the major medical complication rate for each composite score, and divided the cohort into quartiles again based on score. A Pearson linear regression analysis was used to compare the incidence of complications to the score.

RESULTS

The number of fused levels, operative time, volume of intraoperative fluids, and estimated blood loss influenced the complication rate of patients with ASA scores of 3–4. The quartile ranking of each of the four predictive factors was added, and the sum became the composite score. This score predicted the complication rate in a linear fashion ranging from 7.6% for the lowest risk group to 34.7% for the highest group ($r=0.998$, $p<.001$).

The clinical correlation of the Hart-ISSG Proximal Junctional Kyphosis Severity Scale with health-related quality-of-life outcomes and need for revision surgery. Lau D; Funao H; Clark AJ; Nicholls F; Smith J; Bess S; Shaffrey C; Schwab FJ; Lafage V; Deviren V; Hart R; Kebaish KM; Ames CP; and the International Spine Study Group. *Spine* 2016;41(3):213-23.

STUDY DESIGN
Retrospective analysis of prospective data.

OBJECTIVE
Evaluate the utility of the Hart-International Spine Study Group proximal junctional kyphosis severity scale (Hart-ISSG PJKSS).

SUMMARY OF BACKGROUND DATA
Proximal junctional kyphosis (PJK) and failure (PJF) are well-described complications after long-segment instrumentation. The Hart-ISSG PJKSS was recently developed and incorporates neurological deficit, pain, instrumentation issues, degree of kyphosis, presence of fracture, and level of upper-most instrumented vertebrae.

METHODS
All adult spinal deformity patients with PJK or PJF were identified from two academic centers over a 7-year period. Health-related quality-of-life (HRQOL) outcomes were prospectively collected: Oswestry Disability Index (ODI), visual analogue scale (VAS) pain, SF-36 questionnaire, and SRS-30 questionnaire. Patients were retrospectively assigned Hart-ISSG PJKSS scores. Correlation between the Hart-ISSG PJKSS and outcomes was assessed with linear regression, Pearson correlation coefficients, and χ analysis.

RESULTS
A total of 184 cases were included; 21.2% were men and mean age was 65.0 years. Weakness and/or myelopathy were present in 11.4% of patients and 88.6% had pain. Instrumentation issues occurred in 44.0% and 64.1% had PJK-associated fractures. PJK occurred in the upper thoracic spine in 21.7% of cases. Mean PJKSS score was 5.9. The Hart-ISSG PJKSS was significantly and strongly associated with ODI ($P<0.001$, $r=0.611$), VAS pain ($P<0.001$, $r=0.676$), SRS-30 function ($P<0.001$, $r=-0.401$), SRS-30 mental health ($P<0.001$, $r=-0.592$), SRS-30 self-image ($P<0.001$, $r=-0.511$), SRS-30 satisfaction ($P<0.001$, $r=-0.531$), and SRS-30 pain ($P<0.001$, $r=-0.445$). Higher scores were associated with higher proportion of patients undergoing revision surgery ($P<0.001$); scores of 9 to 11 and 12 to 15 underwent revision 96.0% and 100.0% of the time, respectively.

CONCLUSION
The Hart-ISSG PJKSS was strongly correlated with validated functional outcomes and higher scores were associated with higher rates of revision surgery. The Hart-ISSG PJKSS may be a useful clinical tool in the treatment of patient with PJK.

Risk factors for fracture among current, persistent users of bisphosphonates. LeBlanc ES; Rosales AG; Balasubramanian A; O'Malley CD; Egbuna O; Friess D; Perrin NA. *Osteoporos Int* 2015 Feb;26(2):713-25.

SUMMARY

Bisphosphonate therapy reduces fracture risk but does not eliminate fracture occurrence. We determined the fracture incidence and risk factors for fractures among 14,674 bisphosphonate users in a community setting. Bisphosphonate users remained at risk of fracture, and additional measures to prevent fractures in these patients would be beneficial.

INTRODUCTION

Bisphosphonate therapy reduces but does not eliminate fracture occurrence. The incidence of fracture and risk factors for fractures among persistent, current users of bisphosphonates in a community setting has not been well studied.

METHODS

We conducted a retrospective cohort study of 14,674 bisphosphonate users in a health maintenance organization. Patients were followed until a 3-month gap in therapy, creating a pool of highly compliant [mean medication possession ratio (MPR) of 94%] current users. We used Cox proportional hazards models to identify risk factors for fractures among these persistent, current users.

RESULTS

There were 867 fractures over the period of observation or 3.7 fractures per 100 users per year. Older patients who take multiple medications, have lower bone mineral density, have a history of prior fracture, and suffer from particular comorbidities (i.e., dementia, chronic kidney disease, and rheumatoid arthritis) are at higher risk of fracture while taking bisphosphonates.

CONCLUSION

Persistent, current bisphosphonate users remain at risk of fracture, and additional measures to prevent fractures in these patients would be of benefit.

Healing time and complications in operatively treated atypical femur fractures associated with bisphosphonate use: a multicenter retrospective cohort. Bogdan Y; Tornetta P; Einhorn TA; Guy P; Leveille L; Robinson J; Bosse MJ; Haines N; Horwitz D; Jones C; Schemitsch E; Sagi C; Thomas B; Stahl D; Ricci W; Brady M; Sanders D; Kain M; Higgins TF; Collinge C; Kottmeier S; Friess D. *J Orthop Trauma* 2016 [EPub ahead of print].

OBJECTIVES
The purpose of this study is to characterize demographics, healing time and complications of a large series of operatively treated atypical femur fractures.

DESIGN
Retrospective multicenter review.

SETTING
17 academic medical centers.

PATIENTS
Bisphosphonate related fractures as defined by ASBMR. Fractures had to be followed for at least 6 months or to union or revision.

INTERVENTION
Operative treatment of bisphosphonate related fracture.

MAIN OUTCOME MEASUREMENTS
Union time and complications of treatment, as well as information about the contralateral limb.

RESULTS
There were 179 patients, average age 72, average BMI 27.2. Average followup was 17 months. Twenty-one percent had a prior history of fragility fracture; 34% had prodromal pain. Most (88%) lived independently before injury. Thirty-one percent had radiographic changes suggesting stress reaction. Surgical fixation was with cephalomedullary nail (51%), IM nail (48%) or plate (1%). Complications included death (4), PE (3), and wound infection (6). Twenty (12%) patients underwent revision at an average of 11 months. Excluding revisions, average union time was 5.2 months. For revisions, union occurred at an average of 10.2 months after intervention. No association was identified between discontinuation of bisphosphonates and union time (P =0.5) or need for revision (P =0.7). Twenty-one percent sustained contralateral femur fractures; 32% of these had pain and 59% had stress reaction prior to contralateral fracture.

CONCLUSIONS
In this series, surgery had a 12% failure rate and delayed average time to union. Twenty-one percent developed contralateral femur fractures within 2 years, underscoring the need to evaluate the contralateral extremity.

Bilateral navicular-medial cuneiform synostosis manifesting as medial foot pain: a case report and review of the literature. Malone JB; Raney EM. *J Pediatr Orthop B* 2016;25(2):138-41.

Isolated navicular-medial cuneiform tarsal coalition is a rare condition. Very few case reports exist, with limited treatment recommendations. We present a case of an 11-year-old with bilateral isolated osseous navicular-medial cuneiform tarsal coalition. The patient was treated with bilateral coalition excision and soft tissue interposition, with excellent results at 2 years of follow-up. The current case is unusual in being an osseous coalition rather than the more commonly seen cartilaginous or fibrous condition. In addition, this case is uncommon as being in a patient of European rather than Asian descent.

Use of a central splitting approach and near complete detachment for insertional calcific Achilles tendinopathy repaired with an Achilles bridging suture. Gillis CT; Lin JS. *J Foot Ankle Surg* 2016;55(2):235-9.

After 3 to 6 months of conservative management for insertional calcific Achilles tendinopathy, operative intervention might be warranted. Despite a success rate of 75% to 100% with surgery, no consensus has been reached on the amount of acceptable detachment of the Achilles tendon. The present case series reports on the results of a central splitting approach with 80% to 90% detachment of the Achilles insertion repaired with a double-row bridging suture device. A total of 14 patients (16 heels) for whom nonoperative management for insertional calcific Achilles tendinopathy had previously failed were enrolled in the present study they had undergone surgical management. The patients were followed up for a mean of 18 (range 11 to 25) months postoperatively and were evaluated using the American Orthopaedic Foot and Ankle Society Hind Foot scoring system, 36-item Short Form Health Survey questionnaire, and pre- and postoperative visual analog pain scale. The mean visual analog pain scale core had decreased 5.84 (range 1 to 9) points postoperatively ($p < .001$). The mean postoperative American Orthopaedic Foot and Ankle Society Hind Foot score was 87 ± 19.7 (range 52 to 105) points. One patient reported moderate pain with no limitation of activities. The mean 36-item Short-Form Health Survey score for physical functioning was 77.7 (range 30 to 100) points postoperatively in 11 patients. No patient reported incisional discomfort. All 14 patients (16 heels) reported being satisfied and had returned to their previous functional status. Thus, the central splitting Achilles approach with anchoring of the Achilles insertion using the double-row suture device is a safe and reasonable option in the operative treatment of insertional calcific Achilles tendinopathy.

Fracture care challenges in the austere and humanitarian environments. Gellman R. *Current Trauma Reports* 2016 (in press).

It is estimated that 80% of severe fractures occur in the developing world. Long bone fractures of the femur and tibia treated conservatively with traction and casts require prolonged hospital stays and still often leave patients with significant lifelong disability. Locked intramedullary nailing is the standard of care in the developed world for management of these fractures. Humanitarian fracture care in an austere environment often means limited or no access to implants, a reliable power supply and intraoperative radiography traditionally required for locked intramedullary nailing. Creative surgeons with extensive experience in humanitarian work are making significant contributions to improve the management of these complex fractures in the austere environment through education of local surgeons and innovations in orthopedic implants and instrumentation.

Staged total hip arthroplasty in a patient with hip dysplasia and a large pertrochanteric bone cyst treated with EquivaBone. Langston JR; DeHaan AM; Huff TW. *Arthroplasty Today* 2016; 10.1016/j.artd.2016.03.002

Hip arthroplasty in young patients requires thoughtful pre-operative planning. Patients with proximal femoral bone loss complicate this planning and may require a staged procedure to optimize implant insertion. We report on a 26-year-old woman with secondary hip arthritis from developmental dysplasia of the hip and a large pertrochanteric bone cyst that was treated with staged total hip arthroplasty. The cyst was decompressed and filled with an osteoconductive and osteoinductive bone graft substitute called Equivabone. One year later, the patient underwent a successful primary total hip arthroplasty. Fifteen-month follow-up after the hip replacement revealed resolution of postoperative pain and significant functional improvement.

Vitamin D deficiency in patients with osteoarthritis undergoing total knee arthroplasty. Natarajan V; Huff T; Yoo J; Schabel K.

Vitamin D deficiency is common among adults in the United States, and there is a high prevalence of vitamin D deficiency in patients undergoing elective total knee arthroplasty (TKA). This prospective cohort study asked if pre-operative vitamin D deficiency results in poorer functional outcome in patients with osteoarthritis undergoing total knee arthroplasty. Pre-operative 25(OH) D3 levels and basic demographic data including age, sex and BMI were collected from 60 participants undergoing TKA at our institution. The Knee Injury and Osteoarthritis Outcome Score (KOOS) instrument was used to assess functional outcomes pre-operatively and at 6-week, 6-month, and 1-year follow-up points. The Western Ontario & McMaster Universities (WOMAC) index was calculated post-hoc based on the KOOS results. There were no significant pre-operative differences between the vitamin D sufficient (VDS) and vitamin D deficient (VDD) groups in age, sex, BMI, WOMAC index or any of the 5 KOOS subscale scores ($p>0.05$ by Student t-test). At 6 weeks, the VDD group had significantly worse ($p<0.05$) scores in the KOOS Pain, Symptom, ADL, and Quality of Life subscales, as well as the WOMAC index. At 6 months, the VDD group had significantly worse ($p<0.05$) scores in the KOOS Symptom, ADL, and Quality of Life subscales and the WOMAC. At 1 year, the VDD group continued to have significantly worse ($p<0.05$) scores in the KOOS Symptom and ADL subscales and the WOMAC. There was no significant association between vitamin D deficiency and pre-operative functional scores. Post-operatively, study participants with vitamin D deficiency demonstrated significantly worse functional outcomes than those with sufficient vitamin D levels. This disparity was most notable at early follow-up, but some difference continued for one year in follow-up.

Timing of pin removal after supracondylar humerus fracture reduction: a systematic review of the literature. Halsey MF; Halsey CMR; Yoo B; Friess D.

Currently, no consensus exists with respect to timing of pin removal (PR) for the treatment of pediatric supracondylar humerus (SCH) fractures. Therefore, this study sought to define practice patterns and outcomes related to PR by a systemic review of existing literature. A PubMed query for "supracondylar humerus fracture" was performed. Papers published from Jun 2008-Jan 2015 were included if there was any mention of the timing of PR. A total of 55 studies met the inclusion criteria encompassing 7,714 patients with an average age of 6.1 years. The timing of PR ranged from 14 days to 61 days (median 24.5 days, average 27 days). The studies were split into two groups based on timing of PR. 4,112 patients were placed in the short-timing (ST) group (mean time to PR ≤24.5 days); 3,616 patients were placed in the long-timing (LT) group (mean time to PR >24.5 days). Type III fractures comprised 80% and 58% of the fractures in the ST and LT groups respectively. Flynn criteria were excellent/good in 94.3% of patients in the ST group (13 of 25 studies; 826 patients) and in 91.3% of patients in the LT group (15 of 29 studies; 1,287 patients). Complications were identified in 7.3% of the ST group and 8.0% of the LT group. Heretofore no study has looked specifically at the impact of the timing of PR in the treatment of pediatric SCH fractures. Surprisingly, there is quite a large range of values associated with the timing of PR. A shorter period of time pinned did not appear to increase complications or decrease the success rate of the surgery despite having a higher percentage of type III fractures. It is hoped that this study will prompt a closer look at identifying the most appropriate time to remove the pins after surgical treatment of pediatric SCH fracture.

Lumbar MRI findings in patients with and without Waddell Signs. Cox JS; Yoo JU; Blizzard S; Hiratzka J; Carlson H.

We compared lumbar MRI findings between the patients with and without Waddell's Signs (WS). Physicians in our spine center were trained with a standard method to assess and document WS in all new low back patients. Thirty of these patients with an ODI score >50 and between the ages of 35-55 were randomly selected using block randomization technique to select even distribution of the patients based on number of WS. MRIs were reviewed by three spine specialists who were blinded to clinical exam findings, number of WS, and patient identity. The reviewers assessed the type and severity of the pathology and the presence of surgical as well as non-surgical lesions. Additionally, all the MRIs were rank-ordered based on overall impression of the pathology found on MRI. There were significantly more individual pathologic findings in those without WS (p=0.02). However, there was no difference in the severity of pathology based on WS (p=0.46). The rank ordering based on overall impression of severity showed no difference between the patients with and without WS (p=0.20). Although 100% of the patients without WS showed pathologic findings on MRI, 70% of WS patients also had significant pathology on MRI. The prevalence of spondylolisthesis, stenosis, and disc herniation was similar (p=0.41, p=0.22, and p=0.43, respectively). The prevalence and mean number of lesion amenable to surgery did not differ based on presence of WS (p=0.21 and p=0.18, respectively). The patients with WS present a difficult diagnostic challenge for the physician as their organic symptoms are often co-existent with emotional fear avoidance behavior. While there is more overall pathology in those without the signs, a significant number of these patients appear to have comparable spinal pathology with equivalent severity, which may be either causal or at least contributing to patients' symptoms and disability. Presence of these non-organic symptoms often makes us doubt these patients. However, as part of effective treatment, physicians should better understand both physical and psychological components of patient disability.

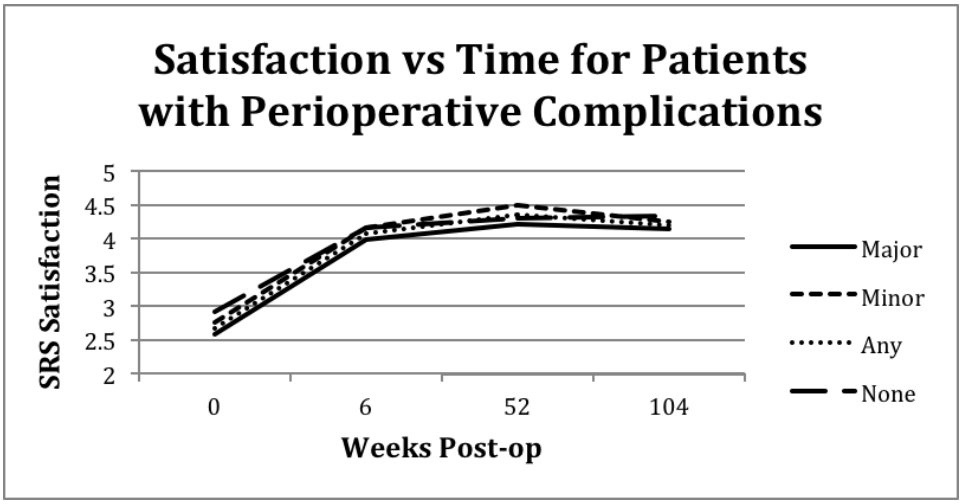
Presented at the American Orthopaedic Association annual meeting, 2016

Disparities in orthopaedic care: race and gender influence management of humerus shaft fractures. Opel D; Rapone B; Krishnamoorthy B; Yoo J; Meeker J.

Racial, gender, and insurance disparities are shown to exist in the delivery of healthcare. The primary purpose of this study is to assess the effect of these factors on the management of humerus shaft fractures (HSF). We reviewed data from U.S. trauma centers as reported to the National Trauma Data Bank (years 2007-2012). We assessed the bivariate relationship of several potential confounding variables with the outcome of surgical management of HSF, followed by a multivariate analysis. The study included 19,818 patients with HSF. In bivariate analysis, compared to white males, black males had reduced odds of surgical management of HSF (OR 0.73, 95% CI 0.66-0.81, p<0.001), as did white females (OR 0.85, 95% CI 0.80-0.91, p<0.001). A gender disparity did not exist amongst blacks. Insurance status did not significantly influence surgery. We conclude that race and gender influence the odds of having surgery for HSF whereas insurance status does not.

Perioperative complications do not affect patient satisfaction following adult spinal deformity surgery. Rastegar F; Hamilton KD; Hiratzka JR; Hiratzka S; Ames C; Smith JS; Shaffrey C; Akbarnia BA; Boachie-Adjei O; Bess S; Scheer J; Daniels A; Lafage V; Schwab F; Hart R.

Patient satisfaction after adult spinal deformity surgery remains incompletely assessed compared to radiographic and clinical outcomes. The goal of this study was to evaluate the change in patient satisfaction after adult thoracolumbar deformity surgery in patients experiencing perioperative complications. A prospective multicenter cohort of 256 patients undergoing thoracolumbar fusion for adult spinal deformity was analyzed retrospectively at minimum 2-year follow-up. Complications were defined as no, minor, major, or any (major + minor). Clinical satisfaction was assessed using Scoliosis Research Society-22- (SRS-22) satisfaction scores, which allows a comparison to satisfaction with pre-operative treatment. Comparisons in satisfaction were made at 6 weeks, 1 year, and 2 year follow up for patients experiencing no, minor, or major, or any complications. 112 (44%) patients experienced a complication (58 major and 54 minor) within the first 6 weeks after surgery. For patients with no, minor, major, or any complications, there was significant improvement in SRS-satisfaction compared to baseline at 6 weeks, 1 year and 2 years ($p<0.0001$ for all groups). There was no significant change in patient satisfaction from 6 weeks to 2 years for any group ($p=0.337$ any complication, $p=0.306$ major, $p=0.741$ minor). There was no difference in satisfaction between patients with no, minor, major, or any complication at any post-operative time point (Figure 1). Patients undergoing thoracolumbar fusion for adult deformity expressed increased satisfaction with treatment over pre-operative state by 6 weeks post-operatively, and maintained similar levels of satisfaction out to 2 years post-operatively. Perioperative complications do not seem to have a substantial effect on overall patient satisfaction. Determinants of patient satisfaction may be related to other factors, such as pre-operative expectations, inpatient experience and relationship with the surgeon.



Presented at the American Orthopaedic Association annual meeting, 2015

Low fusion grade does not impact two-year health related quality of life unless rod fracture occurs for adult spinal deformity. Rastegar F; Ailon T; Hamilton KD; Hart RA; Klineberg EO; Lafage V; Bess S; Burton DC; Gupta MC; Daniels AH; Smith JS; Shaffrey CI.

Pseudarthrosis after adult spinal deformity (ASD) surgery may result in instrumentation failure and need for revision. However, the correlation between fusion grade with or without rod fractures and HRQoL is not known. We assessed the association between HRQoL, fusion grade, and rod fracture with and without revision surgery. A prospective, multi-center ASD database with 2 year followup data was reviewed. Fusion grade was determined on plain films using published criteria; Grade III or IV at one or more segments was considered failure of fusion. HRQoL measures included ODI, SF-36 PCS and MCS, and SRS-22r Total. Radiographs from 205 patients with posterior or combined anterior/posterior thoracolumbar fusion were assessed. Radiographic evidence of solid fusion was achieved in 73% of patients. HRQoL were similar between those that achieved versus did not achieve fusion (ODI 27.3/26.2; PCS 40.6/40.8; MCS 49.4/54.2; SRS-Total 3.7/3.8; SRSS 4.5/4.5) ($p>0.05$). Rod fractures occurred in 35 (17%) of patients at an average of 32.7 months postoperatively. Of these 35 patients, 17 required revision and 18 did not. Comparing patients with no rod fractures to those with rod fractures and those with rod fractures requiring revision, we found a progressive and significant worsening in ODI ($p<0.0001$), PCS ($p=0.02$), MCS ($p=0.03$), and SRS-Total ($p=0.006$) (Table 1). Failure of fusion at ≥1 level after ASD surgery did not significantly impact 2-year HRQoL. The occurrence of rod fractures requiring revision surgery was associated with significantly worse 2-year HRQoL outcomes as compared to no rod fractures. Fusion grade was less sensitive to clinical outcomes than the occurrence of rod fracture, especially for patients requiring revision surgery.

	No Rod Fracture (NRF)	Rod Fracture (RF)	Rod Fracture Requiring Revision (RFR)	p-value
ODI	24.7 (19.7)*	33.6 (20.3)	46.4 (26.4)*	<0.0001
PCS	41.9 (11.4)*	37.4 (10.8)	34.1 (12.2)*	0.023
MCS	50.7 (11.7)	45.7 (13.6)	42.9 (17.6)	0.030
SRS-Total	3.8 (0.8)*	3.5 (0.7)	3.1 (1.0)*	0.006
Back Pain	3.5 (3.2)	3.8 (2.9)	3.8 (3.4)	0.900
Leg Pain	2.4 (2.9)	2.6 (3.0)	2.7 (2.9)	0.890

Presented at the American Orthopaedic Association annual meeting, 2016

Responses to altered oxygen tension are distinct between human stem cell types and those of high and low chondrogenic capacity. Anderson DE; Markway BD; Bond D; McCarthy HE; Johnstone B.

Lowering oxygen from atmospheric (hyperoxia) to the physiological level (physioxia) of articular cartilage promotes chondrogenesis in vitro; however, the role of physioxia in preventing hypertrophy of mesenchymal stem cell (MSC)-derived chondrocytes remains unclear. The differentiation of articular cartilage progenitors (ACPs) has not been studied in physioxia. MSCs and ACPs had a wide range of chondrogenicity between donors. Physioxia significantly enhanced the chondrogenic potential of both ACPs and MSCs compared with hyperoxia, but the magnitude of response corresponded with intrinsic chondrogenic potential. Physioxic differentiation of MSCs of high chondrogenicity significantly decreased hypertrophy related genes MMP13 and COL10A1 but still produced the hypertrophic marker protein, type X collagen. Highly chondrogenic ACPs had significantly lower hypertrophic gene levels, while type X collagen protein was below detectable levels in physioxia, emphasizing the potential advantage of these cells.

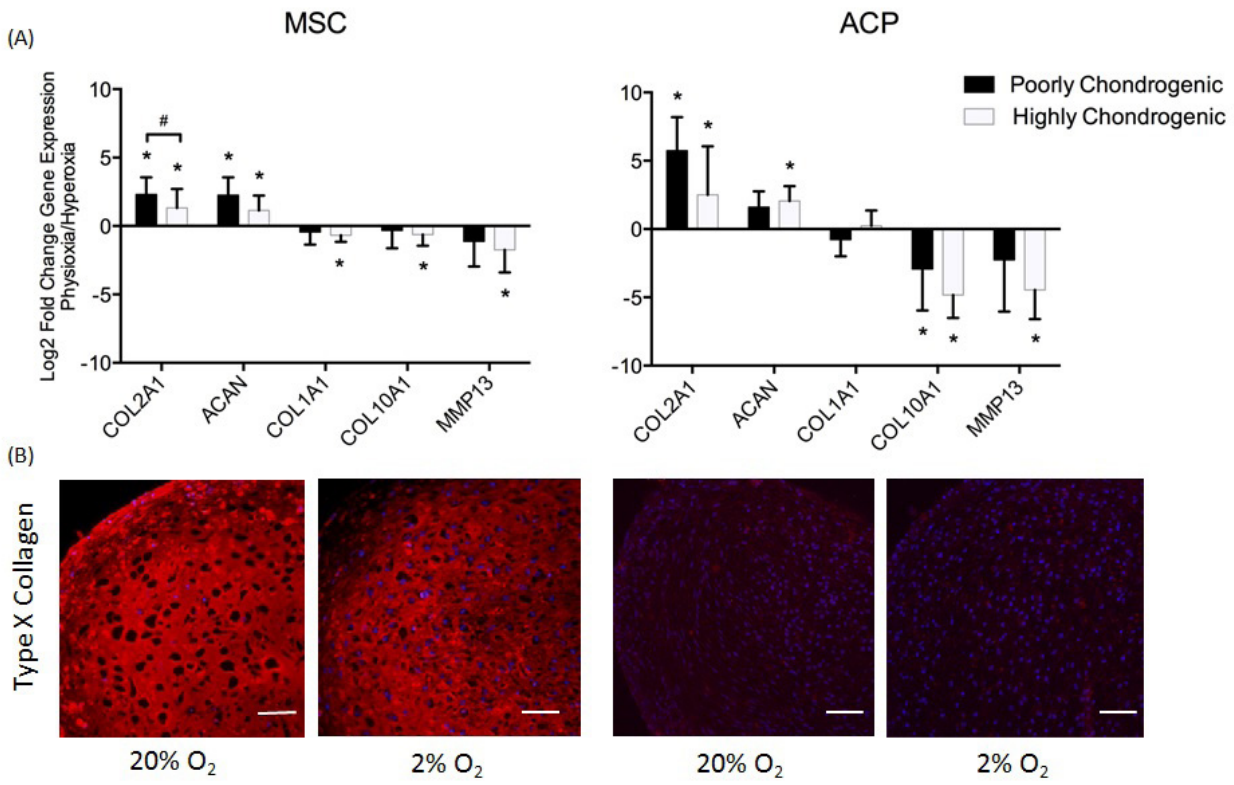


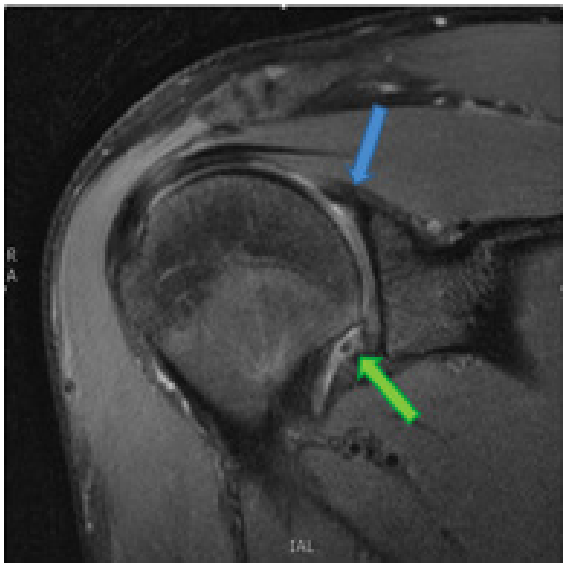
Figure 1. (A) Highly chondrogenic MSCs and ACPs significantly increased expression of genes of the articular cartilage phenotype (COL2A1 and ACAN) and decreased those of the hypertrophic phenotype (COL10A1 and MMP13) in physioxia compared with hyperoxia. (B) At the protein level MSCs have high type X collagen protein expression regardless of oxygen level, while ACPs lack type X collagen. Scale =100um.

NeoCart in comparison to microfracture after five years: a report of primary outcome measures at study conclusion from the "exploratory" phase II FDA regulated randomized clinical trial. Kane MS; Williams RJ III; DeBerardino TM; Taylor D; Ma CB; Anderson DE; Crawford DC

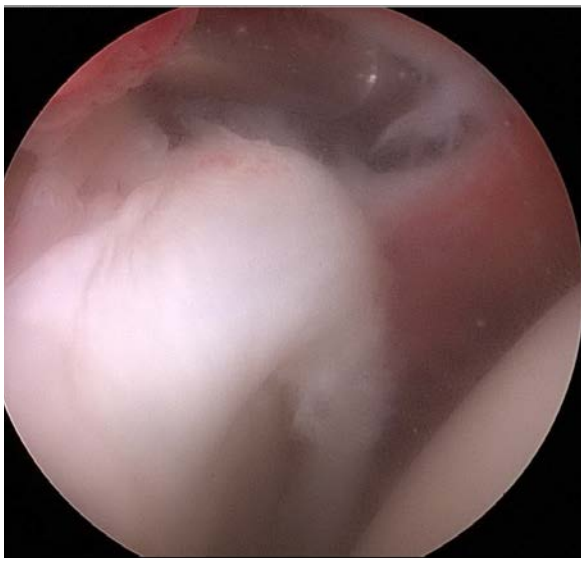
NeoCart, an autologous cartilage tissue-engineered implant, reduced pain and increased function compared with microfracture at 3-24 months following primary treatment of grade III ICRS cartilaginous knee lesions. We asked is these differences would continue through 5 years. Patients with full thickness cartilage injury were randomized to NeoCart (n=21) or microfracture (n=9) treatment. Patient outcome surveys were assessed annually throughout the 5 year study. Average follow-up time was 51 ± 14 months. Adverse event rates did not differ between treatment arms. Mean age, injury acuity and lesion size were similar at baseline, although BMI and VAS pain scores were higher in the NeoCart cohort, and KOOS Sports & Recreation was higher in the microfracture cohort ($p<0.05$). Outcome score change from baseline for the NeoCart cohort was greater than microfracture for IKDC at 1 and 2 years, and for KOOS Pain (the two study primary end points), as well as QOL, Symptoms, and Sports & Recreation until 2-4 years. At 5 years, IKDC score, KOOS Pain, ADL, and QOL, and SF-36 Physical scores for both treatment arms improved significantly ($p<0.05$) from baseline. These improvements for NeoCart were significant throughout the study period, while improvements for microfracture began later. The NeoCart but not microfracture group also improved significantly in KOOS Symptoms, Sports & Recreation, and VAS scores. At final follow-up, the difference in change from baseline scores between the NeoCart and microfracture groups was only significant for VAS Average scores. Responder analysis identified significantly more NeoCart patients with clinical improvement at 1 year ($p=0.046$). All non-responders in the microfracture group dropped out prior to 5 years. NeoCart implantation has a safety and efficacy profile over 5 years supporting further consideration of this therapy as a primary cartilage treatment.

"Monocept": A brief report of congenital absence of the long head of the biceps tendon and literature review. Winston B; Crawford D.

Congenital absence of the long head of the biceps (LHB) tendon is an uncommon but described anatomic anomaly. The LHB plays an important functional role in glenohumeral stability, acting dynamically through the range of motion as well as via depression of the humeral head, and serving as anchorage point of the superior glenoid labrum. When damaged and functionally compromised (e.g. superior labral tears), shoulder instability is frequently described. We report a case of an 18 year old male patient with a congenital absence of the biceps tendon presenting with recurrent shoulder instability and the presence of only the short head of the biceps. We coin the term "monocept," to describe this congenital anomaly.



Axial T2 weighted MRI demonstrating absence long head of the biceps tendon (blue arrow) and inferior labral tear (green arrow)



Intra-operative arthroscopic image from the posterior portal, demonstrating absence of origin of the long head of the biceps tendon and presence of the superior labrum

Hip arthroscopy complicated by May-Thurner syndrome: a case report. Claman B; Lieberman E; Herzka A.

Postoperative deep-vein thrombosis is a rare but serious complication of hip arthroscopy. Anticoagulant therapy has been proven to be effective prophylaxis in the context of other orthopaedic procedures, but there is no consensus surrounding practice guidelines for anticoagulation following routine hip arthroscopy. May-Thurner syndrome is a vascular anatomic abnormality of the iliac vein, which causes thrombogenic hemostasis. This variant could contribute additional risk of both DVT and PE in susceptible patients. Current risk assessment models that are used to determine the necessity of postoperative prophylactic anticoagulation cannot account for the presence of this rare variant and therefore may lead to inadequate anticoagulation in patients who are at higher risk than the models predict. In this report we detail the case of a patient who underwent routine hip arthroscopy and developed a symptomatic deep vein thrombosis. The patient was found to have May-Thurner syndrome. The extensive DVT was successfully diagnosed and treated, however she required hospital re-admission to the ICU, multiple interventional radiology procedures, and a 1-year course of warfarin therapy. The patient is now 5 years post-op and has experienced no further complications. The attributable risk of the May-Thurner variant in hip arthroscopy has not yet been identified. Familiarity with the stigmata of May-Thurner Syndrome among orthopedic surgeons increases the likelihood of early recognition and intervention which is critical. We present this data to showcase an anatomic variant, which is asymptomatic at baseline but may pose an increased risk of DVT and life threatening PE in patients undergoing hip arthroscopy.

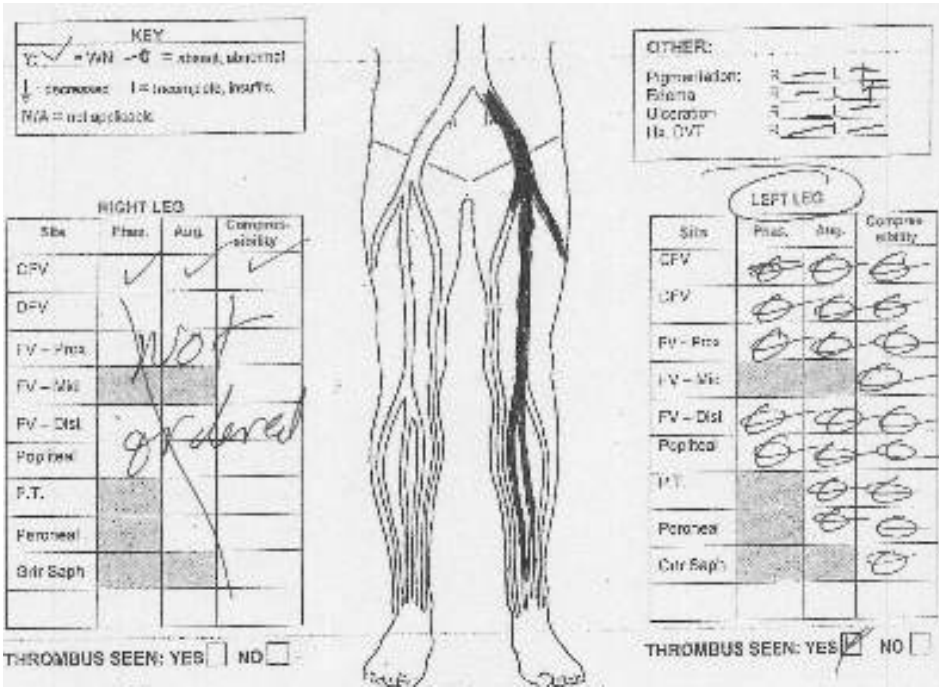


Figure 1: Venous duplex report showing left leg clot burden

The time to teach residents surgical fixation of hip fractures; a comparison of a teaching and community hospital. Hart C; Kagan R; Hiratzka S; Mirza A; Mirarchi A; Friess D.

We compared operative times and clinical outcomes between surgeries performed at a teaching hospital with resident support and a community hospital without it. This was a retrospective analysis on 176 patients who underwent surgical fixation at the community hospital, and 136 at the teaching hospital. All of the operations were performed by one of three trauma specialists with clinical duties at both hospitals. The mean operative time was significantly less at the community hospital compared to the teaching hospital (average, 54.9 compared with 80.2 minutes, $p<0.001$). There was no difference in the surgical characteristics between the two settings. There was a higher 30-day mortality at the teaching hospital compared to the community hospital, though this did not reach significance (5.9% compared with 1.7%, $p = 0.063$). We conclude that resident teaching and participation in the surgical fixation of hip fractures leads to longer operative times, but does not affect other early clinical outcomes.

The "Portlandia" medial approach to the humerus: a case report. Baksh N; Lieberman E; Friess D.

Humeral shaft fractures compromise 3-5% of all orthopaedic fractures. It is estimated that approximately 30% of the world's population has tattoos. This is likely an underestimation of the tattooed population in Portland, Oregon, which has the most tattoo shops per capita in the United States with approximately 12 tattoo shops per 100,000 people. In this case report, we describe a medial approach to the humerus for operative fixation of a humeral shaft in a young polytrauma patient with extensive arm tattoos. The patient is a 24 year-old male who presented to our level 1 trauma center after a motor vehicle accident. His orthopaedic injuries included a left midshaft humerus fracture and right posterior column acetabular fracture/hip dislocation. The patient was indicated for surgery due to his concomitant lower extremity injury. A medial incision was used to approach the humerus at the interval between the biceps and triceps. The neurovascular bundle was identified and retracted posteriorly; the biceps was retracted anteriorly. The musculocutaneous nerve was mobilized from the brachilais and retracted medially. The brachialis was divided to access the fracture site, which allowed excellent visualization for fixation. The fracture was reduced and fixed with a large fragment locking proximal humerus plate without complication. While it is unorthodox to veer from commonly used approaches for tattoo preservation, it should be recognized that body art is increasingly common in the population. This is particularly true at our home institution. It is the authors' experience that patients are more satisfied with their surgical outcomes if incisions through tattoos can be avoided or, if an incision is necessary, the tattoo can be precisely re-approximated. We found that the humeral shaft can be safely dissected using a medial approach with proper knowledge of the pertinent anatomy. The vital neurovascular structures can be readily visualized and safely mobilized away from the fracture site. In the case of the humeral shaft the medial approach is a viable option in a select patient population.

Frequency and treatment trends for periprosthetic fractures about total hip arthroplasty in the United States. Cox JS; Kowalik T; DeHart M; Duwelius PJ; Mirza AJ.

Periprosthetic proximal hip fractures (PPHFx) are a challenging complication that is increasing with time. There is wide variability in the quality and size of prior epidemiologic studies and we aim to enhance our knowledge of these fractures by using the largest publicly available database in the US. The HCUP-NIS was used to analyze trends related to the frequency, fracture type, mortality, treatment, patient demographics, length of stay, and hospital charges associated with PPHFx from 2006-2010. From 2006-2010, patient age, hospital characteristics, rate of PPHFx, treatment choice, length of stay, mortality, and time to procedure all remained stable. The Southern US had the highest frequency of fractures and females had nearly twice the rate of PPHFx each year. Despite these consistencies, hospital charges increased by $27,683 over the study period (p<.0001). In the era of containing cost while improving quality of care, this study demonstrates that despite consistent treatment trends of PPHFx, hospital charges are increasing seemingly independently. Refining our understanding of this relationship will be fundamental to further improving quality and reducing cost associated with these fractures.

Presented at the American Association of Hip and Knee Surgeons annual meeting, 2015

Impact of anterior versus posterior approach for total hip arthroplasty on post-acute care service utilization. L'Hommedieu C; Tessier J; Cox JS; Burns M; Gera J; O'Neill O; Rupp G; Salin J; Duwelius PJ.

We compared the post-acute care utilization, episode costs, and readmissions in patients undergoing total hip arthroplasty (THA) with either the anterior or posterior approaches. Retrospective claims data for all patients undergoing elective THA from 62 group practices participating in the Medicare Bundled Payment for Care Improvement Initiative was analyzed for 90 days post-discharge. Data was separated into anterior and posterior groups based on surgeon preference acquired by Signature Medical Group, Inc. Claims data from 26,773 Medicare beneficiaries receiving elective THAs was analyzed (23,653 posterior, 3,120 anterior). Anterior vs. posterior approach showed no difference in episode cost ($22,517 vs. $22,068), skilled nursing facility (SNF) utilization (36% vs. 32%), SNF length of stay (23.3 vs. 22.4 days), home health (HH) utilization (65% vs. 64%), HH cost ($2,875 vs. $2929), and readmission rates (9.3% vs. 7.7%). The inpatient rehab (IPR) cost for anterior vs. posterior ($15,387 vs. $14,305, P = 0.16) and length of service ($2875 vs. $2,929, P = .034) favored the posterior approach, but were negligible when considering the effect size. Surgical approach alone is not the primary driver of post-acute care service utilization, quality outcomes, or cost. Other factors such as physician-led patient-focused care pathways, care coordination, rapid rehabilitation protocols, perioperative pain management protocols, and patient education are integral for effective patient care.

Presented at the American Academy of Orthopaedic Surgeons annual meeting, 2015

Sacral insufficiency fractures: determining frequency and defining the patient profile. Obrock B; Mirza A; DeHart M.

When insufficiency fractures occur at the sacrum, they represent a significant cause of low back pain and disability within the geriatric population. However, there has never been a large-scale study examining the epidemiological trends associated with the disease, and thus the condition has been largely under recognized. This study analyzed the Nationwide Inpatient Sample (NIS) database to trend the frequency, comorbid conditions, patient demographics and financial burden of the disease from 1998-2010. In 1998 there were 14,629 occurrences of SIFs in the NIS population; this number steadily increased to 35,434 by 2010. This represents a 142% increase over the 12 year span. Congruently, there was an exponential increase in the total financial burden of SIFs in the NIS health care institutions. In 1998, the total financial burden of SIFs within the NIS database was $581 million; this number increased to $3.18 billion in 2010. Overall this study highlights that the frequency of SIFs is increasing as our population ages, and that limited understanding of the disease characteristics have created a disproportionate burden on the health care system.

Presented at the American Osteopathic Association of Orthopedics annual meeting, 2015

Rapid progression of hip osteoarthrosis following intra articular corticosteroid injection. Baum KS; Westlake B; Parker N; Ryan JA.

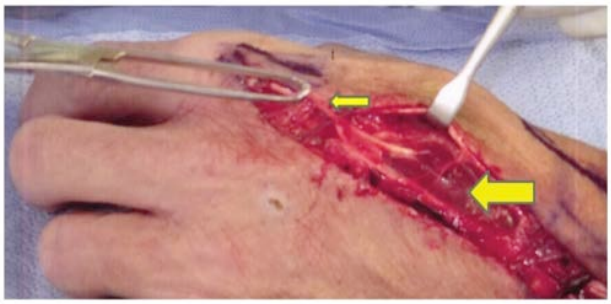
The aim of the current study is to investigate the prevalence of rapid progression of hip osteoarthrosis following intra articular corticosteroid hip injection. Between 2009 and 2014, 197 patients with a diagnosis of hip osteoarthrosis who underwent intra articular hip injection were reviewed. Pre and post injection radiographs were compared to determine the percentage of joint space narrowing and absence or presence of femoral head collapse. This information was used to identify the prevalence of rapidly progressive osteoarthrosis following intra articular corticosteroid hip injection. A total of 197 patients were reviewed in the current study with 170 patients meeting inclusion criteria and 104 patients with complete pre and post injection AP pelvic radiographs. The overall prevalence of femoral head collapse following hip injection in our population was 28.8%. The prevalence of joint space narrowing of 50% or greater within 6 months of injection was 15.4%. The overall prevalence of rapidly progressive osteoarthrosis was 44.2%. Rapid progression of joint space narrowing in patients with osteoarthrosis of the hip receiving corticosteroid injection occurs at an incidence rate much higher than previously recognized. The current study suggests that corticosteroid hip injection in patients with existing advanced osteoarthrosis poses a significant risk for the development of rapid disease progression and warrants further, prospective evaluation.

Presented at the American Osteopathic Academy of Orthopedics annual meeting, 2015

An anomalous hand extensor confounding treatment of a chronic extensor pollicis longus rupture. Gillis CT; Tsai PC.

The extensor digitorum brevis manus (EDBM) muscle confounds clinical diagnosis and surgical treatment of dorsal wrist pain. Symptoms likely arise from a hypertrophic muscle and synovitis at the distal fourth dorsal compartment. Surgery is considered after conservative management and consists of complete muscle excision or division of the extensor retinaculum. The extensor indicis proprius (EIP) is absent in 15.9% of EDBM cases. This creates a complex situation when managing tendon transfers for a chronic extensor pollicis longus tendon rupture (EPL). We report on a patient with a remote history of EDBM exploration who presented with atraumatic dorsal wrist pain followed by inability to extend his thumb. A tendon transfer was undertaken and intraoperatively he had an absent EIP with an intact EDBM. Without an EIP available for transfer, the ulnar slip of the extensor digitorum communis to the index finger was used as an intercalary graft. At four month follow up, the patient had satisfactory results with no limitations. Given the rare nature of a symptomatic EDBM, the treating surgeon needs to be cognizant of this anomalous muscle as it can easily be misdiagnosed. Surgeons must be aware of the anatomic variants of the EDBM as an EIP may be unavailable for transfer. We conclude that fourth compartment syndrome from an EDBM should be initially managed with extensor retinaculum division instead of muscle excision. EDBM has been used as a tendon transfer for a chronic EPL rupture but caution should be used with the different subtypes based on Ogura's classification.

Presented at the American Society for Surgery of the Hand annual meeting, 2015



Intraoperative photograph of the type 1 EDBM after tenotomy. Large arrow indicates EDBM muscle belly, small arrow indicates EDBM tendon.

Posterior shoulder pain in a college pitcher with prior SLAP repair. Nelson A; Aukerman D; Therrien J; Vela L.

A 20-year-old NCAA Division I right hand dominant baseball pitcher presented with right posterior shoulder pain immediately after a practice pitch. He described sudden, sharp pain at the release point of his throwing motion. He was unable to continue throwing secondary to pain. He admitted to radiation from his axilla down to his elbow but denied any numbness or tingling. His past medical history was only significant for an arthroscopic SLAP repair eleven months prior. He had seven months of rehab and a sufficient throwing program prior to return. He was painless with throwing for four months prior to this injury. He was tender over the posterior rotator cuff, joint line and proximal humerus. He had painful Obrien's, lift off, and load and jerk. His x-rays were normal, but his MRI showed acute grade 2 strain of isolated Latissimus Dorsi muscle, at the myotendinous junction. There was also a partial avulsion at the tendinous insertion on the humeral shaft with no recurrent SLAP tear identified. While the differentials includes recurrent labral tear, rotator cuff strain/tear, triceps strain, combined teres major and latissimus dorsi strain/tear, there are very few studies on the treatment of Latissimus dorsi strains or tears, and isolated latissiumus dorsi tears are rare. The largest study, also sport specific to professional baseball pitchers, concluded that non-operative treatment was recommended. Conservative therapy and a throwing program with symptomatic progression can enable players reach their prior level of play. Operative treatment has been shown to be effective in a very limited number of case reports, but all patients were older and not high level athletes. This athlete progressed well. The day of injury he was placed into a sling with non-weight bearing of the right upper extremity, and ROM of the elbow and wrist. His remaining rehabilitation plan included a throwing program at 2-4 months post injury, and return to play between 4-6 months if asymptomatic.

Presented at the American Medical Society for Sports Medicine annual meeting, 2014.

Incidence of osteoporosis in the spine population: implications for patients with spine disease and significance for the spine surgeon. Blaty D; Blaty T; Lewis T; Ranzoni S; Nelson A; Noonan C.

We obtained dual-energy X-ray absorptiometry (DXA) scan results in 191 consecutive patients with various spine diagnoses in order to evaluate for incidence and prevalence of osteoporosis in this specific population. To our knowledge, there has been no study in the US analyzing DXA results specifically in this population. In our IRB-approved cross-sectional study, the prevalence of osteoporosis and osteopenia combined in patients over the age of 50 was notably higher than that reported in the general population; 63.9% versus 54%, respectively. Analysis of DXA results within each spine diagnosis and age group was performed, and certain diagnoses were associated with higher rates of osteoporosis. Our results suggest that patients older than age 50 with spine disease have a higher prevalence of decreased bone density than the general population. With osteoporosis negatively affecting spine surgery outcomes, it is recommended to evaluate bone density in patients preparing for spine surgery.

The effect of preoperative tranexamic acid on blood loss and transfusion rates in intertrochanteric and subtrochanteric femur fractures. Yakel S; Krumrey J.

Tranexamic Acid has a long and proven history of clinical safety and effectiveness in decreasing perioperative blood loss in the Orthopaedic literature. While it has quickly become standard of care within total joint arthroplasty, its effect in lower extremity fracture care is less well understood. The objective of this study is to evaluate the effect of Tranexamic Acid (TXA) on blood loss and need for perioperative blood transfusion following intertrochanteric and subtrochanteric femur fractures. We hypothesize that administration of TXA at the time of hospital presentation will reduce perioperative blood loss in patients with intertrochanteric and subtrochanteric femur fractures when compared to a placebo. This study is a double-blinded, randomized, placebo controlled trial. We are currently in the patient collection stage and plan to submit our findings for publication upon completion of the trial.

Patient-specific versus conventional total knee arthroplasty: perioperative and cost differences. DeHaan AM; Adams JR; DeHart ML; Huff TW.

BACKGROUND

The role of patient-specific instrumentation (PSI) in total knee arthroplasty (TKA) is yet to be clearly defined. Evidence evaluating perioperative and cost differences against conventional TKA is unclear and based on small studies. Through a large single-surgeon case series, we hypothesized that accurate implant size could be predicted using PSI TKA, and that PSI has lower peri-operative morbidity and no increased cost compared to conventional TKA.

METHODS

Retrospective review of all primary TKAs between July 2008 and April 2013 were examined. Patients received a PSI TKA based on custom cutting jigs created from MRI or a conventional TKA. Peri-operative outcome measures include tourniquet and total surgical time, room turnover time, EBL, drain output, transfusion requirements, and length of stay. Cost analysis evaluated multiple variables including the pre-operative MRI, implant and cutting blocks, operative time, and implant tray sterilization.

RESULTS

339 patients underwent 398 TKAs: 331 of these had PSI and 67 had conventional arthroplasty. The groups were similar with respect to age and BMI. The predicted component size was correct in 82.3% of femoral templates and 88.4% of tibial templates. The PSI group had 24.3 minutes less total surgical time, a 20% reduction in room turnover time, and less post-operative blood loss than the conventional group. At our institution, there was an upcharge applied to the patient-specific custom cutting blocks and there was cost associated with the MRI. This increased cost was offset through money saved in operating room time, turnover time efficiency, and fewer surgical trays requiring sterilization.

CONCLUSION

PSI TKA resulted in accurate sizing, decreased surgical time, decreased blood loss, and increased operating room efficiency compared to conventional TKA. Importantly, the pre-surgical costs of PSI group were offset through the increase in operating room efficiency.

Presented at the Western Orthopedic Association annual meeting, 2015.

Optimization of an engineered 3D muscle tissue from the C2C12 cell line. Jansen K; Keller C.

Mechanisms underlying muscle tumor physiology and function have traditionally been studied in 2D models using cultured cells grown in a single layer. Unfortunately this approach does not simulate the native in situ environment of normal tissue or tumors (1). The ability to reliably form muscle tumor models in an in vitro 3D matrix promises to be valuable tool for studies of muscle tumor biology and ultimately preclinical therapeutic testing. With this in mind we are working to systematically optimize a protocol to fabricate engineered 3D muscle tissue from the permanent myogenic C2C12 cell line. Our ensuing goal is to seed the muscle constructs with labeled rhabdomyosarcoma cells allowing for monitored invasion and growth.

METHODS

Production of 3D culture chambers: Novel culture chambers were designed using CAD software, 3D printed, and epoxied onto glass microscope slides. The engineered tissue forms along the bottom of the well between two Velcro® anchors, one of which is pinned to an angled piece of silicon polymer.

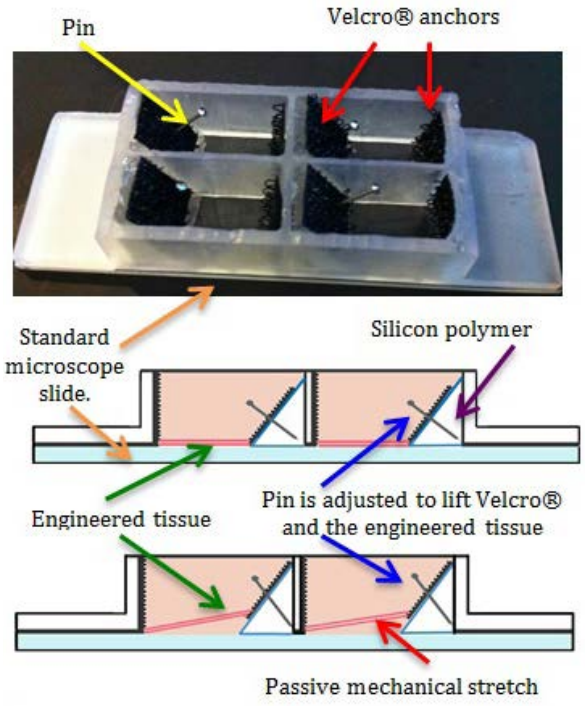
Decellularization of skeletal muscle and matrix preparation: Skeletal muscle from bovine gastrocnemius was harvested and decellularized as previously published (2). The remaining extracellular matrix (ECM) was freeze-dried, enzymatically digested, and ground into a powder. This was then reconstituted within a buffered solution.

Assembly of Fibrin/Cell Scaffold: Following sterilization each culture chamber was coated with reconstituted ECM, briefly incubated, and aspirated. Approximately 5 x 106 pre-differentiated C2C12 cells were suspended in a growth media/thrombin solution and pipetted into the chambers. A fibrinogen solution was added to initiate the formation of a thin fibrin gel along the bottom of the well. After a period of incubation the stainless steel pin was gently adjusted within the silicon polymer to lift the engineered tissue from the glass substrate and provide a constant passive stretch.

In gel staining: Cell viability of the muscle tissue constructs was assessed using in gel staining.

RESULTS

The above methods represent the initial stages of optimizing an engineered 3D muscle tissue fabrication protocol from the C2C12 cell line. We were able to show cell viability and tissue organization along the axis of mechanical stretch at 5 days.



DISCUSSION

Our methods are simple and inexpensive permitting use of the system with basic laboratory equipment. This 3D culture chamber design is unique in that it first allows the tissue to form a perfectly even and thin layer which aids in diffusion of nutrients to the cells, yet the tissue can still be suspended and placed under stretch. The mechanical stretch is critical to cell differentiation, maturation, and alignment (3). Our choice to use a microscope slide along the bottom of the wells was beneficial by allowing visualization of the live-engineered tissue without removal from the chamber wells. A fibrin gel was chosen as our scaffold substrate based on prior studies demonstrating its ability to provide mechanical properties that allow for muscle cell proliferation and organization (4, 5). Many trials were undertaken to determine the ideal thrombin/fibrinogen and cell density ratios for our protocol with the conclusion that a high density of cells is critical. Finally, it is our belief that the addition of reconstituted ECM provides chemical and biological cues that are essential in the in vivo formation of functional tissue.

CONCLUSION

Our preliminary work to optimize a protocol to fabricate engineered 3D muscle tissue shows promise. It is our hope that continued work will lead to the ability to monitor invasion and growth of labeled rhabdomyosarcoma cells within 3D in vitro muscle constructs.

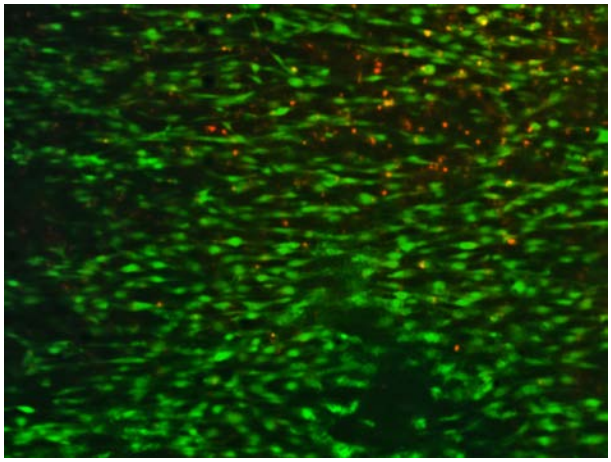


Figure 1: In-gel staining at 5 days (150x mag, Lumar). Calcein AM (green) showing live cells. Propidium iodine (red) showing dead cells.

1. Cukierman, E., R. Pankov, D. R. Stevens, and K. M. Yamada. 2001. Taking cell-matrix adhesions to the third dimension. Science 294: 1708-1712. 2. DeQuach, J. A., V. Mezzano, A. Miglani, S. Lange, G. M. Keller, F. Sheikh, and K. L. Christman. 2010. Simple and high yielding method for preparing tissue specific extracellular matrix coatings for cell culture. PLoS One 5: e13039. 3. Matsumoto, T., J. Sasaki, E. Alsberg, H. Egusa, H. Yatani, and T. Sohmura. 2007. Three-dimensional cell and tissue patterning in a strained fibrin gel system. PLoS One 2: e1211. 4. juhasz, I., G. F. Murphy, H. C. Yan, M. Herlyn, and S. M. Albelda. 1993. Regulation of extracellular matrix proteins and integrin cell substratum adhesion receptors on epithelium during cutaneous human wound healing in vivo. Am J Pathol 143: 1458-1469. 5. Mikos, A. G., G. Sarakinos, S. M. Leite, J. P. Vacanti, and R. Langer. 1993. Laminated three-dimensional biodegradable foams for use in tissue engineering. Biomaterials 14: 323-330.

The epidemiology of primary and revision total hip arthroplasty in teaching and non-teaching hospitals in the United States. Kowalik TD; DeHart M; Gehling H; Gehling P; Schabel K; Duwelius P; Mirza A.

INTRODUCTION

The purpose of this study was to examine the epidemiology of primary and revision THA in teaching and non-teaching hospitals.

METHODS

The HCUP NIS was queried from 2006-2010 to identify primary and revision THA at teaching and non-teaching hospitals.

RESULTS

1,336,396 primary and 223,520 revisions were identified. 46% of all primaries and 54% of all revisions were performed at teaching hospitals. Teaching hospitals performed 17% of all their THA as revisions and non-teaching hospitals performed 12% as revisions. For primary and revision THA, teaching hospitals had fewer patients over 65 years old, fewer Medicare patients, similar gender rates, more non-white patients, and more patients of the highest income quartile compared to non-teaching hospitals. Costs, LOS, and Charlson score were similar, however, mortality rate was lower at teaching hospitals.

	Primary THA		Revision THA	
	Non-Teaching	Teaching	Non-Teaching	Teaching
Age				
64 years or less	309663 (42.9%)	302843 (49.4%)	36654 (45.9%)	52450 (43.2%)
65 years or more	412478 (57.1%)	309750 (50.6%)	65309 (64.1%)	69005 (56.8%)
	P<.001		P<.001	
Gender	**Non-Teaching**	**Teaching**	**Non-Teaching**	**Teaching**
Male	311219 (23.4%)	271693 (44.4%)	41915 (41.1%)	52609 (43.4%)
Female	408718 (56.8%)	340040 (55.6%)	59986 (58.9%)	68749 (56.6%)
	P<.001		P<.001	
Race	**Non-Teaching**	**Teaching**	**Non-Teaching**	**Teaching**
White	497377 (88.5%)	408136 (85.4%)	69771 (88.3%)	80542 (84.9%)
Black	28557 (5.1%)	40387 (8.5%)	3926 (5.0%)	7637 (8.1%)
Hispanic	17303 (3.1%)	13577 (2.8%)	2864 (3.6%)	3523 (3.7%)
Other	18589 (3.3%)	15614 (3.3%)	2454 (3.1%)	3145 (3.3%)
	P<.001		P<.001	
Hospital Region	**Non-Teaching**	**Teaching**	**Non-Teaching**	**Teaching**
Northeast	100314 (13.9%)	171901 (28.0%)	11802 (11.6%)	29855 (26.4%)
Midwest	172940 (23.9%)	178298 (29.1%)	22715 (22.3%)	33673 (27.7%)
South	266368 (36.8%)	168821 (27.5%)	41125 (40.3%)	36304 (29.9%)
West	183726 (25.4%)	94028 (15.3%)	26361 (25.8%)	21688 (17.8%)
	P<.001		P<.001	
Income Quartile in USD	**Non-Teaching**	**Teaching**	**Non-Teaching**	**Teaching**
38,999 or less	147799 (20.9%)	102790 (17.1%)	23214 (23.2%)	23888 (20.1%)
39 to 47,999	199931 (28.2%)	135657 (22.5%)	27832 (27.8%)	29459 (24.8%)
48 to 62,999	184478 (26.0%)	160868 (26.7%)	25552 (25.6%)	31021 (26.1%)
63,000 or more	176428 (24.9%)	202515 (33.6%)	23378 (23.4%)	34631 (29.1%)
	P<.001		P<.001	
Primary Payer Type	**Non-Teaching**	**Teaching**	**Non-Teaching**	**Teaching**
Medicare	399331 (55.3%)	301845 (49.3%)	67482 (66.2%)	73963 (60.9%)
Medicaid	20392 (2.8%)	23898 (3.9%)	3388 (3.3%)	6450 (5.3%)
Private	277132 (38.4%)	265398 (43.4%)	27095 (26.6%)	36168 (29.8%)
All other	25257 (3.5%)	20981 (3.4%)	3899 (3.8%)	4807 (4.0%)
	P<.001		P<.001	

Table 1. Demographic, payer type of patients that underwent primary and revision THA. Raw numbers presented with percent of total in parenthesis. Data pooled from 2006-2010 for each category.

CONCLUSIONS

This study found small but significant differences in key epidemiological and outcome variables while examining primary and revision THA at teaching and non-teaching hospitals.

Presented at the American Academy of Orthopaedic Surgeons annual meeting, 2015. Accepted for Publication in the J Am Acad Orthopaedic Surgeons.

Drill penetration injury to extensor tendons: a biomechanical analysis. Mahylis JM; Burwell A; Bonneau L; Marshall L; Mirarchi AJ.

BACKGROUND

Little is known about extensor tendon failure following drill injury at time of volar plate fixation. Our goals were to analyze extensor tendon injury following simulated drill penetration, and change in tendon displacement during cyclic loading following simulated drill penetration injury.

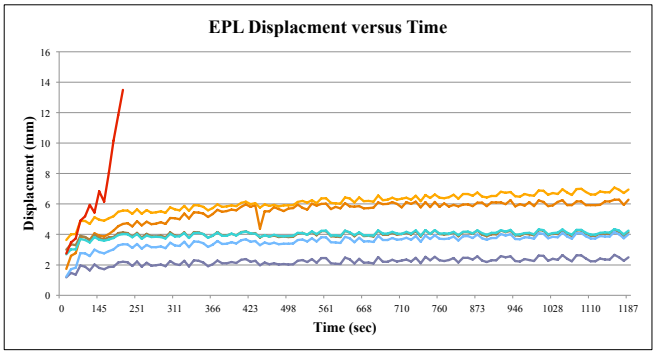
METHODS

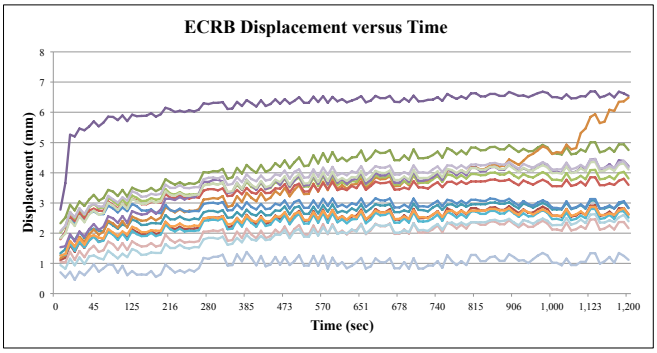
Extensor Pollicis Longus (EPL) and Extensor Carpi Radials Brevis (ECRB) tendons were harvested from nine fresh frozen cadaveric arms. Eighteen EPL and 18 ECRB samples were created from harvested tendons. Drill penetration injury was performed in either a continuous or oscillating mode. Injured tendons were subjected to 1200 cycles at 1 to 15 kg cyclic load at a frequency of 1 Hz, and analyzed for failure at drill sites and change in displacement throughout the testing cycle.

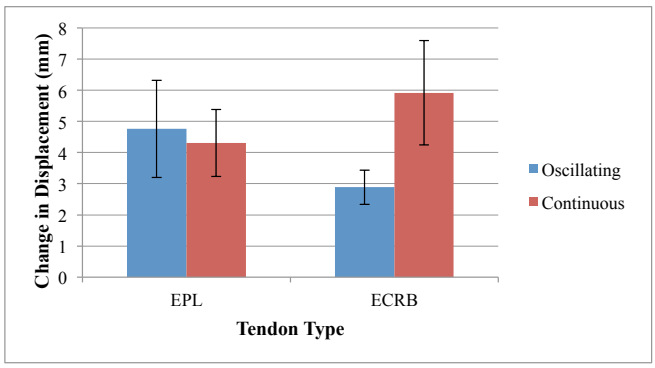
RESULTS

Ten EPL samples and 16 ECRB samples completed testing without failure. Tendon type (ECRB, EPL), mode of injury (continuous, oscillating), and location (proximal, distal) did not affect tendon displacement during loading. A single EPL tendon failed following continuous drill penetration injury.

ECRB samples had a mean change in displacement of 2.8 mm (s.d. 1.5 mm) and 5.9 mm (s.d. 4.7 mm) for oscillating and continuous modes, respectively. Six EPL samples had a mean change in displacement of 4.7 mm (s.d. 2.7 mm) and 4.3 mm (s.d. 1.8 mm) for oscillating and continuous modes, respectively.







CONCLUSION

Complete extensor tendon failure due to drill penetration was rare. Drill mode did not affect the degree of elongation. Increasing cyclic loading of extensor tendons after drill injury caused modest extensor tendon elongation.

Proximal junctional kyphosis: inter- and intra-observer reliability of radiographic measurements in adult spinal deformity. Rastegar F; Contag A; Daniels A; Hiratzka J; Lin C; Chang J; Than K; Raslan A; Kong C; Nguyen N-L; Hostin R; Hart R.

BACKGROUND

Proximal junctional kyphosis (PJK) is commonly seen after adult spinal deformity (ASD) surgery and radiographic assessment is important in properly managing patients. No study to date has identified the reliability of radiographic measurement of junctional kyphotic angle after ASD surgery. We evaluated the inter- and intra-observer reliability of radiographic kyphosis measurements in patients who have undergone ASD surgery.

METHODS

Radiographs from 52 patients treated surgically at a single institution for ASD were selected. The radiographs were divided into four categories based on the level of the upper instrumented vertebra (UIV) and the presence of proximal junctional failure (PJF). These categories were upper thoracic (UT) without failure, thoracolumbar (TL) without failure (TL), UT with failure (UTF), and TL with failure (TLF). Seven spine surgeons and two spine fellows performed the radiographic kyphotic measurements twice at least 6-weeks apart. Intraclass correlation coefficients (ICC) were calculated to determine inter- and intra-observer reliability.

RESULTS

The inter-observer reliability for radiographic kyphosis measurement of UT, TL, UTF, TLF demonstrated an almost perfect agreement with ICC scores of 0.917, 0.965, 0.956, 0.882, respectively, for round 1 and 0.932, 0.975, 0958, 0.989, respectively, for round 2 (Table 1, Figure 1).

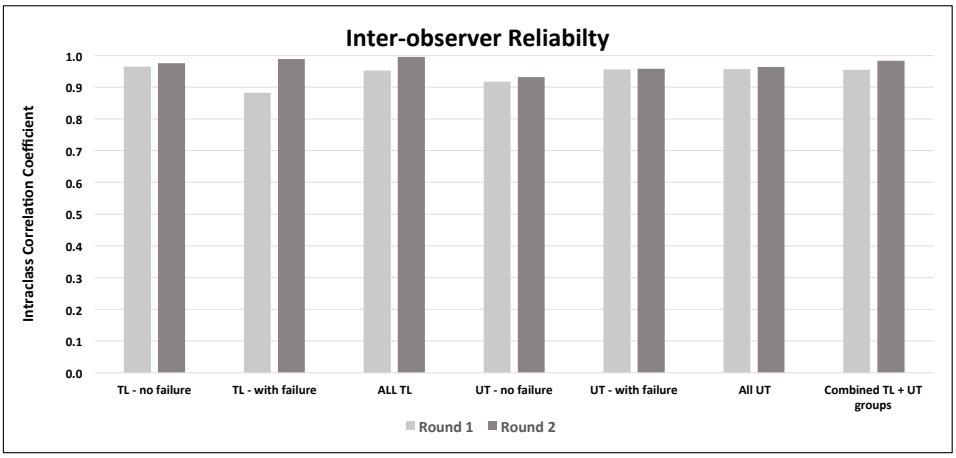
The intra-observer reliability for radiographic kyphotic measurement for the TL and TLF group had an almost perfect agreement with a mean of 0.898 (0.817-0.969) and 0.976 (0.931-0.995), respectively. The intra-observer reliability for radiographic kyphotic measurement for the UT and UTF group had an almost perfect agreement with means of 0.801 (0.662-0.942) and 0.879 (0.760-0.988), respectively (Table 1, Figure 2, 3).

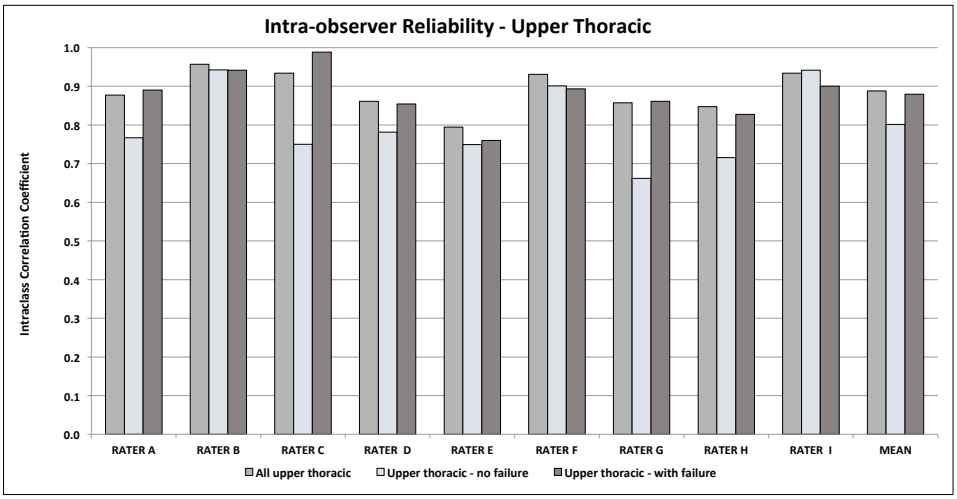
CONCLUSION

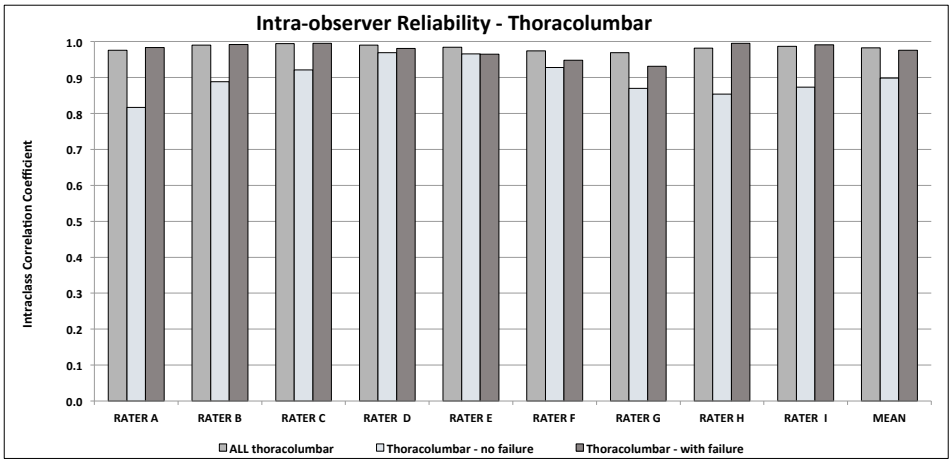
This study demonstrates a high inter- and intra-observer reliability in radiographic kyphosis measurement above posterior instrumented fusion, irrespective of level of the UIV or presence PJF in patients who have undergone corrective spine surgery for management of ASD.

	Inter-observer reliability (ICC)		Intra-observer reliability (ICC)	
	Session 1	Session 2	Mean	Range
Thoracolumbar - no failure	0.965	0.975	0.898	0.817 - 0.969
Thoracolumbar - with failure	0.882	0.989	0.976	0.931 - 0.995
All thoracolumbar	0.953	0.995	0.983	0.969 - 0.990
Upper thoracic - no failure	0.917	0.932	0.801	0.662 - 0.942
Upper thoracic - with failure	0.956	0.958	0.879	0.760 - 0.988
All upper thoracic	0.957	0.963	0.888	0.794 - 0.957
Combined TL, TLF, UT, UTF	*0.955*	*0.983*	*0.948*	*0.914 - 0.979*

TL, thoracolumbar; UT, upper thoracic







Presented at the Lumbar Spine Research Society annual meeting, 2016.

Past and Present: OHSU Annual Beals Lectureship

The Beals memorial lectureship is an annual event established in honor of the late Rodney K. Beals, MD, Professor Emeritus in the Department of Orthopaedics & Rehabilitation at Oregon Health & Science University, who taught orthopaedics for more than 50 years. Dr. Beals was a lifelong "Oregonian" and spent his entire professional career practicing orthopaedic surgery in Portland, OR. Dr. Beals was a committed clinician, master surgeon, revered educator and accomplished researcher. It was not only out of respect for his scientific accomplishments, but for his humble guidance and mentorship that the OHSU Department of Orthopaedics & Rehabilitation established the annual Beals Memorial Lecture Series.

Dr. Beals attended Willamette University for his undergraduate training, graduating in 1952, and received his medical degree from the University of Oregon Medical School (precursor to OHSU) in 1956. He completed his internship at Minneapolis General Hospital followed by a General Surgical Residency in San Bernadino County Hospital in California. He ultimately completed his training in Orthopaedic Surgery at the University of Oregon Medical School in 1961. Dr. Beals immediately joined the faculty and rapidly rose through the ranks at OHSU, serving as Head of the Division of Orthopedics from 1981 to 1994. Dr. Beals also served as the first chairman for the Department of Orthopaedic Surgery at OHSU in 1994. At the age of 77, he remained an active member of the Orthopaedic faculty at OHSU until the time of his passing on August 7, 2008.

Dr. Beals was an accomplished researcher throughout his career. He was nationally recognized for his research on skeletal manifestations of growth disturbances in children. He authored more than 150 peer-reviewed publications. Dr. Beals was also a revered educator. During his tenure at OHSU, he helped train more than 150 orthopaedic surgeons in residency. He also helped thousands of patients and mentored countless numbers of medical students. Throughout his remarkable career, Dr. Beals represented and personified excellence in medicine and orthopaedic surgery.

There will not be a Beal's lecture in 2016, but the lecture will be returning in 2017.

Shriners Hospital for Children – Portland Lectureship Series

BEATTIE LECTURE SERIES

Mr Byron Beattie was the owner and operator of a printing plant in Portland, Oregon. Mr Beattie became acquainted with Dr "French" Eldon Chuinard, while Dr Chuinard was the chief of staff at Shriners Hospital for Children, Portland. He was so impressed with the importance of the educational mission of Shriners Hospital that he created an endowment fund to support our local education activities. The first seminar was held in 1985.

Guest Lecturer 2015
James G. Wright, MD, MPH

Dr. James G. Wright, as Chief of Perioperative Services, was responsible operationally from 2005-15 for six surgical divisions (Cardiovascular, General, Neurosurgery, Orthopaedic, Plastic and Urology) and five departments (Anaesthesia, Critical Care, Dentistry, Ophthalmology and Otolaryngology). The Perioperative Services staff are engaged in highly complex clinical care, basic and clinical research, undergraduate and postgraduate education and numerous administrative responsibilities. Dr. Wright was also from 2005-15 the Surgeon-in-Chief, Department of Surgery.

Dr. Wright is a Senior Scientist in the Sickkids Child Health Evaluative Sciences Program. Research in this program focuses on the systematic study of characteristics of health and disease and outcomes of treatment modalities in children. Dr. Wright's research has focused on the development of measures to evaluate surgical therapy, randomized clinical trials, and evaluating unmet need and disparity in the use of orthopaedic procedures. Dr. Wright was holder from 2000-15 of the Robert B. Salter Chair of Paediatric Surgical Research. He has more than 250 peer-reviewed publications, including publications in Lancet, Science, New England Journal of Medicine, Journal of the American Medical Association, and the British Medical Journal. In addition to his hospital and administrative activities, he was the Associate Editor for the Evidence Based Orthopaedic Section of the American Journal of Bone and Joint Surgery from 2000-12 and Chair of the Research Council for the Pediatric Society of North America for 4 years. As of September 2015 Dr. Wright is a Senior Clinical Research Fellow and Honorary Consultant Paediatric Orthopaedic Surgeon at the Nuffield Department of Orthopaedics, Rheumatology, and Musculoskeletal Sciences, University of Oxford.

54TH ANNUAL DILLEHUNT MEMORIAL LECTURE

The Dillehunt Memorial Lecture honors the contribution of a great surgeon and legendary teacher who inspired many orthopaedists. With his devotion to children, Dr. Richard Dillehunt was instrumental in the establishment of the Shriners Hospitals for Children — Portland and served as the first Chief Surgeon. His legacy continues through the Dillehunt Memorial Trust Fund, sponsoring visiting distinguished Pediatric Orthopaedic Surgeons from throughout the world.

Guest Lecturer 2015
Jaroslaw Czubak, MD, PhD

Professor Czubak is Head of the Dept. of Orthopedics, Pediatric Orthopedics and Traumatology, at Gruca Teaching Hospital Otwock, a branch of the Postgraduate Medical Education Centre, Warsaw. He completed a Fellowship at Wiktor Dega Hospital, Medical University, Poznan. As a hip surgeon, his emphasis is on joint preservation from early childhood to adulthood. He is engaged in the Edu¬cation Committee of European Pediatric Orthopedics Society, engaged in charity work in Africa, India, and Sri Lanka, and is a committed mountain and road biker, together with his wife Marzena (Shakespeareologist) and all three children. In January 2015, he became Grandfather of Maja.

Leo S. Lucas Outstanding Orthopaedic Educator Award: Presented to the faculty member most instrumental in the development of future orthopaedic surgeons.

Morris Hughes Award: Presented to the resident who best demonstrates concern for patients and for education of the next generation of physicians.

Research Award: Presented to the resident recognized for a commitment to the development, execution and publication of original research during residency.

YEAR	LEO S. LUCAS	MORRIS HUGHES	RESEARCH AWARD
2007	Tom Ellis	Rob Tatsumi	Joseph Schenck
2008	Dennis Crawford	Stephan Pro	Kate Deisseroth
2009	Darin Friess	Stephan Pro	N/A
2010	Amer Mirza	Gary Kegel Gregory Byrd	Patrick Denard
2011	James Hayden	Jayme Hiratzka	Jayme Hiratzka Matthew Harrison
2012	Jesse A. McCarron	Luke Rust	Dawson Brown Matthew McElvany
2013	James Hayden	Laura Matsen Ko Jacqueline Munch	Adam Baker
2014	Adam Mirarchi	Rich Myers	Trevor McIver
2015	Kathryn Schabel	Dustin Larson	Alexander DeHaan

Where are They Now?

ADAM BAKER, MD

I spent my fellowship year training at the Campbell Clinic Memphis, TN. There, I gained valuable knowledge and experience dealing with all aspects of foot and ankle care. It was a privilege to train at one of the nation's oldest and most well-known orthopedic centers.

I feel that I was very fortunate to train in Oregon at OHSU. Not only did I receive world class training I was also able to experience all that Portland and the Northwest had to offer. After my fellowship I returned to the Pacific Northwest and I became a member of the Adventist Hospital orthopedic program in Portland. Currently I am treating the entire spectrum of foot and ankle disorders along with general orthopedic fracture care.

Although work keeps me busy, I still try to enjoy all that Oregon has to offer. My wife and I take our two kids on adventures such as salmon fishing, hiking, snowboarding, and hiking.

DANIEL WIEKING, MD

We left OHSU and spent six months in Melbourne, AUS, doing a Foot and Ankle Fellowship with the Melbourne Orthopedic Group. After returning to the States, we settled in Grants Pass, OR where I am in the process of building a practice as a lower extremity generalist. My first year, we bought a hundred year old dairy barn which we have finished remodeling into a house. We now have 6 chickens, 7 goats, 2 miniature horses, and two life size children. We still travel to Portland for the food.

Where are They Now?

JACQUELINE MUNCH, MD

After graduating from OHSU, I spent one year in Manhattan, training in Sports Medicine and Shoulder Surgery at the Hospital for Special Surgery (HSS). There, I provided team coverage for the New York Liberty professional women's basketball team, and the St. John's University women's soccer team, while learning from some of the best and brightest surgeons in the sports world. I was inspired by my fellowship director, Scott Rodeo, the medical director for the U.S. Olympic teams, to get involved in Olympic sports coverage. I will spend my first two-week rotation at the Olympic Training Center in Colorado Springs in February 2016. Thereafter, I have been accepted as a lay volunteer for the Rio Games this summer. This experience will serve a dual purpose as my honeymoon following a summer wedding.

When my fellowship training was finished, I signed on as a faculty member at OHSU. I became Assistant Program Director and Director of Surgical Simulation for the residency training program. The medical school's Orthopaedic Surgery Interest Group selected me as their faculty advisor, and I have been making strides toward capitalizing on the resources from the simulation laboratory experiences to support the medical student exposure to anatomy as it relates to orthopaedic surgery. Meanwhile, I am conducting research in various areas, including medical education research and biomechanical studies (for instance, ACL graft preparation). I wrote the proposals for two multicenter clinical trials focusing on patellofemoral instability, which are being led by my fellowship institution, HSS. Other involved centers include OHSU, Texas Scottish Rite Hospital for Children, San Diego Children's Hospital, Mayo Clinic, Boston Children's Hospital, and Cincinnati Children's Hospital. These studies will hopefully help to shape our understanding of the patellofemoral joint and the indications for various forms of conservative and surgical treatment. My research interests are broad, and I have a particular interest in understanding and improving our treatment for ligament injuries and knee/shoulder instability.

Where are They Now?



LAURA MATSEN KO, MD

My medical school and residency years at OHSU gave me a solid platform on which to build my career in reconstructive orthopaedic surgery. On graduation I had the great opportunity to work with Dr. Paul Duwelius at the Orthopedic Fracture Clinic in Portland. He and his partners provided a broad experience including minimally invasive surgery, the posterior total hip approach, and press fit knees. We also studied models of efficiency in the OR. I had the opportunity to join Dr. Duwelius for a trip to the Dominican Republic as a part of Operation Walk/ Freedom to Move where we helped local residents and surgeons learn to do joint replacements on the many patients in need there. My second fellowship was with the Rothman Institute in Philadelphia where I had a year-long opportunity to work with some of the true leaders in the field of hip and knee joint reconstruction: Drs. Rothman, Austin, Parvizi, Hozack, Chen, Sharkey, Deirmengian, and Lonner. There, I developed my skills in additional approaches to the hip, including the anterior, anterior-based-muscle-sparing and direct lateral approaches as well as revision total knee and total hip surgery. During that year, I focused on outcome research including the outcomes of dual mobility sockets, the outcomes of robotic- assisted partial knee replacement, and the outcomes of using spinal anesthetic. I also researched prosthetic joint infections, including the effects of implementing a multimodal approach to decrease infection rates.

Since completing fellowship, my husband Kevin Ko (and co-resident) and I have joined OPA Orthopedics in Seattle, WA. We have very much enjoyed starting practice and putting all our years of learning into helping our own patients.

We are thrilled to be back in the Pacific Northwest where we can return to our favorite sports of backcountry skiing, running, cycling and mountaineering. Of note, we were recently blessed with a son: Logan Matsen Ko.

I am most grateful to OHSU for 8 years of great educational experience. The faculty, the staff and my fellow residents were wonderful and so many remain my very closest friends. A very special thanks to Dr. Yoo for his development of such a terrific residency program on which all of my subsequent orthopaedics has been based.

Where are They Now?

MICHAEL KUHNE, MD

After spending a year in San Francisco, CA completing a Trauma Fellowship at the Orthopaedic Trauma Institute, I was stationed at Marine Corps Base Camp Lejeune in Camp Lejeune, NC. I am currently the orthopaedic trauma surgeon at Naval Hospital Camp Lejeune serving the Sailors and Marines stationed here. My military commitment will be complete later this year, at which time I plan to separate from military service. We plan to move back across the country to Chico, a town in Northern California, where I will be an orthopaedic traumatologist at Enloe Medical Center. We are looking forward to our move back to the West Coast. Jayson is turning 6 and finishing kindergarten and Andrew will be 4 years old early this year. We send our best wishes to Portland, and everyone we've had the pleasure of knowing during our 4 years at OHSU.

GRADUATE	FELLOWSHIP TRAINING	CURRENT PRACTICE LOCATION
2015		
Alex DeHaan	Adult Reconstruction - Tahoe Reno Arthroplasty Fellow, Reno, NV	
Troy Miles	Adult Reconstruction - UC Davis, Davis, CA	
Dustin Larson	Hand and Upper Extremity - Univ. of New Mexico, Albuquerque, NM	
Vivek Natarajan	Pediatrics - Children's Hospital of Pittsburgh, PA	
John Seddon	Foot & Ankle - Melbourne Orthopedic Group, Melbourne, Vic, Austrailia/Summit Orthopaedics, Portland, OR	
2014		
Zachary B. Domont	Sports Medicine - Univ. of Pennsylvania, Philadelphia, PA	AMG-Lincolnshire Orthopedics, Lincolnshire, IL
Jia-Wei Kevin Ko	Shoulder & Elbow - Rothman Institute, Thomas Jefferson Univ., Philadelphia, PA	Orthopedic Physician Associates, Seattle, WA
Trevor C. McIver	Spine - Spine Institute of Arizona, Scottsdale, AZ	St. Cloud Orthopedics, St. Cloud, MN
Richard J. Myers	Orthopaedic Trauma - Univ. of Maryland, College Park, MD	Sentara Orthopedic Trauma Specialists, Norfolk, VA
Brent M. Roster	Foot & Ankle - Univ. of California Davis Medical Center, Sacramento, CA	Missoula Bone and Joint, Missoula, MT
2013		
Adam P. Baker	Foot & Ankle - Northwest Orthopedic Specialists, Portland, OR	Adventist Hospital, Portland, OR
Michael Kuhne	Trauma Orthopedics - Univ. of California, San Francisco General Hospital, San Francisco, CA	Camp Lejeune Naval Hospital, Jacksonville, NC
Laura J. Matsen Ko	Adult Reconstruction - Thomas Jefferson Univ., Philadelphia, PA	Orthopedic Physician Associates, Seattle, WA
Jacqueline L. Munch	Shoulder Surgery, Sports Medicine - Hospital for Special Surgery, New York, NY	Oregon Health & Science Univ., Portland, OR
Daniel C. Wieking	Foot & Ankle - Melbourne Orthopaedics, Melbourne Australia	Orthopedic Physician Associates, Seattle, WA
2012		
Dawson S. Brown	Sports Medicine - Southern California Orthopedic Institute, Van Nuys, CA	West Sound Orthopedics, Silverdale, WA
Peter D. Fredericks	Trauma Orthopedics - Indiana Orthopaedic Hospital, Indianapolis, IN	Colorado Springs Orthopedic Group, Colorado Springs, CO
Matthew D. McElvany	Shoulder & Elbow - Univ. of Washington Medical Center, Seattle, WA	Kaiser Permanente, Santa Rosa, CA
Cuchulain Luke Rust	Foot & Ankle - Orthopaedic Associates of Michigan, Grand Rapids, MI	Rebound Orthopedics, Vancouver, WA
2011		
Matthew J. Harrison	Foot & Ankle - Oakland Bone & Joint Specialist Clinic, Oakland CA; Middlemore Hospital, Auckland, New Zealand	Alta Orthopedics, Santa Barbara, CA
Jayme R. Hiratzka	Spine Surgery - Univ. of Utah, Salt Lake City, UT	Oregon Health & Science Univ., Portland, OR
Jackson B. Jones	Adult Reconstruction - Harvard Medical School's Brigham and Women's Hospital, Boston, MA	Reno Orthopedic Clinic, Reno, NV
2010		
Matthew W. Bradley		Orthopedic Sports Medicine & Spine Care Institute, St. Louis, MO
Gregory D. Byrd	Hand - Beth Israel Deaconess Medical Center, Boston, MA	Olympia Orthopedics, Olympia, WA
Adam E. Cabalo	Spine - Spine Care Medical Group, Daly City, CA	Southern Oregon Orthopedics, Medford, OR
Patrick J. Denard	Shoulder - Centre Orthopédique Santy, Lyon, France and San Antonio Orthopaedic Group, San Antonio, TX	Southern Oregon Orthopedics, Medford, OR
Gary Kegel	Hand - St Luke's-Roosevelt Hospital Center, New York, NY	Group Health Capital Hill Medical Center, Seattle, WA

GRADUATE	FELLOWSHIP TRAINING	CURRENT PRACTICE LOCATION
2009		
Stephen L. Pro	Sports Medicine - Santa Monica Orthopaedic and Sports Medicine Group, Santa Monica, CA	Ortho Kansas, Lawrence, KS
Khalid Shirzad	Foot & Ankle - Duke Univ. School of Medicine, Durham, NC	Northwest Orthopedic Specialist, Spokane, WA
Abner M. Ward	Hand - SUNY Stony Brook Univ. Hospital & Medical Center, Stony Brook, NY	VA Pacific Islands Health Care System, Honolulu, HI
2008		
Kate B. Deisseroth		Malcolm Grow Medical Center, Andrews Air Force Base, MD
Andy J. Kranenburg	Surgery and Trauma - San Francisco Spine Institute, San Francisco, CA	Southern Oregon Orthopedics, Medford, OR
Kenna Larsen	Hand - Univ. of New Mexico, Albuquerque, NM	Utah Orthopaedics, Ogden, UT
2007		
William Magee	Sports Medicine -TRIA Orthopaedic Center, Park Nicollet Methodist Hospital, Minneapolis, MN	Rockwood Clinics, Spokane, WA
J. Rafe Sales	Spine-San Francisco Spine Institute, San Francisco, CA	Summit Spine, Portland, OR
Joseph Schenck	Sports Medicine - Perth Orthopaedic Sports Medicine Center, Perth, Australia and Arthroscopic Surgery and Computer Navigated Total Joint Arthroplasty - Sir Charles Gairdner Hospital, Nedlands, Western Australia	Orthopedic & Sports Medicine, Portland, OR
Robert L.Tatsumi	Spine - LA Spine Institute, Santa Monica, CA	Oregon Spine Care, Tualatin, OR
2006		
Catherine A. Humphrey	Trauma - Vanderbilt Univ. Medical Center, Nashville, TN	Univ. of Rochester Medical Center, Rochester, NY
Amer J. Mirza	Trauma - Harborview Medical Center, Seattle, WA	Summit Orthopaedics, LLP, Portland, OR
Mark B. Wagner		Orthopedics NW, Tigard, OR
2005		
Patrick A. Dawson	Upper Extremity and Sports Medicine - Congress Medical Associates, Pasadena, CA	Cascade Orthopaedic Group, Tualatin, OR
Suresh Kasaraneni		Scott Memorial Hospital, Scottsburg, IN
Christopher M. Untch	Surgical Services - Davis Monthan AFB, Tucson, AZ	Arizona Orthopedics, Tucson, AZ
Corey J. Vande Zandschulp	Trauma - OrthoIndy, Methodist Hospital, Indianapolis, IN	Summit Orthopaedics, LLP, Portland, OR
2004		
Benjamin C. Kam		Joint Base Elmendorf - Richardson, Anchorage, AK
Britton (Polzin) Frome	Hand Surgery - UT Southwestern, Dallas, TX	Summit Orthopaedics, LLP, Portland, OR
2003		
Jennifer R. Miller	Sports Medicine - Congress Medical Associates, Pasadena, CA	Idaho Sports Medicine Institute, Boise, ID
John B. Reid		Taos Orthopedic Institute, Taos, NM
Eric F. Shepherd	Trauma - UC Davis Medical Center, and Auckland City Hospital, NZ	Santa Barbara Orthopedic Associates, Santa Barbara, CA
2002		
Michael A. Binnette	Spine - Univ. of Washington, Seattle, WA	OA Center for Orthopaedics, Portland, ME
Kevin M. Kahn	Trauma - Universitatsspital, Zurich Switzerland, Vanderbilt Orthopaedic Inst., Nashville, TN	Rebound Orthopedics & Neurosurgery, Vancouver, WA
Tamara S. Simpson	Trauma - UCSF - Sports Medicine; Hennepin Medical Center, Minneapolis, MN	Cascade Orthopaedic Group, Tualatin, OR

GRADUATE	FELLOWSHIP TRAINING	CURRENT PRACTICE LOCATION
2001		
Michael J. Gustavel	Sports Medicine - San Diego Sports Medicine and Orthopaedic Center, San Diego, CA	Idaho Sports Medicine Institute, Boise, ID
James B. Hayden	Musculoskeletal Oncology - Massachusetts General Hospital, Boston, MA	Oregon Health & Science Univ., Portland, OR
Todd W. Ulmer	Sports Medicine - Univ. of Washington, Seattle, WA	Columbia Orthopedic Associates, Portland, OR
2000		
Mark S. Metzger	Joint, Spine & Tumor - Harvard Medical School, Boston, MA	
Lorenzo L. Pacelli	Hand & Microvascular Surgery - Hand Center, San Antonio, TX	Scripps Clinic Torrey Pines, La Jolla, CA
Edward A. Perez	Trauma - R. Adams Cowley Shock Trauma Center, Baltimore, MD	Campbell Clinic Orthopaedics, Germantown, TN
1999		
Anthony I. Colorito	Sports Medicine - Cincinnati Sports Medicine and Orthopedic, Cincinnati, OH	Orthopedic & Sports Medicine, Portland, OR
John M. Kioschos	Shoulder and Elbow Surgery - Florida Orthopaedic Institute, Tampa, FL	Tri Star Skyline Medical Center, Nashville, TN
Jill A. Rider-Graves		
1998		
John D. Curtis		Dory Orthopaedics, Uab Medical West, Bessemer, AL
Darrin F. Eakins	Sports Medicine and Knee - Royal N Shore Hospital, Sydney, Australia	Ortho Wilmington, Wilmington, NC
Ronald D. Wobig	Sports Medicine and Knee - Louisiana State Univ., Lake Charles, LA	Beaver Sports Medicine, Corvallis, OR
1997		
Dennis J. Davin		
Kevin M. Lee		Upper Valley Orthopedics, Rexburg, ID
Ronald L. Teed		Cascade Orthopedic Surgery, Hillsboro, OR
1996		
Knute C. Buehler	Lower Extremity Reconstruction - Scripps Clinic and Research Foundation, San Diego, CA	Center Orthopedic & Neurosurgical Care & Research, Bend, OR
Thomas J. Croy		310 Villa Road, Ste 108, Newberg, OR
Marc R. Davidson	Sports Medicine - The Hughston Clinic, Columbus, GA	Advantage Orthopedic and Sports Medicine Clinic, LLP, Gresham, OR
1995		
Douglas R. Bagge		Cortez Orthopedics, Cortez, CO
Robert A. Foster	Hand and Microvascular Surgery - Univ. of Minnesota, MN	Texas Orthopedics Sports and Rehabilitation Association, Austin, TX
Gregory A. Voit	Hand and Microvascular Surgery - Univ. of New Mexico Health Sciences Center, Albuquerque, NM	
1994		
Robert J. Grondel	Sports Medicine and Shoulder - Mississippi Orthopaedic & Sports Medicine Clinic; Trauma - Emanuel Hospital, Portland, OR	Orthopaedic Institute of Henderson, Henderson, NV
Allen L. Hershey	Lower Extremity Reconstruction - Scripps Clinic and Research Foundation, San Diego, CA	Precision Orthopedics and Sports Medicine, Salinas, CA
Brian J. Padrta	Foot and Ankle - Florida Orthopaedic Institute, Univ. of South Florida, Tampa, FL	Northwest Orthopaedic Specialists, Spokane, WA
Mark R. Rangitsch		Cheyenne Orthopaedics LLP, Cheyenne, WY

GRADUATE	FELLOWSHIP TRAINING	CURRENT PRACTICE LOCATION
1993		
Blaine A. Markee		
Dean K. Olsen		Park Nicollet Orthopaedics, Burnsville, MN
Andrew H. Schmidt	Adult Reconstruction, Shoulder Surgery, Trauma - Hennepin County Medical Center, Minneapolis, MN	Hennepin County Medical Center, Minneapolis, MN
1992		
Edward C. Pino	Sports Medicine - Cincinnati Sports Medicine, Cincinnati, OH; Foot & Ankle - Michigan Internat. Foot and Ankle Center, Detroit, MI	Kaiser Permanente, Denver, CO
Stephen S. Tower		Anchorage Fracture & Orthopedic Clinic, Anchorage, AK
Michael R. Van Allen	Hand and Microsurgery - Univ. of Alabama, Birmingham, AL	Legacy Meridian Park Medical Center, Tualatin, OR
1991		
Ronald R. Bowman		Tigard Orthopedic & Fracture Clinic, Portland, OR
William H. Dickinson		
Richard A. Rubinstein	Methodist Sports Medicine Center, Indianapolis, IN	Providence Portland Medical Center, Portland Knee Clinic, Portland, OR
1990		
Gregory T. Bigler	Sports Medicine and Arthroscopy - Harvard Medical School, Massachusetts General Hospital, Boston, MA	Thomas & Bigler Knee and Shoulder Institute, Las Vegas, NV
Adrian B. Ryan		Anchorage Fracture & Orthopedic Clinic, Anchorage, AK
Theodore S. Woll	Foot and Ankle - Univ. of Washington, Seattle, WA	Rebound Orthopaedics, Vancouver, WA
1989		
James R. Hazel		Tri-City Orthopaedics, Kennewick, WA
Asa E. Stockton		Eureka Community Health Center, Eureka Open Door, Eureka, CA
Keith J. Ure	Joint Replacement - Joint Replacement Institute, Orthopaedic Hospital, Los Angeles, CA	Olympic Medical Center, Sequim, WA
Robert G. Zirschky		Hope Orthopedics of Oregon, Salem, OR
1988		
John D. DiPaola		Occupational Orthopedics, Tualatin, OR
Jeffrey E. Flemming	Texas Southwestern Medical Center - Texas Back Institute, Dallas, TX	Providence Portland Medical Center, Portland, OR
Morris Hughes		
Michael B. Wyman		Orthopedic Specialists, Portland, OR
1987		
Dale G. Bramlet	Orthopaedic & Plastic Surgery, Hand and Upper Extremity - Univ. of Rochester Medical Center, Rochester, NY	Advent Orthopedics, Pinellas Park, FL
Scott B. Jones		Orthopedic & Sports Medicine Center of Oregon, Portland, OR
Stefan D. Tarlow	Knee Surgery - Dr. Jan Gillquist, Sweden; Sport Medicine - Dr. James Andrews, Birmingham, AL	Advanced Knee Care, PC, Scottsdale, AZ

GRADUATE	FELLOWSHIP TRAINING	CURRENT PRACTICE LOCATION
1986		
Mark J. Buehler	Hand - Duke Univ., Durham, NC	Providence Hospital, Portland, OR
Wendell D. Ferguson	Providence Medical Center, Portland, OR	Vallejo Kaiser Medical Center, Vallejo, CA
Paul A. Switlyk	Shoulder - Univ. of Western Ontario, London, ON	Orthopedic & Sports Medicine Center of Oregon, Portland, OR
1985		
Stanley J. Neitling		
Daniel N. Ovadia		Santa Barbara Cottage Hospital, Santa Barbara, CA
1984		
Steven J. Bruce		PeaceHealth Center Orthopedics, Bellingham, WA
Kenneth A. Hermens	Knee Reconstruction - UCLA, Los Angeles, CA, Kantonsspital Bruderholz, Basel, Switzerland	Tuality Orthopedic, Sports, Spine & Rehabilitation Center, Hillsboro, OR
Wendy M. Hughes	Baylor University in Dallas, TX	Portland VA Medical Center, Portland, OR
1983		
Michael J. Grundy	Strong Memorial Hospital	Piedmont Hospital, Atlanta, GA
Paul J. Mills		Stanford Hospital and Clinics, Redwood City, CA
John C. Schwartz		Orthopedic Specialists, Mid Columbia Medical Center, The Dalles, OR
1982		
Julie Isaacson		Retired
James D. Livermore		Whidbey Orthopedic Surgeons, Whidbey General Hospital and Clinics, Coupeville, WA
John S. Toohey	Spine - South Texas Orthopedic and Spinal Surgery Associates, San Antonio, TX	Univ. of Texas Health Science Center, San Antonio, TX
1981		
Christopher A. Blake		Willamette Valley Orthopedics, McMinnville, OR
Wayne K. Nadamoto		Kuakini Medical Center, Honolulu, HI
Samuel K. Tabet	Sports Medicine - Univ. of Oregon, Eugene, OR	New Mexico Orthopaedics, Albuquerque, NM
1980		
Lenart C. Ceder		Retired
Jonathan H. Hoppert		Retired
Robert W. Jordan		Retired
1979		
Brian Laycoe		Retired
Donald Peterson		
James Robbins	Cincinnati Sports Medicine & Orthopaedic Center, Cincinnati, OH	
1978		
Lyle Mason		Retired
Edgar K. Ragsdale		NW Surgical Specialists, Vancouver, WA
Enoch D. Shaw		700 Bellevue Street SW, Suite 225, Salem, OR

GRADUATE	FELLOWSHIP TRAINING	CURRENT PRACTICE LOCATION
1977		
David L. Noall		Retired
Byron K. Skubi		Whidbey Orthopedic Surgeons, Coupeville, WA
Robert K. Smith		Northwest Permanente PC, Clackamas, OR
Theodore J. Vigeland		Portland VA Medical Center, Portland, OR
1976		
Wayne C. Kaesche		Retired
Walter A. Smith		Retired
Stephen J. Thomas		Retired
1975		
Randy W. Crenshaw		
John O. Hayhurst		Retired
Patrick T. Keenan		
Kelsey C. Peterson		Pacifico Orthopedics Medical Group, Huntington Beach, CA
Ned R. Schroeder		Retired
1974		
Thomas W. Hutchinson		922 51st Street SW, Everett, WA 98203
Robert J. Porter		
Frederick L. Surbaugh		Retired
1973		
James L. Baldwin		Retired
David A. Haaland		
Craig MacCloskey		Retired
1972		
Michael S. Hmura		
Grant D. Lawton		
Michael R. Marble		
1971		
Charles B. Bird		
Robert G. Chuinard		
Jim Dineen		
Ilmar O. Soot		

GRADUATE	FELLOWSHIP TRAINING	CURRENT PRACTICE LOCATION
1970		
Philip J. Fagan		
Robert J. Foster	Univ. of Gothenburg Hospitals	Retired
Art Hauge		
Edwin A. Kayser		
Gerald T. Lisac		
Ira M. Yount		

1969
- Thomas E. Fagan
- Michael H. Graham
- George W. Ingham
- Joseph P. Klein
- Scott Struckman

1968
- Benjamin F. Balme
- James D. Kunzman
- James D. Nelson
- Frederick D. Wade

1967
- Michael S. Baskin
- John W. Gilsdorf
- John W. Thompson

1966
- Charles A. Bonnett
- McGregor L. Church
- Don D'Amico
- Fred G. Grewe
- Howard E. Johnson

1965
- Arthur L. Eckhardt
- John Hazel
- Richard L. Mercer

1964
- Robert F. Corrigan
- Richard C. Zimmerman

1963
- Donn K. McIntosh
- Michael R. Rask

1962
- Phaen Gambee
- Norman D. Logan
- Keith A. Taylor

1961
- Rodney K. Beals
- Thomas A. Edwards
- George Keyes
- Ralph E. Peterson

1960
- Charles A. Fagan
- Calvin H. Kiest
- Betty J. Hohmann
- Robert W. Straumfjord
- Bud Yost

1959
- Raymond A. Case
- James V. Harber

1958
- Richard G. Gardner
- William D. Guyer

1957
- Hadley F. Fitch
- Richard S. Gilbert

1956
- William E. Hummel
- Joseph R. McProuty
- Jack B. Watkins

1955
- Edward A. Attix
- Max M. Bocek

1954
- Howard I. Popnoe
- Dale D. Popp

1953
- Donald D. Smith

1952
- Melvin L. Makower

1951
- Bob Maris
- William E. Snell
- James W. Weed

1950
- Ralph Thompson

1949
- Howard Cherry
- Boyd G. Holbrook
- Richard J. Hopkins

1948
- Robert F. Anderson
- George W. Cottrell
- Carl L. Holm

1947
- Edward A. LeBold

1946
- William P. Horton
- Clyde D. Platner
- Faulkner A. Short

1945
- Joseph H. Gill

1943
- Paul G. Hafner

1942
- Rodney Begg
- Harold E. Davis

1940
- Leslie S. Porter

1938
- Arthur M. Compton

1935
- E.G. Chuinard

1931
- Harry Leavitt

1929
- D.G. Leavitt

1928
- Leslie C. Mitchell

1925
- John LeCocq

1924
- Leo S. Lucas

Special Thanks

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Mrs. Joyce Beals & Ms. Brynn R. Beals

The Beals family continues their generosity to our department with contributions in the name of Dr. Rodney Beals, and in their estate plans as an eventual beneficiary. The history of our department and orthopaedics in the state of Oregon would not be the same without the significant contributions of Dr. Beals, and the Beals family contributions are vital to keeping Dr. Beals hopes for Oregon Orthopaedics alive.

David Noall, MD

In 1941, my father, Lawrence Noall, started at the University of Oregon Medical School as an associate professor in the Division of Orthopedics. After World War II, he transitioned to the volunteer clinical staff until his retirement from surgery in 1975. I completed my residency in 1977 and was active on the clinical staff as Orthopedic Consultant for the Hemophilia Clinic until the late 1990s. After my father passed away in 2001, our family established the Lawrence Noall MD Fund for Excellence in Orthopaedic Resident Education in his memory. It has been exciting to watch the Department "grow up" from a Division in the Department of Surgery with fewer than 5 full time staff to a full-fledged Department which serves the community both in resident education and as a valuable referral destination for patients with unusual and difficult orthopedic problems.

In Addition

In addition, we sincerely thank the contributors who wish to remain anonymous, as well as the past and present residents, faculty and staff who so kindly donate to our department.

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Residency Coordinator
A special thanks to our Residency Program Coordinator, Robin Sasaoka. She is our continual resource for all resident needs. She coordinates all conferences, call schedules, educational schedules, financial paperwork, and much more.

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The editors would like to thank Marie Kane for all of her support to make this journal a reality. Without her constant encouragement, support and expertise this publication would have never made it to the press.

The goal of this publication is to grow and mature over the next several years. We would love any input from our alumni and local community on ways to improve the journal.

If you are an alumni and your information has changed with regard to your current practice type and/or practice location, please contact us so that your information can be updated for next year's journal.

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Photo by Ryan Moore, MD, Radiology resident, OHSU

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You can make a significant impact on our ability to train the next generation of specialists, advance patient care, and develop new knowledge through research. We are building on a legacy of excellence that spans Richard Dillehunt, M.D., and Leo Lucas, M.D., to Lawrence Noall, M.D., and Rodney Beals, M.D., to our current department chair, Jung Yoo, M.D. Your personal gift is a vital part of this legacy and will help us advance the future of Orthopaedics.

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