UC DAVIS HEALTH | Department of Orthopaedic Surgery

THE PAUL R. LIPSCOMB ALUMNI SOCIETY PRESENTS:

DEPARTMENT OF ORTHOPAEDIC SURGERY GRADUATE RESEARCH SYMPOSIUM

ROBERT HARPER, M.D.

ALVIN SHIEH, M.D.

AVREETA SINGH, M.D.

KYLE NATSUHARA, M.D.

TREVOR SHELTON, M.D.

UC DAVIS HEALTH | Department of Orthopaedic Surgery

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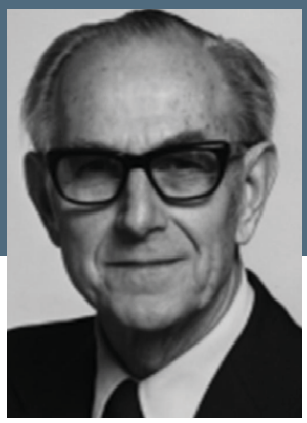
WELCOME TO THE 2020 PAUL R. LIPSCOMB ALUMNI SOCIETY GRADUATE RESEARCH SYMPOSIUM

This outstanding gathering is an opportunity for our department to highlight scientific as well as clinical research, and to reconnect with clinical faculty and alumni who have served our department over the years. This is an occasion to commemorate the graduation of five outstanding residents into the ranks of orthopaedic surgery. While always a bittersweet occasion, this day validates the wonderful camaraderie and continuity of our field. Thank you for being part of this memorable event.

ORTHOPAEDIC SURGERY CHAIRS



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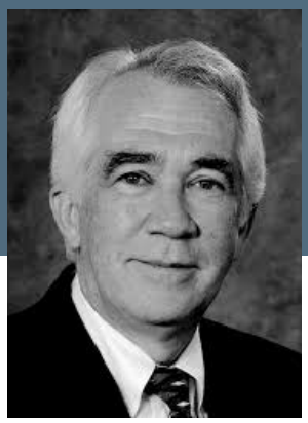
Lipscomb, M.D.
Professor
Emeritus Chair
1969-1979

Michael W.
Chapman, M.D.
Professor
Emeritus Chair
1979-1999



George T. Rab, M.D.
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Emeritus Chair
1999-2006

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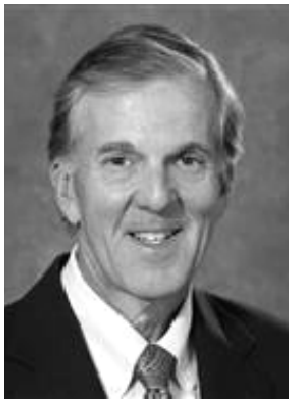
M.D., FACS
Professor and Chair
Michael W.
Chapman Chair
2006-2011



Richard A. Marder, M.D.
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Michael W. Chapman
Chair 2011– 2018

R. Lor Randall, M.D., FACS
Professor and Chair
The David Linn Endowed
Chair
2018– present

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Professor, Orthopaedic Research Laboratory

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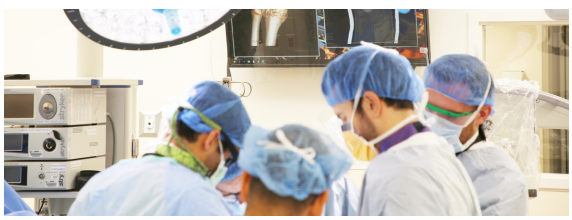
Associate Professor, Adult Reconstructive Service



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SHRINERS HOSPITAL FOR CHILDREN, NORTHERN CALIFORNIA

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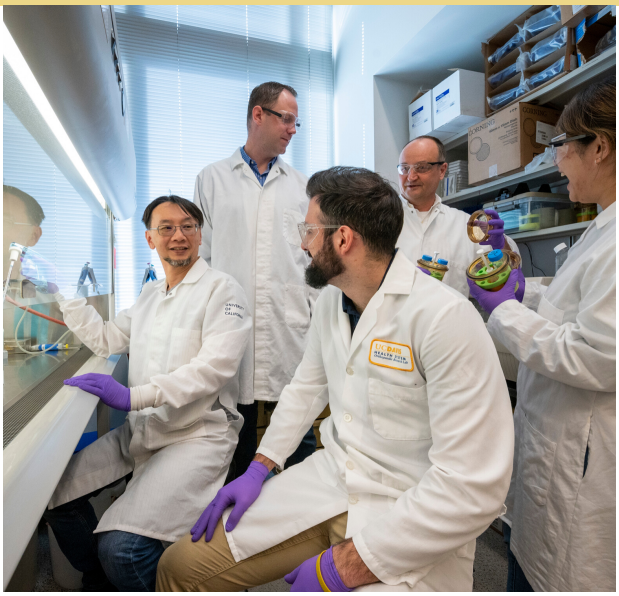

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KYLE M. NATSUHARA, M.D.

Education:
Undergraduate School:
University of California, Los Angeles
Medical School:
University of California, Los Angeles, School of Medicine

Next Step:
Orthopaedic Foot and Ankle Surgery Fellowship at Baylor University Medical Center (Dallas, TX).

Career Objective:
My career goal is to be the best orthopaedic surgeon I can be by providing all of my patients with my utmost attention, care and expertise. I want to give back to the community and be able to teach in some capacity as well. Additionally, I want to maintain a good work-life balance to be able to spend time with my wonderful family.

Significant Other/Children:
Shannon Natsuhara (nurse)
Noah (3-1/2 years old), Hannah (1 year old)

PERSONAL STATEMENT

It is surreal finally approaching the end of residency. It will be strange not starting my day off with 5809 triage and seeing/hearing my co-residents, and I will truly miss that. As challenging as residency can be at times, it is also so rewarding. I feel privileged to have been able to train here at UC Davis and learn from our

amazing faculty, diverse range of patients, and my talented co-residents. I am excited for the next steps of beginning fellowship and starting my career. I want to thank all of my co-residents, especially my co-chiefs, for their great camaraderie and friendship. Most importantly, I want to thank my wonderful wife and children for always supporting me. I would not have made it through residency without you!

A Comparison of Tibiotalocalcaneal Hindfoot Fusion Nails: Dynamic Nitinol Compression Versus Static Compression

Kyle M. Natsuhara MD, Kimberly Allen, Emily Bolton, Eric Giza MD, Christopher D. Kreulen MD, MS

Background:

Hindfoot nails are an accepted way of achieving tibiotalocalcaneal (TTC) arthrodesis, although there is still a risk of nonunion and continued pain. Recently, hindfoot nails with an internal nitinol compression element have been developed to achieve continual compression. The purpose of this study was to compare the rate and robustness of fusion using a nail with static compression (SC) versus dynamic nitinol compression (NC).

Methods:

At a single institution between 2010 and 2018, patients were identified who had undergone TTC arthrodesis utilizing a hindfoot nail and had at least six weeks of radiographic followup. 36 patients were managed with a NC nail and 46 patients were managed with a SC nail. Fusion was determined by radiographic analysis.

Results:

There was an 89% union rate of all joint surfaces at one year postoperatively in the NC nail group compared to 73% in the SC nail group. There was a statistically higher fusion rate in the NC nail group of the tibiotalar joint at the three month time point and of the subtalar joint at the six week time point. There was a significantly higher median percentage fused in the NC nail group of both the tibiotalar and subtalar joints at the six week time point.

Conclusion:

The NC nail appeared to achieve an increased fusion rate, an earlier time to fusion, and a more robust fusion of the tibiotalar and subtalar joints when compared to the SC nail.

AVREETA K. SINGH, M.D.

Education:
Undergraduate School:
UC Davis
Medical School:
UC Davis School of Medicine

Next Step:
Hand Surgery Fellowship Massachusetts General Hospital.

Career Objective:
Adult and pediatric hand surgery on West Coast near my family.

PERSONAL STATEMENT

I feel extremely proud to be a part of the UC Davis Orthopaedic Department. I am indebted to the faculty and educators we are surrounded by, and feel grateful for their passion and dedication to our education. I want to say thank you to my residency brothers and sisters who made coming to work everyday such a joy. The department and residency has really blossomed in my time here, and I think this is just the beginning.

Development of a Smartphone Videogame to Measure Thumb Activity in Pre-Schoolers

Avreeta Singh, MD, Anita Bagley, PhD, Michelle James, MD.

Purpose:

A smartphone videogame for young children was developed in an effort to take advantage of touch screen technology to evaluate motor function. Other applications have tested older children's ability to use a phone, whereas the current app, Barnyard ThumbP is intended to specifically test thumb function in younger children. A tool that reproducibly assesses hand function in preschoolers could help hand surgeons time reconstruction in order to optimize function and minimize risk in children with hand deformities. The purpose of this study was to obtain normative data for such a tool, with the hypothesis that 2-8 year old children with typical hand function would show age-based differences in their ability to play a smartphone video game.

Methods:

88 subjects aged 2-8 years (mean, 4.9 years) with normal thumb function, played a smartphone videogame developed for this study. Subjects instructed to "hit" targets appearing on the screen using only their thumbs, in 50 possible random locations. They completed a 3-minute game twice. The number, timing, and location of hits were scored. Parents and investigators completed questionnaires regarding subject's engagement and ability to follow directions with the test. Scoring parameters were compared by age (6 month intervals) using correlation coefficients, and test-retest performance was measured using interclass correlation coefficients.

Results:

Test performance improved with increasing age. There was a strong positive correlation (r = .85) between increasing age group and average number of hits (Figure 1). There was a strong negative correlation (r = -.94) between increasing age group and average time to hit (Figure 2). Interclass correlation coefficent for test-retest performance was 0.827. Subjects >54 months used only their thumbs 98% of the time to complete the test, whereas subjects <54 months used only their thumbs 47% of the time.

Conclusion:

This smartphone application can reliably discriminate the number, timing, and location of "hits" based on age in typically developing children. The application makes it possible to test thumb function in children, at the age when surgeons typically reconstruct hand malformations. Different abilities based on age can be factored in to the evaluation of surgical results using this application, to determine which improvements are associated with normal development and which are due to surgical intervention. This tool is relevant and applicable for preschoolers, who are typically exposed at an early age to touch screen phones. It is easy to use and could be incorporated into a busy clinic setting.

ALVIN K. SHIEH, M.D.

Education:
Undergraduate School:
University of California, San Diego
Graduation School
University of California, San Diego
Medical School:
University of California, San Diego School of Medicine

Next Step:
Orthopaedic Trauma Fellowship at Harborview Medical Center, Seattle, WA.

Career Objective:
To be a great surgeon!

Significant Other:
Allison Han

PERSONAL STATEMENT

I am forever grateful to the program for giving me the opportunity to train in such a rich learning environment. As I look back at my time here, I think about the great residents who came before me and the faculty who taught me what it takes to be dedicated to a craft - they have been an inspiration throughout this whole process. I am fortunate to have shared this experience with amazing residents who have become like family to me. Most importantly, I would like to thank my wife and parents for supporting me throughout this journey.

Defining Stability in Pediatric Femoral Shaft Fractures Treated with Titanium Elastic Nails

Alvin K Shieh, MD MS, Augustine M Saiz Jr, MD, Kelsey Hideshima BS, Brian Haus MD, Holly B Leshikar, MD MPH

Introduction:

Optimal pediatric femoral shaft fractures patterns or lengths amenable to titanium elastic nail stabilization has not been well defined. The purpose of this study is to identify radiographic measurements based on fracture pattern, location, and injury severity predictive of treatment failure with titanium flexible intramedullary nails.

Methods:

A retrospective review was performed of all femoral shaft fractures treated with flexible intramedullary nails over a 5-year period. All patients who had at least 6 weeks of post-operative radiographic imaging was included. Fracture characteristics including location, pattern, length relative to cortical width, and obliquity in angles were recorded. Injury severity factors measured on injury radiographs such as angulation, translation, and shortening were also documented. Post-operative radiographs after bony bridging but prior to bony remodeling were reviewed to determine the amount of shortening or angulation. Unplanned post-operative interventions were considered complications.

Results:

There were 58 patients with 60 femoral shaft fractures stabilized with titanium nails, with 46 healing within acceptable parameters and 14 considered treatment failures based on treatment guidelines. 6 patients developed loss of reduction requiring early intervention. Between the treatment success and treatment failure groups, fracture pattern, location, and length or obliquity were not statistically different. Initial fracture severity also was no different between the two groups. Mean nail canal fill was significantly lower in the failure group, with ROC curve identifying canal fill 76% as the optimal threshold to minimize risk of failure.Conclusion: Fracture length, pattern, or degree of injury may not preclude successful treatment with titanium elastic nails. As the failure group had a lower mean nail canal fill, we recommend the use of larger nail sizes in the treatment of pediatric femoral shaft fractures, especially if there is concern for residual instability.

ROBERT A. HARPER, M.D.

Education:
Undergraduate School:
University of Missouri-Columbia
Graduate School
Washington University in St. Louis
Medical School:
university of Missouri School of Medicine

Next Step:
Stanford University Spine Surgery Fellowship.

Career Objective:
My career objective is to always do the right thing for my patients.

Significant Other/Children:
Spouse: Janine Harper
Children: Brynn and Oliver Harper

PERSONAL STATEMENT

Each of our lives is the sum total of of the many people that have helped us along the way. As we come to the end of out training at UC Davis, I am overcome with gratitude to those that made this possible. I thank my amazing and patient wife, who has moved across the country, put up with the long hours, and endured the delayed gratification that is medical training, all with nothing but love and support. She has never wavered in her commitment to our family. I thank her also for my greatest gift, our two beautiful children, who are a miracle in every way. I thank my parents

who endowed me with the notion that all things are possible, but with the knowledge and the work ethic to see them through. They are the true manifestation of unconditional love. I thank my co-residents who made training more bearable with their friendship and humor. I thank the many attendings who lent their expertise, their time, their patients, and occasionally their patience in training me to be a surgeon. And finally, I thank the innumerable patients who put their trust in me everyday to care for them and to put their health and interests above my own.

A Comparison of the Incidence of Symptomatic Hip Arthritis in Long Fusions to the Pelvis vs the Sacrum

Robert Harper MD, James Reynolds MD, Max Haffner MD, Eric Klineberg MD

Background:

It is known that articular structures adjacent to fused joints are predisposed to progression of osteoarthritis, as contact forces and motion increase. Recent collaboration between the Adult Spine Service and the Adult Reconstruction Service at UC Davis has revealed that there is a higher risk of need for total hip arthroplasty in Adult Spinal Deformity patients that are female and that have longer fusion constructs. The distal extent of the fusion was not identified in the study. It is not currently known, when considering fusion to the sacrum vs the ilium, which fusion construct leads to a higher incidence of symptomatic hip arthritis.

Methods:

We conducted a retrospective review of adult patients (greater than 40 years of age) who underwent posterior lumbar fusion surgery (3 vertebral segments or greater) with the Orthopedic Spine Department from 2014-present. We searched operative records via CPT codes establish our cohorts. The first cohort was 67 patients with fusion 3 levels or greater that conclude at the sacrum. The second cohort was 80 patients with fusion 3 levels or greater that conclude at the ilium. Age, sex, BMI, smoking status, number of levels fused, whether the patient underwent THA, and time to THA was collected.. Patients with THA prior to fusion, pelvic or LE trauma after fusion, rheumatoid or inflammatory arthritis, connective tissue disorder were excluded

Results:

A total of 70 patients met inclusion for the sacral fusion cohort. Four patients (6.3%) from the sacral fusion cohort underwent THA. A total of 80 patients met inclusion criteria for the pelvic fusion cohort. Seven patients (9.6%) from the pelvic fusion group underwent THA. The average time to THA in the sacral fusion group was 17.1 months (range 6.9-26.09 months). The average time to fusion in the pelvic fusion group was 21.2 months (range 6.5-39.6 months). In sub group analysis, A threshold that would the need for THA

The average time to THA in the sacral fusion group was 17.1 months (range 6.9-26.09 months). The average time to fusion in the pelvic fusion group was 21.2 months (range 6.5-39.6 months). In sub group analysis, A threshold that would the need for THA infusion patients was determined using the area under the curve (AUC) of the receiver operating characteristic (ROC) curve. For sacral fusion patients, 4 levels fused or greater was predictive of the need for THA (AUC=0.80556).

Conclusion:

There was no statistically significant difference in the incidence of symptomatic hip arthritis in comparison of fusion to the pelvis vs fusion to the sacrum in our pilot study, but did find that fusion of four levels or greater in the sacral chort did predict the need for eventual THA.

TREVOR J. SHELTON, M.D.

Education:
Undergraduate School:
University of Utah
Graduate School
University of Utah
Medical School:
University of Utah School of Medicine

Next Step:
Sports medicine fellowship at the Southern California Orthopedic Institute in Los Angeles followed by a hip preservation fellowship at The Steadman Clinic in Vail, CO.

Career Objective:
I want to be in a practice where I can treat a variety of hip, knee, and shoulder pathology to help restore patient function and quality of life both surgically and through research.

Significant Other/Children:
Erika Shelton
Colton (5 years), Caroline (3 years), Samuel (7 months)

PERSONAL STATEMENT

It's been an amazing 6 years here at UC Davis and I couldn't be more appreciative of my experience here. First I would like to thank my wife and family for supporting me through this incredible journey. Second, I would like to thank the faculty. The faculty have all been great and I feel like I could honestly reach out to them with anything at any time. Each one of them has helped shape who I am and has prepared me both technically and

clinically to move on to fellowship and beyond. Lastly, I would like to thank all the residents I've worked with. The best part of this residency has been the family type feel amongst the residents. Each is willing to help the other out and has a genuine interest in each other's life and well-being. I am proud to be graduating from such a great program and I look forward to the bright future of UC Davis Department of Orthopaedic Surgery.

Donor Age Effect on Biomechanical Properties in Bone-Patellar Tendon-Bone Allografts

Trevor J. Shelton, MD, MS, Connor Delman, MD, Sean M. McNary, PhD, J. Ryan Taylor, MD, MPH, and Richard A. Marder, MD.

Background context:

Patellar tendon allografts are a common graft choice for anterior cruciate ligament (ACL) reconstruction. Initial biomechanical properties may be important for graft selection and it is currently unknown whether aging effects the biomechanical properties of the patellar tendon.

Hypothesis/Purpose:

The purpose of our study was to determine whether donor age imparted a significant effect on the mechanism of failure and structural, material, and viscoelastic properties of central third patellar tendon allografts.

Study Design:

Controlled Laboratory Study

Methods:

34 younger (15-30 years of age) and 34 older (51-61 years of age) nonirradiated allografts from tissue banks were prepared isolating the central third of the patellar tendon using a 10 mm scalpel under 10 N loading to ensure uniformity of harvest. Bone blocks were potted in polymethylmethacrylate. Tendon length and cross-sectional area were measured using a micrometer. A mechanical loading system was used to precondition the grafts for 103 cycles with load between 50 and 250 N (1 Hz). A creep load (500 N) was applied at a rate of 100 mm/min (15 mins). Tendon recovery at 10 N was followed by pull to failure at a rate of 100% per second. Mechanism of failure (midsubstance vs. avulsion) was noted and the structural, material, and viscoelastic properties calculated and compared between groups.

Results:

There were 33 (97%) midsubstance tears in the younger group and 28 (82%) in the older group (p=0.034). Younger grafts had greater ultimate load to failure (1,782N versus 1,319N) (p=0.006) and ultimate tensile stress (37.4MPa versus 27.5MPa) (p=0.006). There were no differences in displacement, stiffness, strain, elastic modulus, creep displacement, and creep strain.

Conclusion:

These findings suggest that aging weakens the bone-tendon interface and decreases the ultimate tensile strength of patellar tendon allografts which could make older grafts more susceptible to a higher failure rate.

CONNOR M. DELMAN, M.D.

2019-2020 RESEARCH RESIDENT

Education:

Undergraduate School:
University of California, Los Angeles
Medical School
University of California, Davis School of Medicine

In Vivo Kinematics of a Medial Ball-and-Socket More Closely Mimic the Native Knee than a Low-Conforming TKA Design

Connor Delman, MD, Delaney Ridenour, BS, Stephen Howell, MD, Maury Hull, PhD

Background:

The intent of a cruciate substituting medial ball-and-socket with a lateral flat insert (B&S-Flat CS) TKA design is to provide kinematics that more closely mimic the native knee than

a low-conforming, posterior cruciate ligament retaining (LC CR) design. This studydetermined differences in femoral condylar motion relative to the tibial baseplate between each implant design in patients with bilateral calipered kinematically aligned TKAs.

Methods:

Both TKAs in twenty-five patients were imaged with single-plane fluoroscopy during a deep knee bend at ≥ 12 months of follow-up. Analysis following 3D model-to-2D image registration determined the anterior-posterior (A-P) location of the lowest point of the femoral condyles relative to the tibial baseplate in each compartment at 0˚, 30˚, 60˚, 90˚, and maximum flexion. Patients completed validated outcome scores for both knees.

Results:

For the medial compartment, the range of A-P motion of the femoral condyle was 1.3 mm for the B&S-Flat CS design and 3.6 mm for the LC CR design ($p<0.0001$). For the lateral compartment, the range of A-P motion was greater for the B&S-Flat CS design (9.4 mm vs. 5.7 mm, $p<0.05$). From 0˚ to 30˚, the lateral femoral condyle moved posteriorly for both implant designs (-4.9 mm vs -4.2 mm, $p=0.54$). From 30˚ to maximum flexion, the lateral femoral condyle moved an additional -3.4 mm posteriorly for the B&S-Flat CS design, whereas for the LC CR design, the lateral femoral condyle moved paradoxically 1.0 mm anteriorly ($p<0.001$). Internal rotation of the tibial baseplate on the femoral component during flexion was 4.5˚ greater for the B&S-Flat CS design (10.4˚ vs 5.9˚, $p<0.05$). The Oxford Knee, Forgotten Joint, WOMAC, and Oxford Knee Activity and Participation scores were not different between implant designs.

Conclusion:

Although both implant designs provided similar high outcome scores, the B&S-Flat CS design exhibited medial A-P stability and kinematics that more closely mimic the function of the native knee. In contrast, the LC-CR design functioned like an ACL-partial meniscal deficient knee with medial A-P instability and undesirable kinematics.

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Huge thank you to our Resident Program Leadership

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Steven Thorpe, M.D.
Residency Selection Director

Mark. A. Lee, M.D.
Vice Chair of Education

Margaret MacNitt
Education Programs Manager

Margaret Allen
Education Programs Coordinator

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