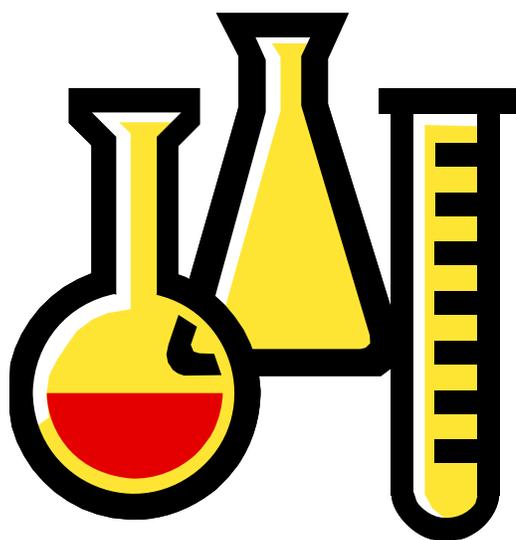


THE OHIO STATE UNIVERSITY

35th Annual
Mallory-Coleman
Resident Research Day



Friday, April 13, 2007
7:30 am

Blackwell Hotel
OSU Campus

PROGRAM

- 7:30 am Continental Breakfast
- 7:40 am Welcome and Introduction
- 7:50 am James Latshaw, M.D.
"Functional Outcome of Patients Treated with the Proximal Humeral Locking Plate for Displaced and Unstable Fractures of the Proximal Humerus"
- 8:05 am Brent Bickel, M.D.
"Cross-Sectional Area Measurement of the Semitendinosus and Gracilis Tendons for Anterior Cruciate Ligament Reconstruction in the Pediatric Patient"
- 8:20 am Jeffrey Feinblatt, M.D.
"Evaluation of "High Strength" Orthopaedic Suture: A Head-To-Head Comparison"
- 8:35 am Douglas Pittner, M.D.
"Treatment of Clubfoot with the Ponseti Method: A Comparison of Casting Materials"
- 8:50 am Erik Monson, D.P.M.
"A Retrospective, Short-Term Review of the Long-Arm Chevron Osteotomy in Correcting Mild to Severe Hallux Valgus Deformities"
- 9:05 am Eric Parsons, M.D.
"In Vivo Degradation Characteristics of Bioabsorbable Cross-Pins in Anterior Cruciate Ligament Reconstruction"
- 9:20 am Break
- 9:35 am John Mowbray, M.D.
"Two Team, Simultaneous Bilateral Knee Arthroplasty and the Obese Patient"
- 9:50 am Truitt Cooper, M.D.
"Cost Comparison of Allograft and Autograft Anterior Cruciate Ligament Reconstruction"
- 10:05 am Benjamin Taylor, M.D.
"Financial Impact of a Capitation Matrix System on Total Knee and Total Hip Arthroplasty"
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- 10:20 am Alicia Bertone, D.V.M., Ph.D.
"Mesenchymal Stem Cell Gene Delivery of BMP2 in an Articular Fracture Model"
- 10:35 am Kraig Solak, D.O.
"ACL Reconstruction with Hamstring Autograft vs. Tibialis Anterior Allograft: A Multivariable Analysis of Graft Failure, Single Surgeon, 2 Year Follow Up"
- 10:50 am Eric Parsons, M.D.
"Risk Factors for Graft Failure Following Anterior Cruciate Ligament Reconstruction Using Soft-Tissue Allograft: Does Tissue Bank Matter?"
- 11:05 am Break
- 11:20 am William Garrett, Jr, M.D., Ph.D., Visiting Professor and Moderator
"ACL Injury Mechanisms"
- 12:20 pm Lunch
- 1:05 pm Brad Ellison, M.D.
"Long-Term Femoral Remodeling With a Tapered Titanium Porous Plasma-Sprayed Primary Femoral Stem"
- 1:20 pm Atiba Jackson, M.D.
"Functional Outcomes of Distal Biceps Tendon Rupture Repair Using Anatomical Reattachment"
- 1:35 pm Peter Edwards, M.D.
"Possible Differences in ACL Injury Mechanisms Among Soccer Players: Contact vs. Non-Contact Injuries"
- 1:50 pm Graham Frazier, D.P.M.
"Acetylated Regenerated Cellulose in the Treatment of Chronic Diabetic Pressure Ulcerations of the Lower Extremity"
- 2:05 pm Isaac Meta, D.D.S.
"Appendicular Skeleton Phenotypes Extend to the Mandible of High and Low BMD Mice"
- 2:20 pm End of Day
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MALLORY-COLEMAN DAY

Mallory-Coleman resident research day was established by Drs. Thomas Mallory and Carl Coleman in 1972 in memory of Katherine Virginia Mallory and Sally Jo Coleman.

This research day was established in order to encourage the development of ideas related to research in orthopaedic surgery and related basic sciences.

Each year, a distinguished visiting professor from an outside institution is invited to moderate and analyze the resident presentations and provide constructive criticism and commentary.

Past Visiting Professors:

2006 Peter Stern, M.D.
2005 James Goulet, M.D.
2004 Steven Arnoczky, D.V.M.
2003 Joseph Buckwalter, M.D.
2002 Victor Goldberg, M.D.
2001 James Urbaniak, M.D.
2000 Douglas Jackson, M.D.
1999 Douglas Dennis, MD
1998 Thomas Einhorn, MD
1997 Larry S. Matthews, MD
1996 Gary Friedlander, MD
1995 James Herndon, MD
1994 Clement B. Sledge, MD
1993 Eric L. Radin, MD

2007 MALLORY-COLEMAN VISITING PROFESSOR AND MODERATOR:

WILLIAM GARRETT, JR., M.D, PH.D.



Dr. Garrett has a longstanding interest in orthopaedic sports medicine clinical practice and research. He has been especially interested in conditions affecting exercise and performance of the knee including anterior cruciate ligament, meniscus, cartilage, and patellar injuries.

He is past president of the American Orthopaedic Society for Sports Medicine and has served as a Director of the American Board of Orthopaedic Surgery, both of which he continues to serve in other capacities. He is also a member of the American Academy of Orthopaedic Surgeons and American College of Sports Medicine. He also serves on committees for the International Olympic Committee. For the past 16 years he has served as the Medical Director of the United States Soccer Federation and Chairman of the Physical Fitness, Sports Medicine and Research Committee. He has served as team physician with the U.S. Men's and Women's National Teams in World Cup competition.

Dr. Garrett is the author of 150 manuscripts in refereed journals, editor of 13 books and 50 book chapters. He is the recipient of numerous awards including the Kappa Delta Award from the American Academy of Orthopaedic Surgeons, the Citation Award for the American College of Sports Medicine, and the George D. Rovere Award for Education in the American Orthopaedic Society for Sports Medicine. He has won teaching awards at both Duke University and the University of North Carolina.

His clinical activities focus on arthroscopic and reconstructive surgery on the knee and shoulder. He is currently conducting basic and clinical studies on anterior cruciate ligament (ACL) injuries in athletes, particularly in better understanding the difference between ACL injuries in men and women. He is also working on new instrumentation for anterior cruciate ligament reconstructive surgery to create a more anatomic reconstruction with more normal biomechanics. His goal for the Michael W. Krzyzewski Human Performance Laboratory, otherwise known as the K-Lab, is to conduct research in injury prevention and performance enhancement for elite and recreational athletes.



James Latsban, M.D. is a Resident in Orthopaedics at The Ohio State University

FUNCTIONAL OUTCOME OF PATIENTS TREATED WITH THE PROXIMAL HUMERAL LOCKING PLATE FOR DISPLACED AND UNSTABLE FRACTURES OF THE PROXIMAL HUMERUS

Authors: James C. Lathsaw, M.D., Joseph Mileti, M.D.
Presenter: James C. Latsaw, M.D.

There is no universally agreed upon treatment method for displaced and unstable proximal humerus fractures. This study reports the radiographic and functional outcomes of patients with unstable and displaced fractures treated by a single surgeon with a proximal humeral locking plate.

Fourteen of 18 (77.8%) patients who suffered unstable or displaced proximal humeral fractures returned for a postoperative evaluation at a mean follow-up of 2.1 years (1.2-3.7). One patient was deceased and 3 were lost-to-follow-up. Treatment efficacy was assessed using the American Shoulder and Elbow Surgeons (ASES) Scoring System and safety was determined by the incidence of complications. Final radiographs were obtained to assess the adequacy of fracture reduction, fracture healing, and the presence of avascular necrosis.

The overall mean ASES Score for the repaired shoulder was 83.2, compared to a mean of 92.6 for the contralateral side. There was no statistically significant difference in the ASES Score between the repaired shoulder and contralateral side. The mean elevation for the repaired shoulder was 144.1° (120.0°-165.0°), compared to the mean elevation of 150.2° (70.0°-170.0°) for the contralateral side. The mean external rotation of the repaired shoulder was 67.1° (40.0° - 85.0°) versus 74.4° (30.0° - 90.0°) for the contralateral side. Impingement was observed in 2 shoulders (14.3%). Good to excellent shoulder strength was achieved in all cases.

Complete union was achieved in the 16 of the 17 fractures followed for a sufficient period of time. No patients developed avascular necrosis. Two patients had hardware penetration into the joint. 1 patient developed a nonunion

Utilization of this proximal humeral locking plate is a safe and effective option for the treatment of displaced, unstable proximal humeral fractures. Due to the excellent results, lack of complications, and successful outcomes, implementation of this technique is recommended



Brent Bickel, M.D. is a resident in Orthopaedics at Mt. Carmel

CROSS-SECTIONAL AREA MEASUREMENT OF THE SEMITENDINOSUS AND GRACILIS TENDONS FOR ANTERIOR CRUCIATE LIGAMENT RECONSTRUCTION IN THE PEDIATRIC PATIENT

Authors: Brent Bickel, M.D., Kevin Klingele, M.D., Brent Adler, M.D., John Mowbray, M.D.
Presenter: Brent Bickel, M.D.

We measured the cross-sectional area (CSA) of the semitendinosus (ST) and gracilis (GT) tendons in 26 pediatric patients (12-18 years of age) with an anterior cruciate ligament (ACL) injury using axial magnetic resonance (MRI) measurements. This is a retrospective review of these patients to scrutinize the appropriateness of using a double-looped hamstring graft for ACL reconstruction. Measurements of the CSAs of the ST and GT tendons were closely correlated with the intraoperative double looped hamstring graft area ($\gamma = 0.6395$) as well as the intraoperative graft diameter ($\gamma = 0.6413$). If the CSA of the combined ST and GT was greater than 17mm² then there was an 80% chance of obtaining an intraoperative graft of adequate size (7mm diameter) for ACL reconstruction. We conclude that the use of CSA measurements preoperatively may aid the surgeon in better informing the pediatric patient and their families regarding graft choices in ACL reconstruction procedures.



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EVALUATION OF “HIGH STRENGTH” ORTHOPAEDIC SUTURE: A HEAD-TO-HEAD COMPARISON

Authors: Jeffrey Feinblatt, M.D., David Flanigan, M.D., Alan Litsky, M.D., Sc.D.

Presenter: Jeffrey Feinblatt, M.D.

Abstract:

Suture material may be chosen by a surgeon for a variety of reasons which may include: permanence vs. absorbability, strength, knot security, handling characteristics, cost, and even color or markings which can aid in suture management. Recently, multiple high-strength permanent or semi-permanent suture materials have come to market, and currently play a large role in both open and arthroscopic orthopaedic interventions. While handling characteristics, color and markings will remain in the realm of personal preference, we are unaware of any previous publications that have compared these high-strength materials in terms of elongation, knot security and load to failure. We therefore set out to evaluate material properties and mechanism of failure (suture rupture vs. knot failure vs. excessive suture elongation) and load at failure utilizing three “high-strength” suture materials (Fiberwire, Orthocord, MaxBraid) compared with traditional Ethibond in six knot configurations.

Each suture was hand tied in similar fashion over a metal post measuring 21 cm. in circumference. Ten sutures each of #2 Ethibond, Fiberwire, Orthocord, and MaxBraid were tied in six separate knot configurations (Overhand with 3 Reverse Half-Hitches on Alternating Posts [O-3RHAP], Overhand with 3 of the Same Half-Hitches on the Same Post [O-3SHSP], Duncan Loop with a single Half-Hitch on the initial post followed by 2 Reverse Half-Hitches on Alternating Posts [DL-HHSP-2RHAP], Duncan Loop with 3 Reverse Half-Hitches on Alternating Posts [DL-3RHAP], SMC knot with a single Half-Hitch on the initial post followed by 2 Reverse Half-Hitches on Alternating Posts [SMC-HHSP-2RHAP], and SMC knot with 3 Reverse Half-Hitches on Alternating Posts [SMC-3RHAP]). Each suture tail was cut to approximately 4 mm. Each loop was passed around two rings attached to an MTS, pretensioned to 9 N, then cyclically loaded to 180 N at a rate of 1 Hz until failure (suture breakage, elongation or knot slippage) or a maximum of 3500 cycles. Displacement, number of cycles prior to failure, and failure mechanism were noted.

Results:

All knots in the O-3SHSP groups failed by knot slippage very early regardless of suture type. Both the DL and SMC knots with Fiberwire and MaxBraid failed by knot slippage. The MaxBraid O-RHAP group also failed by knot slippage, but after significantly more cycles. The Fiberwire O-RHAP group survived to the maximum number of cycles (3500) without failure. With the exception of the O-SHSP group, all Orthocord knots failed by suture breakage. The Ethibond broke prior to reaching 180 N.

Conclusion:

The O-3SHSP was a poor knot regardless of suture utilized, and we would recommend against its clinical use. Both DL and SMC knots with RHAP were superior to O-SHSP, but inferior to O-RHAP. Orthocord failed by suture breakage at the knot base indicating poor failure resistance in areas of stress concentration. Fiberwire in the O-RHAP configuration was the only group to survive to conclusion of cyclic loading, and we would recommend its use based on this mechanical testing. .



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TREATMENT OF CLUBFOOT WITH THE PONSETI METHOD: A COMPARISON OF CASTING MATERIALS

Authors: Douglas E. Pittner, M.D., Kevin E. Klingele, M.D., Allan Beebe, M.D.
Presenter: Douglas E. Pittner, M.D.

Purpose:

Popular treatment for congenital clubfoot includes serial manipulations described by Ponseti. Two materials are commonly used for casting. Plaster is very moldable but also heavy, easily damaged by water, and difficult to remove. Semirigid fiberglass has provided an alternative that is more durable, convenient, and often better tolerated. To our knowledge, no study to date has compared the clinical results of these two materials. The objective of this randomized prospective study was to compare the effectiveness of these materials in the nonsurgical management of clubfoot.

Methods:

All presenting clubfeet over a fifteen month period were offered enrollment. Patients were randomly assigned for treatment with either plaster or semirigid fiberglass casts. The severity of the clubfoot deformity was documented using the scoring system devised by Dimeglio, et al. Serial casts were applied according to the technique described by Ponseti, et al. At the completion of nonsurgical treatment, the final clubfoot severity was rescored. Parental opinion questionnaires were used regularly throughout the study.

Results:

A total of 42 clubfeet in 34 patients were enrolled in the study. Three patients were excluded. Thirteen patients received fiberglass and 18 received plaster casts. The mean baseline severity score between the two groups was not significantly different. The mean final severity score was significantly higher in the feet treated with fiberglass than those treated with plaster (6.4 versus 4.1 $p=.037$). There were trends toward higher scores for cast tolerance, durability, and parent satisfaction in the fiberglass group, but these did not reach significance.

Conclusion:

This study supports the use of plaster for clubfoot casting with the Ponseti technique. The use of plaster resulted in a statistically significant lower Dimeglio score at the completion of serial casting. Non-significant trends included higher parent satisfaction in the fiberglass treated group and fewer average number of casts in the plaster group. Whether these differences have an effect on long-term outcomes and recurrence remains to be studied.

Level of Evidence:

Level II. Non-blinded randomized controlled prospective study



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A RETROSPECTIVE, SHORT-TERM REVIEW OF THE LONG-ARM CHEVRON OSTEOTOMY IN CORRECTING MILD TO SEVERE HALLUX VALGUS DEFORMITIES

Authors: Erik K. Monson, DPM, Jeremiah Bushmaker, DPM, Jason P. Glover, DPM,
Alan J. Block, DPM
Presenter: Erik K. Monson, DPM

Metatarsal osteotomies are commonly used in correction of hallux valgus deformities (HAV). Numerous surgical procedures have been described to correct HAV and the choice is generally based on the degree of deformity (rated as mild, moderate, to severe). HAV deformities with a moderate to severe increase in the first intermetatarsal angle may require a proximal first metatarsal osteotomy for adequate correction. However, some of these osteotomies are associated with complications such as dorsal malunion and transfer metatarsalgia due to their inherent instability. These osteotomies often require a longer nonweightbearing period. At our institution we occasionally employ a more distal procedure with severe deformities to allow earlier post-operative weightbearing in patients who have difficulty with prolonged nonweightbearing. We objectively reviewed the results of 49 cases of mild to severe HAV deformities corrected with a long-arm Chevron osteotomy over a three-year period. It was found this procedure was effective in treating the mild to moderated deformities, but less favorable results were seen in the severe deformities. From this study, more favorable results may be obtained by using a proximal osteotomy or 1st metatarsal-cuneiform fusion in severe HAV deformities.



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IN VIVO DEGRADATION CHARACTERISTICS OF BIOABSORBABLE CROSS-PINS IN ANTERIOR CRUCIATE LIGAMENT RECONSTRUCTION

Authors: Eric M. Parson, M.D., Joseph S. Yu, M.D., Angela Pedroza, B.S., Christopher Kaeding, M.D.
Presenter: Eric M. Parsons, M.D.

Purpose: The objective of this study was to evaluate the degradation behavior of bioabsorbable femoral cross-pins following anterior cruciate ligament (ACL) reconstruction.

Methods: Four patients underwent ACL reconstruction using hamstring autograft with femoral fixation provided by a polylactic acid/polyglycolic acid copolymer (Lactosorb L15) cross-pin. Serial computed tomography (CT) scans were performed of the surgically reconstructed knees at approximately 6 weeks, 4 months, 1 year and 2 years, postoperatively. A single experienced musculoskeletal radiologist evaluated the CT scans for the density of the pins and surrounding bone as well as the morphology of the pins at the various time intervals.

Results: On average, the cross-pins demonstrated a relative reduction in density of 15%, 22%, 57%, and 79% at 6 weeks, 4 months, 1 year and 2 years, respectively. Bone density values adjacent to the pin decreased by an average of 7.8% between 6 weeks and 4 months. At one year an additional 14.3% reduction in bone density was seen but at 2 years the relative reduction in bone density had decreased to 8.9%. Evaluation of pin morphology revealed that minimal change had occurred after 6 weeks. At 4 months all of the pins were showing some morphologic changes on the surface, but none had fractured. After 1 year, 2 of the pins had fractured and by 2 years all of the pins had fractured. None of the pins had completely reabsorbed at 2 years postoperatively.

Conclusions: Based upon the findings of this study, LactoSorb L15 cross-pins for femoral fixation in ACL reconstruction remain largely unchanged 4 months postoperatively, suggesting that this device maintains the necessary structural integrity to allow early integration of soft tissue grafts within bone tunnels. In addition, by 2 years the cross-pins had degraded by 79% without osteolysis or other evidence of an aggressive host inflammatory response.



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TWO TEAM, SIMULTANEOUS BILATERAL KNEE ARTHROPLASTY AND THE OBESE PATIENT

Authors: John G. Mowbray, M.D., Steven T. Gaines, M.D., Robert N. Steenson, M.D.,
Allan C. Beebe, M.D.
Presenter: John G. Mowbray, M.D.

Introduction:

Previous authors have demonstrated increased rates of perioperative morbidity and mortality associated with the simultaneous performance of total knee arthroplasty. Likewise, obesity has also been implicated as a cause of increased complications in total knee arthroplasty. The purpose of this study was to investigate the rate of perioperative complications in obese patients undergoing simultaneous bilateral total knee arthroplasty.

Methods:

The surgical patient database was reviewed to identify all patients who underwent simultaneous bilateral total knee arthroplasty by the authors from January 2000 to January 2004 at a single tertiary care hospital. During the study period, 76 obese patients underwent simultaneous bilateral total knee arthroplasty, totaling 152 knees observed. All patients with a BMI >30 and a minimum of 6 months follow-up were analyzed to ascertain demographic information and data related to perioperative complications.

Results:

Eight knees (5.3%) experienced wound complications including arthrofibrosis, superficial infection, seroma formation, and extensor mechanism disruption. Two patients (2.6%) experienced major systemic complications. One patient had a postoperative myocardial infarction, and a second patient experienced bilateral pulmonary emboli. Minor systemic complications affected 8 patients, for a total systemic complication rate of 11.8% in 9 patients (one patient experienced both a major and a minor complication). No mortalities occurred in the study group during the 6 month observation period. Length of stay averaged 4.13 days. Only one patient required intensive care unit admission. Upon discharge, 61.2% of patients left for an extended care facility, while 38.8% returned home with outpatient physical therapy.

Discussion:

Controversy remains regarding the relative safety of simultaneous bilateral knee arthroplasty under one anesthetic. Additionally, the effects of obesity on perioperative complications are of significant concern to the orthopaedic surgeon. These concerns are heightened when performing a large and technically demanding procedure such as simultaneous total knee arthroplasty. Surgeons must balance the potential benefits of decreased cost, higher patient satisfaction, and fewer combined hospital days with the potential for increased perioperative complications. The obese patients in this series experienced low rates of systemic complications and very few wound complications associated with their procedures.

Conclusions:

Simultaneous bilateral total knee arthroplasty can be a relatively safe and successful procedure in the appropriately selected and informed obese patient.



Truitt Cooper, M.D. is a Resident in Orthopaedics at The Ohio State University

COST COMPARISON OF ALLOGRAFT AND AUTOGRAFT ANTERIOR CRUCIATE LIGAMENT RECONSTRUCTION

Authors: M. Truitt Cooper, M.D., Angela Pedroza, B.S., Christopher Kaeding, M.D.
 Presenter: M. Truitt Cooper, M.D.

The decision of whether to use allograft or autograft ligament for anterior cruciate ligament (ACL) reconstruction remains controversial. The purpose of this study is to compare the cost of ACL reconstruction using either hamstring autograft or tibialis anterior allograft.

Methods: The hospital cost and charge data for patients undergoing ACL reconstruction by a single surgeon using either tibialis anterior tendon allograft (n=49) or hamstring tendon autograft (n=49) were retrospectively obtained and analyzed. Costs were broken down into several categories for comparison. Surgeon, operative technique, and surgical team were controlled.

Results: The mean total hospital costs for ACL reconstruction was \$4072.02 for autograft and \$5195.19 for allograft for a difference of \$1123.16 (P<0.0001). The only other statistically significant differences found were in the costs of the supplies (\$1296.07 more for the allograft, P<0.0001) and the recovery room (\$82.54 more for the autograft, P<0.01). No statistically significant differences were found in the costs for the operating room, anesthesia, or pharmacy.

Conclusions: The cost of ACL reconstruction performed by a single experienced surgeon is significantly less (P<0.0001) using hamstring autograft than using tibialis anterior allograft. This is primarily due to the cost of the supplies, including the graft itself, and is not found to be significantly offset by decreases in anesthesia, operating room, or recovery room costs.

Discussion: The theoretical decrease in post-operative pain in the allograft patient may have accounted for the minor recovery savings, but the theoretical savings due to a shorter OR time did not result in significant savings. The increased OR time for autograft harvest was only 12 minutes. This may not hold true for less experienced surgical teams. This study did not evaluate the economic savings of allograft use with respect to shorter time to return to work and less postoperative physical therapy.



Ben Taylor, M.D. is a resident in Orthopaedics at Mt. Carmel

FINANCIAL IMPACT OF A CAPITATION MATRIX SYSTEM ON TOTAL KNEE AND TOTAL HIP ARTHROPLASTY

Authors: Ben Taylor, M.D., Richard Fankhauser, M.D., Ty Fowler, M.D.
 Presenter: Ben Taylor, M.D.

Total hip and total knee arthroplasty are high-volume surgical procedures that have significant economic impact for the healthcare system. This study analyzes the financial effect of a capitation matrix system on total knee and total hip implant costs over a 1-year period at a community hospital system. The matrix implant levels were based on implant characteristics, correlating increased technological sophistication of the various implants with increased but capitated payment to vendors. In the first year following implementation of the matrix system, implant costs for the hospital decreased by 26.1% per implant for 369 total hip procedures and also by 26.1% per implant for 934 total knee procedures.



Alicia Bertone, D.V.M., Ph.D. is a Professor of Veterinary Medicine and Professor of Equine Orthopaedic Surgery at The Ohio State University



Kraig Solak, D.O. is an Orthopaedic Sports Medicine Fellow at The Ohio State University

MESENCHYMAL STEM CELL GENE DELIVERY OF BMP2 IN AN ARTICULAR FRACTURE MODEL

Authors: Zachos, T.A., Diggs, A., Weisbrode, S.E., Bartlet, J.S., Bertone, A.L.
 Presenter: Alicia Bertone, D.V.M., Ph.D.

Bone and cartilage are injured in articular fracture. We tested if bone morphogenetic protein 2 (BMP2) can promote bone and cartilage repair using stem cells. Distal femoral articular osteotomies in nude rats were treated with stem cells, either wild-type or transduced with an adenoviral (Ad) BMP2. Cells were delivered in alginate (ALG) carrier or by direct injection in saline solution. Gene expression of these cells at the osteotomy was confirmed by *in vivo* imaging. At day 14, the AdBMP2 stem cells delivered by direct injection had completely healed the osteotomy while other groups were remained unhealed ($P < 0.0003$). In ALG groups, bone healing was impeded by the development of a chondroid mass, most pronounced in the AdBMP2 ALG group ($p < 0.002$). We were successful in the repair of both bone and cartilage *in vivo* using direct stem cell injection. Our data suggested BMP2 augmentation might be critical to this effect.

ACL RECONSTRUCTION WITH HAMSTRING AUTOGRAFT VS. TIBIALIS ANTERIOR ALLOGRAFT: A MULIVARIABLE ANALYSIS OF GRAFT FAILURE, SINGLE SURGEON, 2 YEAR FOLLOW UP

Authors: Kraig Solak, D.O., Angela Pedroza, B.S., Christopher Kaeding, M.D.
 Presenter: Kraig Solak, D.O.

PURPOSE: Primary objective: To evaluate the odds of re-tear for tibialis anterior allograft compared to hamstring autograft for ACL reconstruction at 2 year follow up. Secondary objective: To identify associated variables that may predict failure. Study type: Prospective cohort.

METHODS: The Multicenter Orthopedic Outcomes Network (M.O.O.N) database was queried for all patients who had undergone ACL reconstruction by the senior author and met minimum 2 year follow up requirements. Two hundred and eighty-nine primary and revision ACL reconstructions were identified from January 1, 2002 to December 31, 2003. A total of 166 ACL reconstructions were performed with tibialis anterior allograft and 123 reconstructions were performed with hamstring tendon autograft. All surgeries were performed by the senior author, utilizing the same femoral fixation (bioabsorbable cross pin) and tibial fixation (bioabsorbable interference screw), and underwent identical post-operative rehabilitation. All patients were given a pre-operative subjective questionnaire and general health questionnaire. The surgeon completed an intra-operative questionnaire recording the status of the chondral surfaces, the menisci, and intraarticular ligaments. The same patient questionnaire was completed 2 years post-operatively, and the patient was asked about additional surgery by phone interview.

STATISTICAL ANALYSIS: A univariate analysis of graft type, sex, primary vs revision ACLR, meniscal status (medial and lateral), weight, age, Marx activity score and height was completed to determine their effects on chance of re-tear. All statistically significant variables were then included in a multivariable logistic regression analysis. **RESULTS:** There were a total of 289 patients (30 re-tear and 259 no re-tear) included in the study. There was no statistical difference in chance of re-tear by sex, primary vs revision, meniscal tear (medial or lateral), weight, and height. Graft type ($p = 0.001$), Marx activity scale ($p = 0.005$) and age ($p < 0.042$) were found to be significant predictors of re-tear. Allograft ACLR showed a significantly higher chance of failure compared to autograft ACLR (Odds ratio, 5.23; 95% confidence interval, 1.95-14.04). An increase in 10 years of age significantly decreased the chance of re-tear (Odds ratio, 0.518; 95% confidence interval, 0.486-0.552). An increase of 4 points on the Marx activity score significantly increased the chance of re-tear (Odds ratio, 3/066; 95% confidence interval 2.52-3.72).

CONCLUSIONS: In this prospective cohort evaluation of ACL reconstruction with tibialis anterior allograft vs. hamstring autograft: increases in activity shows an increased chance of re-tear, allograft reconstructions shows an increased chance of re-tear, and an increase in age shows a decreased chance of re-tear.



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RISK FACTORS FOR GRAFT FAILURE FOLLOWING ANTERIOR CRUCIATE LIGAMENT RECONSTRUCTION USING SOFT-TISSUE ALLOGRAFT: DOES TISSUE BANK MATTER?

Authors: Eric M. Parsons, M.D., Bret C. Powers, D.O., Angela Pedroza, B.S.,
Christopher Kaeding, M.D.
Presenter: Eric Parsons, M.D.

Purpose: The objective of this study was to analyze risk factors which may contribute to graft failure following anterior cruciate ligament (ACL) reconstruction using soft-tissue allograft. Specifically, we sought to determine whether variations in sterilization and preservation techniques between tissue banks might influence the performance of allograft tissue in vivo.

Methods: 228 patients underwent ACL reconstruction using cadaveric tibialis anterior or tibialis posterior graft by one experienced orthopaedic surgeon between July 2002 and June 2005. Allografts were supplied by two separate tissue banks during the period in question. A retrospective chart review and telephone follow-up were performed at a minimum of 18-months to identify the number of graft failures. Chi square testing was used to determine any difference in the proportion of failures between the two groups. A Kaplan-Meier survival analysis was performed to establish any variation in time to failure between the groups. Finally, a Cox proportional hazard model was utilized to assess whether the type of surgery (primary vs. revision), patient gender or patient age had independent effects on the failure rate.

Results: Chi square testing revealed that the difference in failure rate between Tissue Bank A (13.04%) and Tissue Bank B (11.69%) did not reach statistical significance ($p=0.764$). Similarly, Kaplan-Meier survival analysis indicated no statistically significant difference between the groups in time to failure ($p=0.808$). The Cox proportional hazard model suggested that younger age at the time of reconstruction had a significant effect on failure rate ($p<0.001$), while patient gender ($p=0.512$) and whether the surgery was a primary or revision reconstruction ($p=0.728$) did not.

Conclusion: Based upon the findings of this study it can be concluded that no difference in ACL reconstruction failure rate or time to failure exists between the two tissue banks in spite of some variability in their allograft sterilization and preservation techniques. The inverse relationship between patient age and failure rate may be more indicative of activity level and the demands placed on the reconstructed knees than any biologic effect older age might have on allograft incorporation.



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Long-Term Femoral Remodeling With a Tapered Titanium Porous Plasma-Sprayed Primary Femoral Stem

Authors: Brad Ellison, M.D, Nicholas A. Cheney, B.S., Keith R. Berend, M.D., Peter H. Edwards, Jr., M.D., Atiba Jackson, M.D., Noah Shaftel, M.D., Michelle Wright, B.S., Jodi Hartman, B.S.
Presenter: Atiba Jackson, M.D.

Abstract

As longevity of cementless femoral components enters the third decade, concerns arise with long-term effects of fixation mode on femoral bone morphology. We examined the long-term consequences on femoral remodeling following primary THA with the Mallory-Head prosthesis, a proximal porous coated plasma-sprayed tapered titanium stem. Clinical data and radiographs were reviewed from a single center for 97 randomly selected THA implanted with the Mallory-Head femoral component during primary total hip arthroplasty. Measurements were taken from preoperative and long-term follow-up radiographs averaging 14 years. Average changes in the proximal, middle and diaphyseal zones were determined. On AP radiographs, the proximal cortical thickness was unchanged medially and the lateral zone increased 1.3%. Middle cortical thickness increased 4.3% medially and 1.2% laterally. Distal cortical thickness increased 9.6% medially and 1.9% laterally. Using the AP radiographs, canal fill at 100 mm did not correlate with bony changes at any level (spearman's rank correlation coefficient of

-0.18, 0.05, and 0.00; p value = 0.09, 0.67, 0.97). On lateral radiographs, the proximal cortical thickness increased 1.5% medially and 0.98% laterally. Middle cortical thickness increased 2.4% medially and 1.3% laterally. Distal cortical thickness increased 3.5% medially and 2.1% laterally. From lateral radiographs, canal fill at 100 mm correlated with bony hypertrophy at the proximal, mid-level, and distal femur (spearman's rank correlation coefficient of 0.85, 0.33, and 0.28, respectively; p value = 0.001, 0.016, and 0.01, respectively). With long-term follow-up, the Mallory-Head prosthesis does not cause stress shielding, but rather demonstrated increased cortical thickness in all zones for the majority of femora.



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FUNCTIONAL OUTCOMES OF DISTAL BICEPS TENDON RUPTURE REPAIR USING ANATOMICAL REATTACHMENT

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Presenter: Atiba Jackson, M.D.

Rupture of the distal biceps tendon is a relatively infrequent injury; however, the debilitating nature of the injury results in significant strength, endurance, and range of motion deficits in the affected extremity.

Twenty-five patients (26 cases) with distal biceps ruptures were evaluated at a mean follow-up of 4.4 years (1.4 – 10.1 years) after anatomical reattachment to assess functional outcome. The most common injury mechanism was rupture while lifting an object. The study population was comprised of all men at a mean age of 48.9 years (32.6 - 75.6). Efficacy of the treatment was assessed using the Mayo Elbow Performance Score, safety was determined by the incidence of complications, and isokinetic testing was conducted to measure the endurance and strength of the repaired extremity versus the contralateral side.

The overall mean Mayo Elbow Performance Score for the repaired arm was 96.3, compared to a mean of 99.4 for the contralateral side. The Mayo Clinic Elbow Performance Index Score rating was excellent in 18 (75.0%) and good in 6 (25.0%) patients. Six (25.0%) patients reported mild pain at the follow-up evaluation. All patients regained normal range of motion (arc $\geq 100^\circ$), with no varus-valgus instability, and were able to perform normal daily activities of living. There were no statistically significant differences in the Mayo Clinic Elbow Performance Index Score and its subcomponents between the repaired and uninjured arms. No statistically significant differences in strength and endurance between the repaired and uninjured arms were observed. The most recent radiographic evaluation revealed mild arthritic changes in 2 (7.8%) cases, heterotopic ossification in 4 (15.4%) cases, and calcification of the biceps tendon in 5 (19.2%) cases. Early postoperative complications included ecchymosis in one case and muscle weakness in another. Both complications resolved without further treatment. There were no re-ruptures and no subsequent surgeries.

This study corroborates previously reported excellent results following anatomical reattachment for distal biceps tendon rupture repair and suggests continued success through long-term follow-up. Patients, therefore, may expect continued pain relief and restoration of function through this time period.



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POSSIBLE DIFFERENCES IN ACL INJURY MECHANISMS AMONG SOCCER PLAYERS: CONTACT VS. NON-CONTACT INJURIES

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Presenter: Peter H. Edwards, Jr., M.D.

Objectives: The purpose of this study is to determine possible differences in ACL injury mechanisms between contact and non-contact ACL tears.

Methods: ACL reconstructions performed by a single surgeon were both retrospectively and prospectively reviewed to identify tears caused by soccer injury. MRI reports were examined for presence of concomitant injury and ligamentous involvement. Subjects also were surveyed regarding injury etiology and outcome of reconstruction.

Results: Of 122 ACL injuries, 75 cases (61.5%) were non-contact in origin, whereas 47 cases (38.5%) resulted from direct contact to the lower extremity by another player. Contrary to expectations, the non-contact injury rate in females was not significantly higher than in males. There also was no significant difference between type of injury and BMI or occurrence in the dominant knee. However, players who sustained a contact ACL injury were significantly younger at the time of injury than players whose injuries were non-contact in origin ($p = 0.008$). Recreational players were significantly more likely to sustain a non-contact ACL injury compared to high school/club and elite soccer players. No significant difference was observed in concomitant injuries, including bone bruising, meniscal tears, and other ligamentous tears, between injury types. Furthermore, no significance in player position, side of field, time period of injury, and type of field was observed between injury mechanisms. As expected, a foul called at the time of injury was significantly more likely to occur when players sustained a contact injury ($p = 0.900$). Finally, return to play and recovery time was not significant between injury mechanisms, with an overall return of 84.2% at a mean time of 8.0 months.

Conclusion: Contrary to previous reports, in this study population, more ACL tears were sustained as a result of non-contact injury versus those sustained from direct contact. The contact tears that did occur were not associated with higher incidences of bone bruising or other concomitant injuries. The higher incidence of ACL tears observed among recreational players may suggest possible differences in the levels of aggressiveness or fitness between casual players and players at higher levels of competition. Finally, injury mechanism did not impact the ability to return to play or rehabilitation time. Non-contact and contact ACL tears had comparable favorable outcomes with resumption of soccer play.



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ACETYLATED REGENERATED CELLULOSE IN THE TREATMENT OF CHRONIC DIABETIC PRESSURE ULCERATIONS OF THE LOWER EXTREMITY

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Presenter: C. Graham Frazier, DPM

Purpose: To assess the efficacy of Acetylated Regenerated Cellulose (ARC) as a treatment option for Chronic Diabetic Ulcerations of the lower extremity.

Methods: Prospective Case review of 10 subjects, 5 male and 5 female, age range 34 - 82 with Diabetes Mellitus (Type I or II), peripheral neuropathy, and lower extremity pressure ulcerations unresponsive to former treatment regimens for greater than 3 months. The only exclusion criteria was infection, whether cellulitis or osteomyelitis. Each subject was monitored weekly for 6 weeks, with daily dressing changes, offloading, and periodic debridement as needed, determined by Attending Physician and Co-Author.

Results: Subjects 1-4 (3 Female:1 Male) all wound dimensions increased (LxWxD). After review of Charts, all showed noncompliance in off-loading regimen.

Subjects 5-10 (4 Male: 2 Female) - 8 Ulcerations ranging in dimensions (LxWxD) from 2.7 x 1.0 x 0.1 to 0.4 x 0.3 x 0.1. 4 showed complete epithelialization at the end of the 6 weeks. The 4 remaining ulcerations showed average decreases of 59% length and 44% width

Conclusions: ARC appears to warrant further investigation as a treatment option for chronic diabetic ulcerations. When used in conjunction with adequate off-loading and patient compliance, the results of this small review appear promising.

APPENDICULAR SKELETON PHENOTYPES EXTEND TO THE MANDIBLE OF HIGH AND LOW BMD MICE

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Genetic contributions to bone density have been investigated in the appendicular skeleton of C3H/HeJ (C3H) and C57BL/6J (B6) inbred mice. In contrast with long bones, the mandible forms by intramembranous ossification. The growth and development of teeth within the bone is a unique characteristic of the jaws. The overall objective is to extend the examination of the bone phenotypes to the craniofacial region. We desire to (a) characterize the mandibular bone mass, indentation modulus (IM), hardness (H), and bone formation rate (BFR) of C3H and B6 mice and (b) investigate the relationship of the mechanical properties in 3 skeletal sites - mandible, femur, and tibia. Specimens from 17-week-old female C3H and B6 (15/group) inbred mice were obtained. Mandibular bone mass and morphology were estimated from lateral-view (LVA) faxitron images and histologic cross sections (CSA). Mandibular and femoral mineral apposition rate (MAR) and BFR were calculated. Bone blocks from each skeletal site were examined by indentation testing. Data were analyzed with generalized linear model and mixed model.

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