SECOND ANNUAL

OREF VIRTUAL NATIONAL

RESIDENT RESEARCH SYMPOSIUM

Tuesday, November 8, 2022

5:30 p.m. CST

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About OREF:
The Orthopaedic Research and Education Foundation (OREF) was founded in 1955 to ensure an expanding base of knowledge and effective, evidence-based treatment protocols for orthopaedic surgeons to continually improve patient care. Since its founding, OREF has funded more than $147 million in research and educational grants and awards that benefit all of orthopaedics. For more information about OREF grants and awards, please visit www.oref.org, follow OREF on its Facebook page (OREFtoday) and on Twitter (@OREFtoday).

OREF NATIONAL
RESIDENT RESEARCH SYMPOSIUM
SUMMARY AGENDA
Tuesday, November 8, 2022

5:30 p.m. – 5:40 p.m.	**Welcome and Introductions** Joshua J. Jacobs, MD President-Elect Orthopaedic Research and Education Foundation Thomas P. Sculco, MD President Orthopaedic Research and Education Foundation Lee Grossman Chief Executive Officer Orthopaedic Research and Education Foundation
5:40 p.m. – 6:20 p.m.	**Session I – Resident Research Presentations and Discussion** **Moderator: Joshua J. Jacobs, MD** Break
6:25 p.m. – 7:00 p.m.	**Session II – Resident Research Presentations and Discussion** **Moderator: Joshua J. Jacobs, MD** Break
7:05 p.m. – 7:30 p.m.	**Session III – Resident Research Presentations and Discussion** **Moderator: Joshua J. Jacobs, MD** Break – ***Judges and Presenters - Please submit your scores at this time***.
7:35 p.m. – 7:55 p.m.	**Keynote Speaker** ***Diversity in Orthopaedics: Where are we Today?*** Valerae O. Lewis, MD Professor, Orthopaedic Oncology, Division of Surgery Chair, Department of Orthopaedic Oncology, Division of Surgery Dr. John Murray Professor in Orthopaedic Oncology The University of Texas M.D. Anderson Cancer Center
7:55 p.m. – 8:00 p.m.	**Awards Presentation** Joshua Jacobs, MD
8:00 p.m. – 8:05p.m.	**Closing Remarks** Lee Grossman, MD

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KEYNOTE SPEAKER

Valerae O. Lewis, MD

Professor, Orthopaedic Oncology, Division of Surgery
Chair, Department of Orthopaedic Oncology, Division of Surgery
Dr. John Murray Professor in Orthopaedic Oncology
The University of Texas M.D. Anderson Cancer Center

Valerae O. Lewis, MD, the John Murray Professor of Orthopaedic Oncology, attended Yale University and graduated with a degree in Psychobiology. She then matriculated at Harvard Medical School, graduating with honors. Dr. Lewis completed her Orthopaedic training at the Harvard Combined Orthopaedic Residency Program in Boston, MA and her fellowship in Musculoskeletal Oncology at the University of Chicago.

Dr. Valerae O. Lewis is Professor and Chair of the Department of Orthopaedic Oncology at the University of Texas MD Anderson Cancer Center in Houston. She is also the Associate Director of the Department of Thoracic/Orthopaedic Center and Associate Director of the Sarcoma Center. Dr. Lewis is a leader in the field of Orthopaedic Oncology with particular expertise in limb salvage and pelvic sarcoma surgery in adult and pediatric patients. In 2011, she started the Multidisciplinary Pelvic Sarcoma Program at MD Anderson Cancer Center that not only addresses the clinical needs of this unique group of patients, but also works to improve both the clinical and functional outcome of patients with pelvic sarcoma. For the past ten years, Dr. Lewis has served as Director of the Musculoskeletal Oncology Fellowship Program at symposiums throughout the year and is active in the American Academy of Orthopaedic Surgeons (AAOS), American Orthopaedic Association (AOA), the Musculoskeletal Tumor Society (MSTS), and the International Society for Limb Salvage (ISOLS) and the Western Orthopaedic Association (WOA).

Judges

OREF Research Grants Committee Members

Eric R. Henderson, MD
Dartmouth-Hitchcock Medical Center

Joshua J. Jacobs, MD
Rush University Medical Center

Marci D. Jones, MD
University of Massachusetts

Matthew Silva, PhD
Washington University in St. Louis

Moderator

Joshua J. Jacobs, MD
Rush University Medical Center

OREF National Resident Research Symposium
DETAILED AGENDA
Tuesday, November 8, 2022
Program commencing at 5:30 p.m. CST

5:30 p.m. – 5:40 p.m.	**Welcome and Introductions** Joshua J. Jacobs, MD President-Elect Orthopaedic Research and Education Foundation Thomas P. Sculco, MD President Orthopaedic Research and Education Foundation Lee Grossman Chief Executive Officer Orthopaedic Research and Education Foundation
	Session I – Resident Research Presentations & Discussion **Moderator: Joshua J. Jacobs, MD**
5:40 p.m. – 5:45 p.m.	*A Vertebral Stem Cell Mediating Spine Fusion* Kyle W. Morse, MD, Hospital for Special Surgery
5:45 p.m. – 5:50 p.m.	*Buccally Absorbed Cannabidiol Shows Promise in Treating Pain and Improving Satisfaction Immediately Following Arthroscopic Rotator Cuff Repair: A Placebo-Controlled, Double-Blinded, Randomized Trial* Eoghan T. Hurley, MD, Duke University
5:50 p.m. – 5:55 p.m.	*Defining Endogenous Mitochondrial Transfer in Muscle Following Rotator Cuff Injury* Michael Davies, MD, University of California, San Francisco
5:55 p.m. – 6:00 p.m.	*Is a History of Pelvic Fracture an Indication for a Primary Elective Caesarean Section?* Katya Eve Strage, MD, University of Colorado
6:00 p.m. – 6:05 p.m.	*Serum Titanium Levels Remain Persistently Elevated but Urine Titanium is Undetectable in Children with Early-Onset Scoliosis (EOS) Undergoing Growth-Friendly Surgical Treatment: A Prospective Study* Kameron Shams, MD, University of Michigan
6:05 p.m. – 6:10 p.m.	*Heterogeneous Human Fibroadipogenic Cells Subpopulations are Altered in Injury* Steven Garcia, MD, University of California, San Francisco
6:10 p.m. – 6:20 p.m.	Question and Answers
6:20 p.m. – 6:25 p.m.	Break

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OREF National Resident Research Symposium
DETAILED AGENDA
Tuesday, November 8, 2022

Session II – Resident Research Presentations & Discussion
Moderator: Joshua J. Jacobs, MD

6:25 p.m. – 6:30 p.m.	*Factors Predicting Failed Same Day Discharge for Ambulatory Total Hip and Knee Arthroplasty* Hemant Reddy, MD, Montefiore Medical Center/Albert Einstein College of Medicine
6:30 p.m. – 6:35 p.m.	*The Importance of Patient Resilience on Outcomes Following Hip and Knee Arthroplasty* Zachary Clarke, MD, University of Colorado School of Medicine
6:35 p.m. – 6:40 p.m.	*Pregnancy in Orthopedic Residents: Peripartum Barrier Identified* Stacia Marie Ruse, MD, University of Michigan
6:40 p.m. – 6:45 p.m.	*Enhanced Tendon-to-Bone Attachment Healing Through Hedgehog Activation* Andrew Luzzi, MD, Columbia University Irving Medical Center
6:45 p.m. – 6:50 p.m.	*Artificial Intelligence Automated Analysis of Scapula Dynamics Using Dynamic Digital Radiography: Initial Reliability Study* Zaamin B. Hussain, MD, Emory University
6:50 p.m. – 7:00 p.m.	Question and Answer
7:00 p.m. – 7:05 p.m.	Break

Session III – Resident Research Presentations & Discussion
Moderator: Joshua J. Jacobs, MD

7:05 p.m. – 7:10 p.m.	*Patient-Reported Outcomes of Pain and Related Quality of Life One-Year Following Osseointegration in Patients with Lower-Extremity Amputations* Kylie Shaw, MD, University of Colorado
7:10 p.m. – 7:15 p.m.	*Risk for Total Knee Arthroplasty Following Anterior Cruciate Ligament Reconstruction* Paul M. Inclan, MD, Washington University in St. Louis
7:15 p.m. – 7:20 p.m.	*Can Laser-Assisted Indocyanine Green Angiography Be Used to Quantify Perfusion Changes by Anatomical Location During Staged Fixation of Pilon Fractures? A Pilot Study* Brendon Mitchell, MD, University of California, San Diego
7:20 p.m. – 7:30 p.m.	Question and Answer
7:30 p.m. – 7:35 p.m.	Break – Judges and Presenters - Please submit your scores at this time.

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A Vertebral Stem Cell Mediating Spine Fusion

Kyle W. Morse, MD
Hospital for Special Surgery

Purpose: We aim to identify the specific skeletal stem cell responsible for spine fusion.

Significance: Spine fusion is a common orthopedic procedure and multiple cellular adjuncts are used to improve fusion outcomes. The specific stem cell mediating spine fusion remains unknown.

Methods: A murine posterolateral spine fusion model was utilized with both iliac crest bone graft (ICBG) and demineralized bone matrix (DBM). Our group previously identified a distinct murine vertebral stem cell (VSC) and a Zic1-cre targeting this cell was created. Bone volume (BV) formed was measured with microCT and lineage tracing was performed with confocal microscopy. Flow cytometry was used to isolate the VSC.

Results: Lineage tracing within the fusion mass confirmed the contribution of the Zic1+ VSC lineage to osteoblasts in the fusion mass with both ICBG and DBM. Inducing a gain-of-function in Zic1+ VSCs via conditional deletion of the bone formation inhibitor, Shn3, triggered an increase in fusion BV, confirming that Zic1 stem cells functionally contribute to fusion mass formation. FACS identified that induction of fusion triggers egress of Zic1+ VSCs.

Conclusion: Skeletal stem cells marked by Zic1-cre were sorted as Lin-CD200+Thy-6C3-CD105- and are responsible for the fusion mass in a murine posterolateral spine fusion model.

Buccally Absorbed Cannabidiol Shows Promise in Treating Pain and Improving Satisfaction Immediately Following Arthroscopic Rotator Cuff Repair: A Placebo-Controlled, Double-Blinded, Randomized Trial

Eoghan T. Hurley, MD
Duke University

Purpose: The purpose of the study is to evaluate the effects of cannabidiol (CBD) on patients undergoing Arthroscopic rotator cuff repair (ARCR).

Significance: There is a paucity of literature to evaluate its effectiveness, safety, or ideal route of administration of CBD.

Methods: This is an FDA-sanctioned, multi-center, placebo-controlled, randomized, double-blinded trial conducted in 100 patients undergoing ARCR. The experimental group received an oral CBD tablet, while the control group received an identical placebo. Patients were followed-up on Day 1, 2, 7, and 14, and Visual Analog Scale (VAS) for pain, opioid consumption, and satisfaction with pain control were recorded.

Results: On Day 1, VAS pain score was significantly lower in those receiving CBD (4.4 ±3.1, 5.7 ±3.2, $p = 0.039$). On both Day 1 and Day 2, patient satisfaction with pain control was significantly higher in the CBD group (Day 1: 7.0 ±3.0, 5.6 ±3.7, $p = 0.040$ | Day 2: 7.3 ±2.5, 6.0 ±3.3, $p = 0.028$). There were no statistically significant differences in opioid consumption ($p > 0.05$).

Conclusion: Buccally absorbed CBD demonstrates an acceptable safety profile and shows significant promise in reduction of pain in the immediate peri-operative period following ARCR.

Defining Endogenous Mitochondrial Transfer in Muscle Following Rotator Cuff Injury

Michael Davies, MD
University of California, San Francisco

Purpose: To study horizontal mitochondrial transfer from fibroadipogenic progenitors (FAPs) to myogenic cells and examine the effects of beta-agonism on this process.

Significance: FAPs are muscle stem cells that provide support to myogenic cells and regulate muscle homeostasis. This study highlights a novel function of FAPs transferring mitochondria to myogenic cells.

Methods: Mouse and human FAPs were stained with mitochondrial dyes and co-cultured with myoblasts or satellite cells (SCs) and mitochondrial transfer was measured by flow cytometry. Isolated human FAP mitochondria were applied to SCs, and myotube fusion index (MFI) was calculated. Mouse and human single-cell RNA sequencing (scRNAseq) data was analyzed for genes associated with adipogenesis and mitochondrial transfer. PDGFRaCre^{ERT}/MitoTag FAP mitochondria reporter mouse underwent tendon transection and denervation and mitochondrial transfer was analyzed following beta-agonist treatment.

Results: Mouse and human scRNAseq identified an association between adipogenic differentiation and mitochondrial biogenesis in FAPs. Beta-agonism increased mitochondrial transfer in mouse FAP-C2C12 co-cultures (17.8±9.9% vs 99.6%±0.13%, $p<0.0001$). Human SCs treated with FAP mitochondria showed increased MFI compared to PBS (79.0%±7.8% vs 30.6%±9.7%, $p<0.0001$). Rotator cuff injury increased FAP mitochondria transfer to myofibers in mice.

Conclusion: We have described a novel mechanism of endogenous mitochondrial transfer between FAPs and myogenic cells.

Is a History of Pelvic Fracture an Indication for a Primary Elective Caesarean Section?

Katya Eve Strage, MD
University of Colorado

Purpose/Significance: Current literature reports higher rates of Caesarean sections (C-sections) in this cohort of women, ranging from 42% to 62% when compared to the national average rate of 32%. The purpose of this study was to compare rates of primary C-sections in women with a history of pelvic fracture.

Methodology: Retrospective review of female patients between ages of 18 and 45 years old who were admitted to a Level 1 trauma centre between 01/01/2005 and 01/01/2020 for a pelvic fracture and had a subsequent viable pregnancy.

Results: Thirty-five patients were identified. This cohort of women, compared to the institutional average, had 72% (26/36) vs. 87% vaginal deliveries and 28% (10/36) vs. 13% primary C-sections. Of the C-sections, 30% (2/8) were scheduled C-sections compared to institutional average of 8%, and 70% (7/10) were unscheduled C-sections compared to an institutional average of 92%.

Conclusion: Women with a history of pelvic fracture had a lower rate of primary C-sections (28%) compared to prior studies. In summary, our study showed similar rates of Caesarean sections in women with a history of a pelvic fracture compared to the general public, and therefore these women should be offered a trial of labour.

Serum Titanium Levels Remain Persistently Elevated but Urine Titanium is Undetectable in Children with Early-Onset Scoliosis (EOS) Undergoing Growth-Friendly Surgical Treatment: A Prospective Study

Kameron Shams, MD
University of Michigan

Purpose: Compare serum titanium levels in children with EOS treated with growth-friendly instrumentation (GFI) to age-matched controls and collect urine titanium and serial serum titanium in EOS patients. We hypothesized that EOS patients with GFI will have elevated serum titanium that persists over time with low urine titanium.

Significance: EOS patients with GFI are exposed to titanium early in life for an extended duration but the systemic effects are unclear. End-organ deposition of titanium and peri-implant chronic inflammation leading to osteolysis, pseudoarthrosis, and infection have been reported in adults with titanium implants.

Methods: Prospective case-control study. EOS patients with growing rods or VEPTR underwent urine titanium and serial serum titanium collection. Controls underwent serum titanium collection prior to fracture fixation. ANOVA and Chi-Square tests were performed.

Results: 20 EOS patients and 12 controls were analyzed. Mean serum titanium was significantly elevated in EOS patients compared to controls (5.4 vs. 0 ng/mL, $p<0.001$). Mean serum titanium at the second endpoint was 11 ng/mL. No EOS patients had detectable urine titanium.

Conclusion: EOS patients treated with GFI have elevated serum titanium levels compared to controls that persist over time with no renal excretion, raising concerns for end-organ accumulation with unknown long-term effects.

Heterogeneous Human Fibroadipogenic Cells Subpopulations are Altered in Injury

Steven Garcia, MD
University of California, San Francisco

Purpose: We hypothesize that human fibroadipogenic progenitor (hFAP) cells are a functionally heterogeneous population.

Significance: hFAPs are non-myogenic stem cells within skeletal muscle defined by expression of PDGFRa. PDGFRa+ cells have been shown to both aide myogenesis and promote degeneration. Whether this dual role of PDGFRa+ cells during injury is driven by PDGFRa+ subpopulations with distinct functions remains unclear.

Methodology: Isolated PDGFRa+ hFAPs from healthy and injured muscle underwent single-cell RNAseq (n=14). Characterization was performed with immunofluorescence staining and full-spectrum flow cytometry.

Results: hFAPs (24,928 cells) were analyzed and transcriptomically distinct clusters were identified by differential gene analysis. Differential expression of THY1, DLK1, and CD55 marked three overarching meta-subpopulations of hFAPs, while TPPP3 marked a muscle tenocyte progenitor population. Flow cytometry validation determined THY1+DLK1-CD55- cells were 11.8%, CD55+THY1-CD55- were 12%, and DLK1+THY1-CD55- were 6% of the total hFAP population. Proliferative (THY1+), pro-fibrogenic (CD55+) and tenocyte progenitor (TPPP3+) hFAP subpopulations were proportionally increased in injured muscle compared to healthy controls.

Conclusion: hFAPs are composed of transcriptionally distinct subpopulations that can be isolated based on expressed surface markers. hFAP heterogeneity demonstrated here may suggest evidence for the multiple roles hFAPs fill during muscle regeneration.

Factors Predicting Failed Same Day Discharge for Ambulatory Total Hip and Knee Arthroplasty

Hemant Reddy, MD
Montefiore Medical Center/Albert Einstein College of Medicine

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Purpose: Recognizing risk factors for unforeseen overnight admission (failure to launch; FTL) for total joint arthroplasty (TJA) is essential.

Significance: Most reports on the efficacy of same day discharge (SDD) TJA are within commercially insured populations from ambulatory surgery centers.

Methodology: We retrospectively reviewed SDD primary TJA patients between July 2020 and December 2021 at an urban academic medical center. Patients were excluded if the pre-operative plan was inpatient admission. Reasons for FTL, demographic and clinical data were collected. Differences between the FTL and successful SDD (SSDD) groups were compared by Chi-square and Mann-Whitney U-tests.

Results: 445 SDD-TJA patients were included. Medicare/Medicaid compromised 54%, and 73% were low socioeconomic status (Low-SES). FTL rate was 38% (169/445) with 94 (56%) due to PT failure and 34 (20%) for medical necessity. The remaining failed for pain, wound drainage, and miscellaneous factors. The FTL rate was higher in females than males (45% vs 24%; $p<0.01$) and for BMI $\geq$ 40 than BMI < 40 (64% vs 36%; $p<0.01$).

Conclusion: In contrast to prior studies, we report a high FTL, largely due to failure with PT and medical necessity. BMI $\geq$ 40, female gender and afternoon surgery completion are risk factors for FTL.

The Importance of Patient Resilience on Outcomes Following Hip and Knee Arthroplasty

Zachary Clarke, MD
University of Colorado School of Medicine

Purpose: 1) Use the PSEQ-2 to identify high resilience (HR) and low resilience (LR) patients undergoing hip and knee arthroplasty. 2)Compare preoperative patient resilience with validated patient reported outcome measures at different time points.

Significance: Recovery after hip and knee arthroplasty is challenging. There is limited data evaluating the effect of resilience on outcomes. The PSEQ-2 (Pain-Self Efficacy Questionnaire) is a validated measure of resilience via pain self-efficacy.

Methods: We used a PSEQ-2 score of >10 and <10 to create two cohorts: high resilience (HR) and low resilience (LR). PROMIS surveys were administered at pre-op, 3 months, and 12 months post-op. The data was evaluated using a Mann-U Whitney test.

Results: There was statistical significance for higher scores in the HR cohort for many of the surveys at various time points. HR patients scored better on all surveys at all timepoints.
Conclusion: HR patients go into surgery with better outcomes scores. The PSEQ-2 has a stronger predictive value for outcomes at 3 months than at 1 year after TKA. For THA, preoperative resilience has a stronger effect on outcomes at one year than TKA. The PSEQ-2 is a useful measure to set expectations before hip and knee arthroplasty.

Pregnancy in Orthopedic Residents: Peripartum Barrier Identified

Stacia Marie Ruse, MD
University of Michigan

Purpose: To determine the most prominent barriers to pursuing pregnancy during orthopaedic surgery residency.

Significance: While there are multiple barriers that may discourage women from choosing a career in orthopaedics, one area of concern is pregnancy in the midst of residency. This is important given that women are least represented of all surgical subspecialities.

Methodology: A 63-item survey was distributed to female orthopaedic surgeons in the US, including current residents and those who had completed training in an ACGME accredited US orthopaedic surgery training program.

Results: 328 women responded to the survey. The three most prominent barriers to pursuing pregnancy during orthopaedic residency included concerns about the ability to balance clinical duties and duties that come with being a new mother (67%), fear of how the resident would be viewed by those in the program (60%) and being unable to ensure optimal prenatal/postpartum care given an unpredictable schedule (38%).

Conclusion: The results raise concern that qualified female applicants may be deterred from orthopaedics given difficulties that come with being pregnant as a resident. If policies are created to support women who desire to have children as a resident, more females may be encouraged to pursue a career in orthopaedics.

Enhanced Tendon-to-Bone Attachment Healing Through Hedgehog Activation

Andrew Luzzi, MD
Columbia University Irving Medical Center

Purpose: Evaluate the effect of hedgehog(Hh) signaling upregulation on tendon-to-bone healing.

Significance: Rotator cuff repair failures occur largely due to insufficient regeneration of the mineralized-fibrocartilaginous, tendon-bone transition, termed the enthesis, and bone loss below the attachment site. Enthesis formation and mineralization are driven by Hh-responsive cells. Hh-signaling drives regeneration of injured entheses in young animals. Furthermore, Hh-agonism enhances bone formation.

Methods: Bilateral supraspinatus injury-and-repair was performed in 78 adult rats. Right shoulders received microsphere-encapsulated Hh-agonist, while left shoulders received control microspheres. Treatment effects were evaluated via gene expression, biomechanics, bone morphometry, and histology.

Results: *Gene expression*- At 3-days, treatment upregulated Hh-pathway genes (*GLI1, SMO)* and *RUNX2*, a transcription factor of osteogenesis. At 2-weeks, treatment upregulated transcription factors of tenogenesis (*SCX*) and chondrogenesis (*SOX9*), as well as genes of mineralized fibrocartilage extracellular matrix (ECM) (*COL2, COLX)*. *Bone Morphometry*- At 4-weeks, treatment increased trabecular thickness. At 8-weeks, there was a trend towards increased trabecular number. *Histology*- Treatment improved tendon-bone maturity, organization and continuity. *Biomechanics*- At 4-weeks, treatment increased ultimate stress. At 8-weeks, treatment increased work-to-failure, resilience, and yield force.

Conclusion: The effects of treatment on ECM production and mineralization improved biomechanical properties, indicating the therapeutic potential of Hh-agonism in tendon-bone healing.

Artificial Intelligence Automated Analysis of Scapula Dynamics Using Dynamic Digital Radiography: Initial Reliability Study

Zaamin B. Hussain, MD
Emory University

Purpose: Assess the reliability of an artificial intelligence (AI) automated image analysis software.

Significance: Dynamic Digital Radiography (DDR) is a novel technique that uses pulsed low-dose radiographs in the shoulder to allow dynamic non-invasive examination of glenohumeral and scapula kinematics. Manual measurement is the current gold standard to calculate the scapulohumeral rhythm (SHR) budis time consuming.

Methods: DDR was performed on 73 shoulders including normal controls and those diagnosed with rotator cuff tears, adhesive capsulitis, or glenohumeral osteoarthritis. Manual measurements of the angle between the humerus and the midline and the medial border of the scapula and midline were taken by two readers at 30, 60, and 90 degrees of shoulder abduction. Corresponding measurements were taken with a prototype automated AI algorithm to enable paired direct comparison and intra-class correlations (ICC) using a two-way random effects model.

Results: Total number of paired measurements was 219. Excellent inter-rater reliability - 0.87 (95% confidence interval 0.75 – 0.93) was found in the manual measurements. Moderate reliability - 0.58 (95% confidence interval 0.4-0.71) was found between the manual and AI measurements of SHR.

Conclusion: The prototype automated image analysis algorithm shows proof of concept, and early promise but requires further refinement before it can reliably replace manual measurement of SHR.

Patient-Reported Outcomes of Pain and Related Quality of Life One-Year Following Osseointegration in Patients with Lower Extremity Amputations

Kylie Shaw, MD
University of Colorado

Purpose: Our aim is to evaluate differences in pain and quality-of-life one-year after osseointegration (OI) of bone anchored prostheses (BAP) for patients with transfemoral (TF) and transtibial (TT) amputations.

Significance: About 75% of patients with lower extremity amputations experience varying pain phenotypes. Osseointegration allows for prosthetic limb wear through a bone-anchored implant, eliminating the need for a socket-prosthesis and offering improved function/mobility. Patient-reported outcomes (PROs) following OI have not been well studied.

Methodology: We analyzed severity and phenotypes of pain as measured by prospectively collected data from validated PRO surveys (NRS, PROMIS global health, SF-36, Q-TFA). Data was compared between initial and one-year post-operative visits.

Results: 36 participants underwent OI. Both TF and TT patients demonstrated significant improvement in pain intensity as measured by NRS ($p=0.018$) and PROMIS ($p=0.04$), as well as residual limb pain when walking/standing ($p<0.001$) one-year post-OI. This improvement in residual limb pain significantly improved the quality-of-life in both populations ($p= 0.008$;$p= 0.0002$). The improvement in general body pain and back pain is positively correlated with the change in case-specific residual limb pain ($r= 0.87$, $p<0.0001$) and phantom pain. ($r= 0.44$, $p<0.039$).

Conclusion: Osseointegration improves patient-reported pain and quality-of-life in lower extremity amputees.

Risk for Total Knee Arthroplasty Following Anterior Cruciate Ligament Reconstruction

Paul M. Inclan, MD
Washington University in St. Louis

Purpose: The purpose of this study is to define the incidence of and risk factor for total knee arthroplasty (TKA) in patient with prior anterior cruciate ligament reconstruction (ACLr).

Significance: ACLr is common in youth and young adult patients, but little data exists defining incidence of subsequent TKA in this population.

METHODS: The UK Biobank was utilized to define and compare age-specific cumulative incidence of TKA in patients with and without a history of ACLr. Cox regression modeling was utilized to calculate hazard ratios for undergoing TKA in this cohort.

Results: 2,517 individuals with prior ACLr were identified. Patients with prior ACLr demonstrated a cumulative incidence of 27.7% between 40 and 80 years of age. Patients with prior ACLr were 5.6x more likely to undergo TKA by age 60, when compared to individuals without prior ACLr. Body mass index >30 kg/m^2 (hazard ratio (HR) = 3.52, $p<0.001$), performing heavy physical labor (HR = 2.68 $p<0.001$), and having a job that always involved walking or standing (HR = 2.50, $p<0.001$) were associated with an increased risk for undergoing TKA.

Conclusion: Individuals face a substantially increased risk of TKA following ACLr and may be counseled on risk factors at time of ACLr.

Can Laser-Assisted Indocyanine Green Angiography Be Used to Quantify Perfusion Changes by Anatomical Location During Staged Fixation of Pilon Fractures? A Pilot Study

Brendon Mitchell, MD
University of California, San Diego

Purpose: To quantify soft tissue perfusion changes in pilon fractures during staged treatment using laser-assisted indocyanine green angiography (LA-ICGA).

Significance: External fixation is used to allow for soft tissue recovery in the setting of pilon fracture. However, literature in the last decade has demonstrated a potential role for early acute internal fixation, highlighting the need for adjunctive tools to assist in determining tissue perfusion.

Methods: We performed a prospective cohort study including 12 patients with pilon fractures. LA-ICGA using the SPY fluorescence imaging platform was performed. Fractional area of perfusion (FAP) was performed to objectively quantify soft tissue perfusion of the anterior, medial, and lateral ankle at the time of initial external fixation (EF) and at definitive fixation.

Results: FAP averaged 64% medially, 61% laterally, and 62% anteriorly prior to EF placement, and increased to 86% medially, 87% laterally, and 86% anteriorly at definitive fixation. FAP increased 24% medially ($p=0.0004$), 26% laterally ($p=0.001$), and 19% anteriorly ($p=0.002$).

Conclusion: Quantitative improvement in soft tissue perfusion was identified through the course of staged surgical management in pilon fractures. LA-ICGA may be used to determine appropriate timing for definitive surgical intervention based on the readiness of the soft tissue envelope.

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