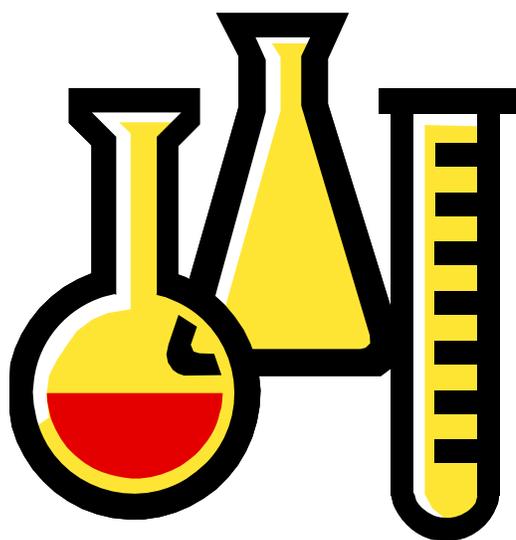


THE OHIO STATE UNIVERSITY

38th Annual
Mallory-Coleman
Resident Research Day



Friday, June 4, 2010

Blackwell Hotel and
Conference Center

PROGRAM

- 7:00 am **Welcome and Introduction**
- 7:15 am **Ty Fowler, M.D.**
“Medial Malleolar Fractures: A Biomechanical Study of Fixation Techniques”
- 7:30 am **Joshua Harris, M.D.**
“Using Evidence-Based Medicine in the Management of Chondral Defects of the Knee in Athletes”
- 7:45 am **Michael Griesser, M.D.**
“Quality of Life and Functional Outcomes After Internal and External Hemipelvectomy or Flail Hip In Patients With Sarcomas”
- 8:00 am **Timothy Miller, M.D.**
“Arthroscopic Evaluation and Treatment of Biceps Brachii Long Head Tendon Injuries: A Survey of the MOON Shoulder Group”
- 8:15 am **Macaira Dymont, D.P.M.**
“Long-Term Results Following First Metatarsal Cheilectomy”
- 8:30 am **Benjamin Taylor, M.D.**
“Osteomyoplastic And Traditional Transtibial Amputations in the Trauma Patient: Perioperative Comparisons and Subjective Outcomes”
- 8:45 am **Vincent Ng, M.D.**
“Fine Needle Aspiration for Clinical Triage of Extremity Soft Tissue Masses”
- 9:00 am **Break**
- 9:15 am **Matthew Beran, M.D.**
“Weight-Bearing Lesions of the Lateral Femoral Condyle Following Patellar Dislocation in the Adolescent Athlete”
- 9:30 am **Joshua Harris, M.D.**
“Complications, Adverse Events, and Failures After Autologous Chondrocyte Implantation”
- 9:45 am **Michael Swiatek, D.P.M.**
“A Retrospective Comparison of Four Plate Constructs for First Metatarsophalangeal Joint Fusion: Static Plate, Static Plate With Lag Screw, Locked Plate, Locked Plate With Lag Screw”
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- 10:00 am **Joseph Fazalare, M.D.**
"Youth Baseball Pitchers: Are We Following The Pitching Guidelines?"
- 10:15 am **Michael Griesser, M.D.**
"VITOSS (Ultraporous Beta Tricalcium Phosphate) As A Viable Option For Filling Cavitary Defects In Benign Bone Tumors"
- 10:30 am **Walter Samora, M.D.**
"Meniscal Pathology Associated With Acute, Anterior-Cruciate Ligament Tears in Patients With Open Physes"
- 10:45 am **Break**
- 11:00 am **Freddie Fu, M.D., Visiting Professor and Moderator**
"Anatomic ACL Reconstruction: What We Have Learned"
- 12:00 pm **Lunch**
- 1:00 pm **Akikazu Ishihara, D.V.M.**
"Dermal Fibroblast-mediated And Direct BMP2 Gene Therapy for Bone Regeneration In Equine Model"
- 1:15 pm **Maria Menendez, B.V.S.c**
"In-Vivo High-Field 3 Tesla Magnetic Resonance Imaging To Assess Osteochondral Healing In An Equine Model"
- 1:30 pm **Jennifer Trinidad, D.P.M.**
"Oblique Metatarsal Shortening Osteotomy By A Single Saw Cut"
- 1:45 pm **Ashraf Darwish, M.D.**
"Evaluation of ACL Injuries in Soccer Players"
- 2:00 pm **Daniel Quinn, M.D.**
"Biomechanical Testing of Femoral Fixation Devices For Anterior Cruciate Ligament Reconstruction Using Cadaveric Hamstring Grafts"
- 2:15 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:

- 2009 James Heckman, M.D.
- 2008 Cato Laurencin, M.D.
- 2007 William Garrett, M.D.
- 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

2010 MALLORY-COLEMAN VISITING PROFESSOR AND MODERATOR:

FREDDIE FU, M.D.



Freddie H. Fu, M.D. is the David Silver Professor and Chairman of the Department of Orthopaedic Surgery, University of Pittsburgh School of Medicine. Dr. Fu specializes in Sports Medicine and holds secondary appointments as Professor of Physical Therapy, Health & Physical Activity, and Mechanical Engineering and serves as the Head Team Physician for the University of Pittsburgh's Athletic Department. In 1999 he was awarded an honorary Doctor of Science degree from Point Park University, an honorary Doctor of Public Service degree from Chatham University, and in 2010 appointed Distinguished Service Professor from the University of Pittsburgh. Dr. Fu graduated summa cum laude from Dartmouth College in 1974 and received his BMS in 1975 from Dartmouth Medical School. He earned his medical degree in 1977 at the University of Pittsburgh and completed his general surgery internship at Brown University. He then returned to Pitt for an orthopaedic research fellowship and to complete his orthopaedic residency training. During that time, Dr. Fu was an AO International Fellow at the Hannover Trauma Center in Germany and an arthroscopic surgery fellow in East Lansing, Michigan. In 1984 Dr. Fu was selected as an AOA North American Traveling Fellow and in 1988 as an ESSKA-AOSSM Sports Medicine Travelling Fellow he visited over 30 sports medicine centers in Europe.

Dr. Fu's major research interest lies in clinical outcomes as well as bioengineering of sports-related problems. His research efforts have led to more than 140 professional awards and honors, 846 national and international presentations, and editorship of 28 major orthopaedic textbooks. Dr. Fu is also the author or co-author of 350 peer-reviewed articles and 103 book chapters on the management of sports injuries. He is a member and has held offices in numerous academic organizations including the prestigious Herodicus Society and American Orthopaedic Association. He served as the President of the Pennsylvania Orthopaedic Society and as a board member of the Arthroscopy Association of North America. In 1996 he was a co-recipient of the prestigious Kappa Delta award for his shoulder research, as well as being awarded by the National Athletic Trainers' Association the Presidential Challenge Award for significant contributions in athletic training. One year later he was elected to the Inaugural Executive Board of the International Cartilage Repair Society. He is on the Board of the Orthopaedic Research and Education Foundation and the American Orthopaedic Society for Sports Medicine (AOSSM). In July 2008 he assumed the Presidency of the AOSSM for a one-year term and, in April 2009, was named President of the International Society of Arthroscopy, Knee Surgery and Orthopaedic Sports Medicine (ISAKOS) for a two-year term.



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MEDIAL MALLEOLAR FRACTURES: A BIOMECHANICAL STUDY OF FIXATION TECHNIQUES

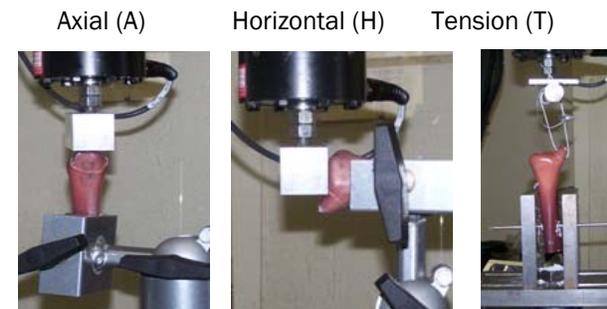
Authors: Ty Fowler, MD, Kevin Pugh, MD, Alan Litsky, MD, ScD, Ben Taylor, MD
Presenter: Ty Fowler, MD

INTRODUCTION: Numerous studies have demonstrated the importance of anatomical reduction and stable internal fixation in the treatment of intra-articular unstable ankle fractures⁽¹⁻²⁾. Fracture fixation of the medial malleolus typically fails in tension and pullout of the screws⁽³⁾. We aimed to test the concept of bicortical fixation of the medial malleolus compared to the traditional unicortical malleolar screws.

The AO group recommends tension band fixation (TBW) of small avulsion type fractures of the medial malleolus that are unacceptable for screw fixation as well as in osteoporotic bone⁴. A well documented complication of tension band fixation of the medial malleolus is prominent symptomatic hardware². We aimed to biomechanically test the strength of tension band construct using Fiberwire® in a figure-of-eight fashion versus the gold standard of 18 gauge stainless steel wire to theoretically decrease soft tissue irritation. Finally, we aimed to compare stiffness across all fixation constructs under tensile loading.

METHODS: Utilizing Sawbones®, osteotomies were created at the level of the tibial plafond. Fixation was conducted utilizing 4 different techniques; Construct #1: two 4.0mm x 40mm partially threaded unicortical cancellous screws. Construct #2: two 3.5mm x 75mm fully threaded bicortical screws. Construct #3: two 2.0mm K wires with a figure-of-eight 18 gauge stainless steel wire. Construct #4: two 2.0mm K wires with a #5 Fiberwire® in a figure-of-eight fashion. A 4.0 mm x 20mm fully threaded cancellous screw was placed 2 cm proximal to the plafond to anchor the proximal limb of the FW.

Each fixation construct for each loading condition consisted of 10 specimens for a total of 80. By utilizing a servohydraulic materials testing system, Constructs #1 and #2 were subjected to three different loads:



Construct #3 and #4 were tested in tensile loads only (T). The force in Newtons required to generate the failure was recorded. Stiffness was determined by the slope of the fracture vs displacement curves. Two-sample student t-tests were used for paired analysis of constructs with significance set at $\alpha < .05$. A one-way balanced ANOVA was employed to compare and identify significant differences between the four different constructs under tension load only.

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MEDIAL MALLEOLAR FRACTURES: A BIOMECHANICAL STUDY OF FIXATION TECHNIQUES, CONTINUED...

Presenter: Ty Fowler, M.D.

DATA AND RESULTS: The bicortical screw construct showed statistically significant results compared to unicortical construct at 2mm, catastrophic failure and stiffness ($\alpha = .001$, $\alpha < .001$, $\alpha < .001$, respectively) under tensile load (T). Standard unicortical malleolar screws were found to demonstrate only 10% the mean stiffness of the bicortical construct in tension.

The TBW with stainless steel constructs were found to be statistically stronger at 2mm displacement, catastrophic failure, and stiffness ($\alpha = .03$, $\alpha < .001$, $\alpha = .007$, respectively). The bicortical screw construct was statistically a stiffer construct than TBW with stainless steel wire and Fiberwire.

DISCUSSION: Our study shows in a Sawbones® model, that bicortical screw fixation displayed a significantly higher load to failure (467 N) compared to unicortical screws (171 N). If an early rehab protocol is to be undertaken post-operatively the above mentioned bicortical malleolar fixation may provide extra stability to the tensile forces across the fracture site and therefore less risk of displacement or failure of fixation. Extrapolation of our results clinically should be exercised with caution as this is a new technique with no in vivo studies to date.

Soft tissue irritation has been well documented in the literature with respect to tension band wiring techniques^(1-2,5). Our results showed inferior biomechanical properties of tension band technique substituting Fiberwire® for 18 gauge stainless steel wire under tension loading. We cannot support the use of #5 Fiberwire® in a tension band construct for fixation of the medial malleolus.

Bicortical screw fixation was stiffer than both TBW constructs in our study and therefore, this challenges the idea that TBW for osteoporotic bone is the strongest and most appropriate construct. Our results suggest that in transverse or oblique fractures of the medial malleolus that are large enough to accept screws, it may be advantageous to employ a bicortical screw technique.

REFERENCES:

1. Toolan, et al. *Foot Ankle Int.* 15(9):483-489, 1994.
2. Ostrum et al. *J Ortho Trauma.* 6(4): 464-468, 1992.
3. Michelson et al. *JBJS*, 84:2029-2038, 2002.
4. *Muller Manual of Internal Fixation.* 3rd ed. 1991.

ACKNOWLEDGEMENTS: A \$10,000 resident research award was received from the Orthopaedic Trauma Association. All implants and product were received from Synthes® as an educational research donation.

DISCLOSURES: Kevin Pugh MD is a consultant for Smith and Nephew. The authors have no financial conflicts of interest to report with respect to the present study.



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USING EVIDENCE-BASED MEDICINE IN THE MANAGEMENT OF CHONDRAL DEFECTS OF THE KNEE IN ATHLETES

Authors: Joshua Harris, MD, Robert Brophy, MD, Robert Siston, PhD, Thai Trinh, BS, David Flanigan, MD

Presenter: Joshua Harris, MD

Background: Autologous chondrocyte implantation (ACI) is a treatment for chondral defects in the knee. Complications such as periosteal hypertrophy and knee stiffness occur more frequently in open, 1st-generation ACI. Avoidance of a periosteal cover has reduced the frequency of hypertrophy. All-arthroscopic ACI has reduced the frequency of stiffness. With newer generations of ACI, the complication and re-operation profile has been reduced.

Purpose: To determine the complication, adverse event, failure, and re-operation rate of all generations and techniques of ACI.

Methods: A systematic review of multiple medical databases was performed. Levels I-IV evidence were included. Generations of ACI and complications after ACI were explicitly defined. All subject and defect demographic data were analyzed.

Results: 95 studies were identified for inclusion (9 Level I, 13 Level II, 10 Level III, 63 Level IV). 5,869 subjects were analyzed (6,691 defects) (3,771 1st-generation periosteal-cover ACI subjects; 906 1st-generation collagen-membrane cover ACI subjects; 1,184 2nd-generation ACI subjects [794 open; 390 arthroscopic]; and 8 3rd-generation ACI subjects). There were 343 failures overall (5.8% subjects; mean time to failure 18 months) with failure rates after PACI, CACI, and 2nd-generation ACI of 7.5%, 1.5%, and 3.9%, respectively. Among workers' compensation subjects, failure rate was 23%. Reoperation rate after PACI, CACI, and 2nd-generation ACI was 37%, 41%, and 18%, respectively. Second-look arthroscopy, however, was planned in 30%, 89%, and 70% of these re-operations, respectively. Hypertrophy was most common after PACI. Arthrofibrosis was most common after PACI or CACI. There were very few cases of infection, deep-vein thrombosis, or pulmonary embolus. There were no deaths associated with ACI.

Conclusions: Nearly the entire volume of ACI cases reported in the orthopaedic literature was evaluated with this review. Failure rate after all generations is low (~5%). Unplanned re-operations are highest with PACI, then CACI, then 2nd-generation ACI. Hypertrophy is most common after PACI. Arthrofibrosis is most common after arthrotomy-based ACI. Newer generations of ACI with avoidance of a periosteal cover and all-arthroscopic approaches have reduced the complication and re-operation rate after ACI.

Keywords: Autologous chondrocyte implantation, adverse event, complication, failure, hypertrophy

Level of Evidence: IV (Systematic review of studies Level of Evidence I, II, III, and IV)

Disclosures: One of the authors (DF) is on the speaker's bureau of Genzyme Co. All of the authors report no conflict of interest and report receiving no external financial support in production of this manuscript.



Michael Griesser, M.D. is a resident in Orthopaedics at The Ohio State University

QUALITY OF LIFE AND FUNCTIONAL OUTCOMES AFTER INTERNAL AND EXTERNAL HEMIPELVECTOMY OR FLAIL HIP IN PATIENTS WITH SARCOMAS

Authors: Michael Griesser, MD, Blake Gillete, MD, Martha Crist, RN, Xueling Pan, PhD, Peter Muscarella, MD, Thomas Scharschmidt, MD, Joel Mayerson, MD

Presenter: Michael Griesser, MD

INTRODUCTION:

The definitive surgical treatment of bone and soft tissue sarcomas of the pelvis and proximal femur commonly is hemipelvectomy. Although great strides in survival have been made over the last half century with adjuvant therapies and current surgical techniques, these procedures continue to have significant morbidity and complications associated with them. We evaluated the current quality of life of patients who have had an internal hemipelvectomy with and without (flail hip) prosthetic reconstruction, and external hemipelvectomy.

METHODS:

We retrospectively reviewed the cases of 19 patients at a major oncologic referral center who had undergone either internal or external hemipelvectomy for tumor between June 2002 and December 2007. Nineteen patients previously treated operatively with either a Type II periacetabular internal (INT, n=5), external (EXT, n=14) hemipelvectomy, or hip disarticulation (combined with EXT group) were evaluated using the Toronto Extremity Salvage Score (TESS), MSTS and SF-36. There were 16 (84%) males and 3 (16%) females with a mean age at operation of 48.7 ± 16.6 (range from 18 to 69).

DATA AND RESULTS:

Followup was 30.7 ± 19.1 (range 5 to 70 months). Overall mean MSTS was 41.2 (range from 6.7 to 83.3), and TESS was 56.6 (range 31.8 to 88). SF-36 physical function results were lower than the general population. Mental health condition was comparable to the normal population. The three measurements, TESS, MSTS and PCS subscale of the SF-36, were all positively correlated. There were no significant influences of post-surgery time on MSTS, TESS or PF. However, the age of the patient at operation has a negative correlation with the physical function. The younger the patients, the higher the TESS and PCS scores.

Summary statistics of TESS, MSTS, SF-36				
	Over-all	EXT	INT	
	n=19	n=14	n=5	
TESS	56.6 ± 15.9	56.4 ± 16.3	57.2 ± 16.3	
MSTS	41.2 ± 16.7	36.2 ± 13.8	55.3 ± 17.3	
SF-36	PCS	31.6 ± 7.97	31.2 ± 6.63	32.8 ± 11.9
	MCS	52.1 ± 12.2	50.2 ± 13.0	57.4 ± 8.7



Figure 1: Examples of external (above) and internal (below) hemipelvectomies



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QUALITY OF LIFE AND FUNCTIONAL OUTCOMES AFTER INTERNAL AND EXTERNAL HEMIPELVECTOMY OR FLAIL HIP IN PATIENTS WITH SARCOMAS, CONTINUED...

Presenter: Michael Griesser, M.D.

DISCUSSION:

Hemipelvectomies (either internal or external) have profound impact on patient lives as illustrated by low TESS, SF-36, and MSTs scores. TESS, MSTs, and PCS were all positively correlated indicating that the patient and physician tabulated scores correlate with one another in our study. The age of the patient at operation had a negative correlation with the physical function in that the younger the patients, the higher the TESS and PCS scores. The time out from surgery did not affect scores.

This finding is useful because early interventions could be employed based on the age of the patient. A younger patient would be counseled that aggressive therapy and mobilization has the greatest potential for optimal outcome, whereas an aggressive approach in an elderly patient would not likely produce better functional outcomes and could be avoided. Efforts could then be focused on lifestyle adaptations and psychosocial support instead of therapy. These observations would be valuable in both preoperative discussions with the patient and family as well as postoperative care decisions. This study adds power to the existing literature regarding quality of life and functional outcome in patients with internal and external hemipelvectomy for tumor.



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ARTHROSCOPIC EVALUATION AND TREATMENT OF BICEPS BRACHII LONG HEAD TENDON INJURIES: A SURVEY OF THE MOON GROUP

Authors: Timothy Miller, MD, Grant Jones, MD

Presenter: Timothy Miller, MD

Background:

Injuries to the biceps brachii long head tendon commonly occur in conjunction with tears of the rotator cuff and glenoid labrum. Since a consensus on the treatment of their varying levels of severity has yet to be determined, treatment preferences vary from surgeon to surgeon. A validated system for classifying these injuries is necessary for standardizing their

Purpose:

To survey members of the Multicenter Orthopaedic Outcomes Network Shoulder Group and determine a consensus on the arthroscopic grading and ideal treatment for biceps tendon injuries with varying levels of severity.

Hypotheses:

The Lafosse classification system will show a high level of inter- and intra-observer agreement for grading injuries to the biceps brachii long head tendon. There will be a high level of agreement between shoulder surgeons for treatment of biceps tendon injuries of varying severity.

Methods:

Arthroscopic videos of thirty patients determined to have biceps brachii long head tendon injuries were viewed by thirteen members of the MOON Shoulder Group. All evaluators were fellowship-trained shoulder surgeons of varying levels of experience. Each member of the group was asked to grade the severity of the injury macrostructure of the tendon based on the classification system of Lafosse et al. (2007). They were then asked to choose from a list of treatment options for the injury (no treatment, debridement, tenotomy, or tenodesis). Approximately four months after the initial survey the same shoulder surgeons viewed the same arthroscopic videos and repeated the survey. Statistical analysis with weighted and non-weighted Kappa values was performed to determine intra- and inter-observer reliability for severity grading and to determine preferred treatments for each level of severity.

Results:

Based on the scale of Viera et al. (2005), intra-observer reliability testing for the Lafosse classification system for biceps brachii long head tendon injuries showed substantial agreement between the thirteen evaluators after two rounds of grading (81.28%, $K = 0.7006$). Interobserver reliability testing for the system demonstrated substantial agreement for Grade 0 ($K = 0.7152$), fair agreement for Grade 1 ($K = 0.3803$), and moderate agreement for Grade 2 injuries ($K = 0.5156$). Regarding treatment, the evaluators' combined responses recommended no surgical treatment for 95.4% of the lesions that were individually classified as grade 0 (62/65). Grade 1 lesions were recommended no surgical treatment in 24.1% of the cases (35/145), debridement for 38.6% of the cases (56/145), and either tenotomy or tenodesis in 37.2% of the cases (54/145). Finally, the evaluators preferred tenotomy or tenodesis for 98.3% of the Grade 2 lesions (177/180).

Conclusions:

Validation analysis for the Lafosse classification system for biceps tendon injuries indicates substantial intra-observer reliability for all grades. However, given that Grades 1 and 2 showed only fair and moderate agreement respectively for inter-observer reliability, a need for a reliable grading system still exists. Not surprisingly, no surgical treatment is recommended for Grade 0 lesions. Our consensus is that Grade 2 lesions should be treated with either tenotomy or tenodesis. At this time, a clear preferred treatment for Grade 1 lesions cannot be determined given the high variability of preferred treatment responses. A higher powered survey may help to determine the ideal treatment of Grade 1 injuries in the future.



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LONG-TERM RESULTS FOLLOWING FIRST METATARSAL CHEILECTOMY

Authors: Macaira Dymant, DPM, Bradley Bussowitz, DPM, Christopher Hyer, DPM

Presenter: Macaira Dymant, DPM

INTRODUCTION

Hallux rigidus is a term describing degenerative joint disease (DJD) to the first metatarsal phalangeal joint (MTPJ). It is the most common DJD encountered in the foot and is the second most common pathology of the great toe behind hallux valgus. Failure of conservative efforts leaves many surgical options ranging from cheilectomy to fusion. The goal of a cheilectomy is to relieve pain and increase MTPJ motion, while debulking the area. Critical evaluation of the cheilectomy must include longevity of desired results. Preoperative MTPJ staging using the Coughlin scale is common to aid in determining the stage of degeneration. The primary goal of this study is to determine how long a cheilectomy can be expected to last before an arthrodesis is performed, if ever. Further, we will establish a stratification of longevity based on the initial stage of hallux rigidus, age, gender, and associated procedures.

METHODS

A retrospective chart review was performed on approximately 300 patients who had first metatarsal cheilectomies performed by OFAC. Data analysis included grading of first metatarsal phalangeal joint radiographs preoperatively based on the Coughlin scale. Procedure longevity was determined and reported relative to the initial procedure date based on the Coughlin scale. End point was the time to fusion, if fusion was performed. This information was stratified as a mean, as well as broken into age, gender, and associated procedures performed to better determine predictors of cheilectomy success. The chart review and radiographic assessment were performed by upper level residents and attending physicians specializing in foot and ankle surgery, who were blinded to the outcome.

RESULTS

Two hundred patients were included in the study and the average age was 52 years (range, 13-80 years), including 125 (62%) women and 75 (38%) men. It was found that there were 37 type one, 128 type two, and 35 type three preoperative Coughlin scores. Associated procedures were performed, including, 35 osteochondral defect repairs, eleven moberg osteotomies, five duvries, seven Weil lesser metatarsal osteotomies, and six first metatarsal osteotomies. Data analysis showed six repeat cheilectomies, one interpositional arthroplasty and only two arthrodeses were performed at 4 months and 31 months postoperatively. Follow-up time was a mean of 60 months (range, 1-120 months).

DISCUSSION

Much of the literature surrounding a cheilectomy offers only short term outcomes, mostly of one year or less. Many consider cheilectomy only appropriate in early DJD of the MTPJ. Others recommend cheilectomy for early and advanced DJD. This retrospective study provides long term evidence that cheilectomy is an appropriate procedure for all stages of degenerative joint disease.



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OSTEOMYOPLASTIC AND TRADITIONAL TRANSTIBIAL AMPUTATIONS IN THE TRAUMA PATIENT: PERIOPERATIVE COMPARISONS AND SUBJECTIVE OUTCOMES

Authors: Benjamin Taylor, MD, Bruce French, MD, Atila Poka, MD, Andrew Blint, MD
Kevin Pugh, MD
Presenter: Benjamin Taylor, MD

INTRODUCTION:

The purpose of this investigation was to retrospectively evaluate and compare transtibial amputation osteomyoplasty and traditional transtibial amputation patient populations, with specific attention to perioperative complications and functional outcomes.

METHODS:

Treatment included transtibial amputation osteomyoplasty or traditional transtibial amputations by fellowship-trained orthopaedic traumatology surgeons at a regional Level I trauma center as a result of high-energy trauma or other postoperative complications. Retrospective chart and radiographic review of initial injury, treatment, and postoperative follow-up course were performed. Additional functional outcomes were then measured using the Sickness Impact Profile (SIP) questionnaire, a validated objective quality of life measurement instrument.

DATA AND RESULTS:

Twenty-six patients who underwent transtibial amputation osteomyoplasty are compared to ten patients with traditional transtibial amputations. The average age of the patients was 42.7 years (range 18-83 years). There was a significant increase in acute fractures in the traditional transtibial amputation population ($p < 0.01$) due to the inclusion of several amputation osteomyoplasty patients being referred from remote trauma and its sequelae. Similarly, the length of time from injury to definitive amputation was significantly longer in the amputation osteomyoplasty group. However, the number of previous procedures was not significantly different. Operative time was roughly doubled from an average of 75.8 minutes to 153.8 minutes when performing the amputation osteomyoplasty. Estimated blood loss revealed no differences between groups.

Final clinical follow up at an average of 13.8 months revealed a significantly greater employment rate in the osteomyoplasty group (46% vs. 10%) and a significantly decreased rate of walking aid usage (15% vs. 70%) as compared to the traditional amputation group. A nonsignificant trend of decreased subsequent ipsilateral stump procedure rate was noted in the osteomyoplasty group; a significant decrease in the stump revision rate was seen in this group, however.

Trends of less postoperative time to temporary and permanent prosthesis fitting were seen in the osteomyoplasty group. SIP questionnaire findings included significantly lower overall and physical dimension subset scores in the amputation osteomyoplasty group.

DISCUSSION:

Treatment of patients requiring amputation presents substantial challenges in decision-making and management. In this study, we describe two approaches to management of this difficult-to-treat set of patients and provide perioperative and outcome data showing several significant differences between groups.

Based on the results of this study, transtibial amputation osteomyoplasty appears to be safe in this trauma population. Several subjective and objective advantages to amputation osteomyoplasty are noted in this small patient group.



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FINE NEEDLE ASPIRATION FOR CLINICAL TRIAGE OF EXTREMITY SOFT TISSUE MASSES

Authors: Vincent Ng, MD, Kristen Thomas, MD, Martha Crist, RN, Paul Wakely, MD,
Joel Mayerson, MD

Presenter: Vincent Ng, MD

Introduction:

Fine needle aspiration cytology (FNAC) is a rapid and low-morbidity alternative to needle core or open biopsy for soft tissue masses. Numerous reports describe its use with metastatic or recurrent lesions, but FNAC is less accepted for primary lesions. The purpose of this study was (1) to estimate the sensitivity, specificity, and positive and negative predictive values of FNAC for diagnosing malignancy; (2) to estimate the accuracy of subtyping and grading; (3) to determine the number of patients definitively treated based on FNAC and the clinicoradiographic presentation without additional diagnostic biopsy; and (4) to determine whether the cases in which a false-negative or false-positive error occurred were a result of interpretive error by the pathologist or sampling error by the FNA.

Methods:

We retrospectively examined the diagnostic accuracy and clinical effectiveness of office-based FNAC performed by a trained pathologist on 213 females and 219 males (mean age, 51.8 years) who presented with a palpable soft tissue mass to one musculoskeletal oncology clinic between 2002-2008.

Results:

The FNAC was reported as benign in 62.0%, indeterminate in 8.1%, and malignant in 29.9%. A second technique, such as needle core or open biopsy, was performed for 24.8% of lesions before a definitive treatment plan was rendered. Final tissue confirmation by open biopsy or resection was available for 52.2% of benign FNAC and 78.3% of malignant FNAC. Sensitivity, specificity, and positive and negative predictive values for detecting malignancy with either histopathologic confirmation or clinical followup were, respectively, 89.2%, 89.8%, 96.1%, and 98.1%. There were seven sampling and nine interpretation errors in determining the nature of the lesion. Subtyping and grading for malignant lesions were, respectively, 77.2% and 95.2% accurate.

Conclusions:

FNAC is effective for initial triage and treatment selection at tertiary referral centers with close collaboration



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WEIGHT-BEARING LESIONS OF THE LATERAL FEMORAL CONDYLE FOLLOWING PATELLAR DISLOCATION IN THE ADOLESCENT ATHLETE

Authors: Matthew Beran, MD, Walter Samora, MD, Kevin Klingele, MD
Presenter: Matthew Beran, MD

INTRODUCTION:

MRI evidence of osteochondral injury following an acute patellar dislocation has been reported in 40-70% of patients. This classically consists of a bone contusion pattern involving the inferomedial pole of the patella and the anterolateral aspect of the nonarticular portion of the lateral femoral condyle. In our practice, we have found a significant number of patients with articular cartilage damage on the weightbearing surface of the lateral femoral condyle.

The purpose of the present study was to characterize the location and extent of osteochondral injury to the lateral femoral condyle identified on MRI following a patellar dislocation. Our hypothesis was that a significant number of patients sustain injury to the weightbearing surface of the lateral femoral condyle and that many of these patients ultimately require some type of operative intervention.

METHODS:

We conducted a retrospective review of all patients referred to a single pediatric primary care sports medicine clinic between January 2006 and October 2009 with a diagnosis of closed patellar dislocation. Inclusion criteria were a documented patellar dislocation and/or reduction maneuver as well as a post-injury MRI. Exclusion criteria included any patient with habitual or obligatory instability, a connective tissue disorder, or a multiligamentous knee injury. MRIs were reviewed and the patterns of injury evaluated including the presence of osteochondral bruising/defects, as well as any associated pathology. Patient age, sex, and status of the distal femoral/proximal tibia physes were documented. The study population consisted of those patients identified with an osteochondral injury on the weightbearing portion of the lateral femoral condyle. In that subgroup of patients, we further evaluated associated injury patterns as well as any relevant surgical history and intraoperative findings.

DATA and RESULTS:

229 patients were seen between January 2006 and October 2009 for a diagnosis of acute patellar dislocation. 80 patients met the inclusion criteria. There were 37 male and 43 female patients with an average age of 13.8 years. Twenty-one patients (twenty-two knees) were identified with a weightbearing lesion of the lateral femoral condyle. There were 16 males and 5 females in this subgroup of patients, with an average age of 14.2 years. The left knee was involved in 14 patients, the right knee in 8 patients. One patient sustained bilateral injuries. Eleven patients (52.4%) had open physes at the time of injury. Osteochondral lesions were identified on xray in 4 knees (22.2%). A true osteochondral defect was seen in 16 knees, while the remaining 6 knees had a bone bruise extending down onto the weightbearing surface. Thirteen of the twenty-one patients were identified with the combined and unique injury pattern consisting of a patellar-sided MPFL avulsion with associated injury to the weightbearing surface of the lateral femoral condyle. Of these 22 knees, 14 underwent operative intervention (63.6%). The most common procedures performed included microrfracture (8 knees), lateral release (6), medial imbrication (6), chondroplasty (5), loose body removal (5), and ORIF of osteochondral fracture (3).

DISCUSSION:

In our series, we found a 27.5% incidence of osteochondral injury to the weightbearing surface of the lateral femoral condyle in those patients who underwent an MRI following a lateral patellar dislocation. Over 60% of those patients ultimately required operative intervention. We thus advocate MRI for any patient with a documented or suspected patellar dislocation, particularly in the setting of tenderness over the articular surface of the lateral femoral condyle. Knowledge of this injury pattern is essential for any patient treating patellofemoral disorders.



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COMPLICATIONS, ADVERSE EVENTS, AND FAILURES AFTER AUTOLOGOUS CHONDROCYTE IMPLANTATION

Authors: Joshua Harris, MD, Robert Siston, PhD, David Flanigan, MD

Presenter: Joshua Harris, MD

Background:

Complications and reoperations after the original 1st-generation, two-stage, open arthrotomy implantation of cultured autologous chondrocytes under a periosteal cover have led to the development of newer techniques designed to improve clinical outcomes and reduce the rate of adverse events.

Purpose:

To determine the profile of complications, adverse events, failures, and reoperations after 1st, 2nd, and 3rd generation (open and all-arthroscopic) autologous chondrocyte implantation (ACI).

Methods:

A systematic review was conducted, evaluating all clinical studies (published between years 1994 – 2010) that reported complications, adverse events, failures, and reoperations after ACI. Levels I, II, III, and IV evidence were included. Inter-generational and open versus all-arthroscopic techniques were compared. Generations of ACI were defined based on previously-reported and accepted techniques. All complications were defined based on previously-described criteria submitted and approved by the U.S. FDA (Food and Drug Administration).

Results:

Ninety-three studies were included (over 7,000 patients / 7,100 knees). Follow-up duration ranged from 3 months to 21 years. Adverse events or complications occurred in nearly 50% of all patients. Variably defined, treatment failure occurred in 0% - 25% of patients within all studies. Over 75% of all failures occurred within three years following cell implantation. The rate of hypertrophy was greatest (0% - 32%) after periosteal-cover, 1st-generation ACI. The rate of delamination was greatest (0 - 22%) after periosteal-cover, 1st-generation ACI. The reoperation rate was greatest after periosteal-cover, 1st generation ACI (0% - 50%). Most reoperations (>50%) were performed for symptomatic hypertrophy of the graft / periosteum.

Conclusions:

Improvements upon the original 1st-generation, two-stage, open arthrotomy implantation of cultured chondrocytes under periosteal cover have reduced the complication and failure profile of ACI. Current and future technological advances with ACI include less invasive, biologically and phenotypically-manipulated cell lines and three-dimensional scaffolds designed to improve clinical outcomes and reduce the rate of adverse events.

Level of Evidence: IV (Systematic review of studies Level of Evidence I, II, III, and IV)



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A RETROSPECTIVE COMPARISON OF FOUR PLATE CONSTRUCTS FOR FIRST METATARSOPHALANGEAL JOINT FUSION: STATIC PLATE, STATIC PLATE WITH LAG SCREW, LOCKED PLATE, LOCKED PLATE WITH LAG SCREW

Authors: Michael Swiatek, DPM, Vytataus Ringas, MD, Chrstioher Hyer, DPM

Presenter: Michael Swiatek, DPM

INTRODUCTION: The primary treatment for progressive first metatarsophalangeal (MTP) joint arthritis is arthrodesis. Multiple fixation types have been used to accomplish fusion including plating. There have been no published papers reporting the outcomes of these four plate/screw constructs. We present our experience with 138 first MTP joints and hypothesize that the locked plate with lag screw will have the highest rate of fusion.

METHODS: A retrospective comparison and radiographic chart review of 132 patients (138 feet) was performed to compare different constructs in regards to successful union and time to fusion. All operations were performed by fellowship trained foot and ankle surgeons. The radiographs were independently read by two authors not involved in the index procedures. Radiographic fusion was determined by bridging cortices across the joint line. All joints were prepared by debriding the surface cartilage and sclerosis to a bleeding subchondral base. The hardware was then implanted, fusing the first MTP joint in a position of: 0° frontal plane, 5-10° abducted and 5-15° dorsiflexed from the weight bearing surface dependant on individual patient needs. Serial radiographs were performed at week 1, 4, 8 and 12, with additional radiographs taken if necessary. The statistical analysis was performed using Kruskal-Wallis which is a nonparametric ANOVA test for data that is not normally distributed. Kruskal-Wallis was used for: rate of union, time to union and time to partial and full weight bearing. ANOVA was used for groups that were normally distributed, in this case, age and gender.

DATA AND RESULTS: There were 138 feet (132 patients) identified over a four year period with: 43 patients in the static plate(SP) group, 14 static plate with lag screw(SPL), 36 locked plate(LP) and 45 locked plate with lag screw(LPL) construct. The mean time to union, in days and rate of fusion were: static plate: 59, 95%, static plate with lag screw: 56, 86%, locked plate: 66, 92%, locked plate with lag screw: 53, 96%. Time and rate of fusion was evaluated in the 4 groups and there no statistically significant difference ($P=0.70$). The mean age for each group was: SP 58.6 years; SPL 57.1 years; LP 57.3 years; LPL 58.1 years. ANOVA was performed and resulted in no significant difference between groups ($P=0.92$). There was no statistical difference between the amount of time to protected ($P= 0.53$) and full weight bearing ($P= 0.086$).

DISCUSSION: We report on the results of fusion comparing four different plate/screw constructs for first MTP joint fusion. The data reveals no significant difference in time to fusion or rate of fusion between static and locked plates, with or without a lag screw. The purpose of this study was to compare the rate and time to union of four different internal fixation constructs for 1st MTP joint fusion. We achieved an overall radiographic union rate of 93% in 138 feet. This rate of union is consistent with reports of long term studies showing union rates of 77-100 percent.¹⁻¹¹ The locked plate with lag screw, as hypothesized, had the highest rate of union at 96%, but was not statistically significant when compared to the other types of internal fixation.

Overall, our results conclude that fixation with a static or locked plate with or with out a lag screw will produce an acceptable rate of union. It is the belief of the authors' that a larger cohort would have produced a statistically significant result with the locked plate and lag screw construct.



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YOUTH BASEBALL PITCHERS: ARE WE FOLLOWING THE PITCHING GUIDELINES?

Authors: Joseph Fazalare, MD, Justin Classie, MD, Angela Pedroza, MPH, Tom Best, MD, Christopher Kaeding, MD

Presenter: Joseph Fazalare, MD

Orthopaedic surgeons are seeing an increasing amount of shoulder and elbow injuries in youth baseball pitchers. Because of this, the USA Baseball Medical and Safety Advisory Committee made pitching recommendations to coaches, parents, and athletes to help avoid these injuries. These guidelines are age based and suggest the safe amount of pitches that should be thrown by youth athletes.

The goal of our research was to see if these recommendations are being followed by the coaches. We hypothesized that the coaches know these guidelines and follow them. An internet based questionnaire was used to test 95 youth baseball coaches of the Central Ohio Youth Baseball League. Their answers were graded based on the appropriate age guidelines.

The coaches of the 9-10 year age group answered an average of 62% of the questions correctly, the 11-12 year age group scored an average of 35%, and the 13-14 year age group scored an average of 42%. Overall, the coaches of the 9-10 year age group had the highest average score compared to the coaches of the 11-12 year and 13-14 year age groups ($p < 0.01$).

The number of pitchers who played with reported pain in the elbow or shoulder increased as age increased ($p < 0.01$). A total of 75% of coaches in the 9-10 year age group, 65% in the 11-12 year age group, and 84% in the 13-14 year age group state that they follow the rules. A total of 40% of the 9-10 year age group coaches, 60% of the 11-12 age group coaches, and 52% of the 13-14 age group coaches say that other coaches follow the rules. The coaches of these young pitchers scored poorly when tested on the pitching guidelines.

By not adhering to these recommendations, these young athletes are at a significant risk to sustain shoulder and elbow injuries.



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VITOSS (ULTRAPOROUS BETA TRICALCIUM PHOSPHATE) AS A VIABLE OPTION FOR FILLING CAVITARY DEFECTS IN BENIGN BONE TUMORS

Authors: Corey Van Hoff, MD, Julie Samora, MD, Michael Greisser, MD, Martha Crist, RN, Thomas Scarschmidt, MD, Joel Mayerson, MD

Presenter: Michael Griesser, MD

INTRODUCTION: The treatment of benign bone tumors with curettage of the lesion results in a cavitory defect. Autologous, allograft, or synthetic bone grafts can be used to fill the defect and accelerate healing. Autologous bone grafts and allografts possess some inherent disadvantages including pain, surgical morbidity, and infection transmission. Synthetic grafts may demonstrate promise by increasing patient safety, decreasing morbidity, and shortening operating times. This study is a retrospective review analyzing radiographic outcomes of patients treated with ultraporous β -tricalcium phosphate bone graft undergoing surgical excision or curettage of benign bone lesions requiring a bone void filler.

METHODS: Thirty-four subjects were treated by a single surgeon with curettage and Vitoss® Morsels. Radiologic defect size at initial post operative presentation and subsequent visits with a minimum of twelve months of follow up was evaluated. Defects were graded on a four-point scale, with a lucency traversing the entire defect space scored as a Grade 1, and with a defect no longer distinguishable from surrounding bone scored as a Grade 4.



Figure 1. Lateral (left) and AP (right) views demonstrating radiolucent bony defect.



RESULTS The average bone void was 50.3 cc³ (range 0.3-211 cc³) and the average follow up was 17.2 months (range 6 to 34.5 months). The average size at most recent follow up was 17.2 cc³ (range, 0-85.9 cc³). The following radiologic grades were observed: one each of Grade 1 and Grade 2, 15 patients with Grade 3 and 16 patients with Grade 4.

Twenty-eight of the 34 patients mobilized on schedule and were clinically pain free at their three month follow-up visit. There were no infections. Three patients had a local recurrence and underwent reoperation. One patient developed AVN of her femoral condyle and subsequently underwent total knee arthroplasty.

CONCLUSION: The results of this study suggest that an ultraporous β -tricalcium phosphate synthetic bone graft is effective in treating bone voids. The vast majority of patients undergoing curettage for benign bone lesions can expect to have complete or near-complete healing of these defects with the use of Vitoss® morsels. Prospective, randomized study comparing β -TCP with autologous bone graft and with synthetic composite bone grafts would aid in providing practitioners evidence with which to make informed clinical decisions.



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MENISCAL PATHOLOGY ASSOCIATED WITH ACUTE ANTERIOR CRUCIATE LIGAMENT TEARS IN PATIENTS WITH OPEN PHYSES

Authors: Walter Samora, MD, Ryan Palmer, DO, Kevin Klingele, MD

Presenter: Walter Samora, MD

INTRODUCTION: The aim of this study was to characterize meniscal pathology associated with acute ACL rupture in skeletally immature patients undergoing arthroscopically assisted ACL reconstruction. Our secondary aim was to evaluate the accuracy of preoperative MRI in predicting meniscal pathology.

METHODS: We performed a retrospective chart review on a consecutive series of 124 skeletally immature patients who underwent arthroscopically assisted ACL reconstruction between April 2003 and December 2009. All surgeries were performed by a single surgeon (KK). Skeletal immaturity was determined by reviewing radiographic evidence of open physes via plain radiographs and/or preoperative MRI. Patients were divided into three groups based on sex, level of skeletal maturity, and type of ACL reconstruction performed. Operative reports and intra-operative arthroscopic images were reviewed to determine patterns of meniscal injury including location, tear pattern, treatment, and any associated intra-articular pathology. The accuracy of preoperative MRI with regard to ACL rupture and predicting meniscal tear pathology was also evaluated.

DATA AND RESULTS: Our patient population totaled 124 patients, which included 80 males with an average age of 14.3 years (range-8.7 to 16.7) and 44 females with an average age of 14.1 years (range-12.7 to 16.1). There were 54 left knees and 70 right knees with a total of 110 meniscal tears. The lateral meniscus was torn in 50 patients, the medial meniscus in 20 patients and both menisci in 19 patients. The incidence of meniscal tear was 71.7%. Location of the tear occurred in the posterior horn in 87 tears (79%), the middle and posterior horn in 17 tears (15.4%), the middle horn in 4 tears (3.6%) and the anterior horn and posterior horn in 2 tears (1.8%). There were no isolated anterior horn meniscal tears in this series of patients. Preoperative MRI available for review in 69 patients demonstrated a 95.6% sensitivity in detecting complete ACL rupture. In characterizing meniscal tears, MRI showed a sensitivity of 73% and a specificity of 91.6%.

DISCUSSION: Although there are many studies that evaluate anterior cruciate rupture in the skeletally immature population, few studies specifically focus on the concurrent meniscal pathology that is often associated with these injuries. Graf et al concluded from a study of 12 skeletally immature patients with ACL tear that meniscal pathology is often associated. We found a 71.7% incidence of meniscal pathology with ACL tears and can agree with their findings. However, we further characterize the location, morphology, and zone of meniscal injury in a much larger patient cohort. Recently, Laundre et al reviewed the MRI results of 120 patients who underwent ACL reconstruction. The average age was 18.5 years with no patient over 40 years old. They found 28 missed tears, 19 of which involved the posterior horn of the lateral meniscus. MRI sensitivity was found to be 58.5% for lateral tears and 88.1% for medial tears. Our study included only skeletally immature patients with open physes. We found that 17 out of 69 patients with preoperative MRI had meniscal tears that were missed on imaging.

In conclusion, our results demonstrate that meniscal injury is commonly associated with ACL rupture in the adolescent and younger population with an overall incidence of 71.7%. Lateral meniscal tears are more common than medial meniscal tears, which were equally as common as combined tears in our patient population. The posterior horn is injured in the vast majority of patients and tear morphology is highly variable. Also, a high percentage of meniscal pathology requires surgical intervention in this clinical scenario. In addition, although MRI has a high sensitivity in detecting ACL rupture, it is much less sensitive in detecting meniscal pathology with an overall sensitivity of 73%. These findings will help guide surgeons in their clinical evaluation and treatment of skeletally immature patients with complete anterior cruciate rupture and meniscal injury.



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DERMAL FIBROBLAST-MEDIATED AND DIRECT BMP-2 GENE THERAPY FOR BONE REGENERATION IN EQUINE MODEL

Authors: Akikazu Ishihara, DVM, Lisa Zekas, DVM, Steven Weisbrode, DVM, Alicia Bertone, DVM

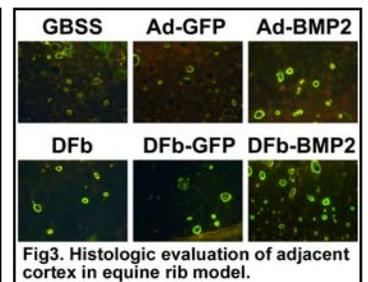
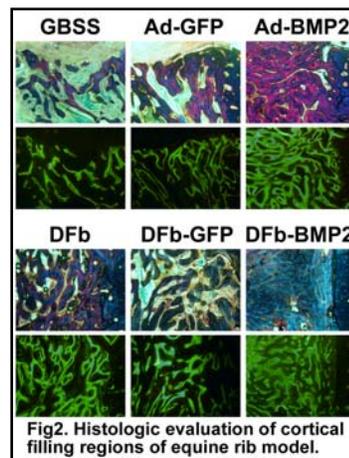
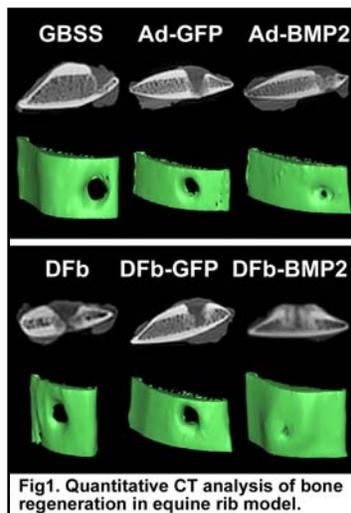
Presenter: Akikazu Ishihara, DVM

INTRODUCTION: Regenerative strategies for inferior bone repair are a growing need in aging people. Although stem cells have been extensively studied for cell-mediated gene therapy, dermal fibroblasts (DFb) have been differentiated into bone-forming cells by the transduction of osteogenic genes such as bone morphogenetic protein-2 (BMP2), and transplanted to promote bone healing in rodent models.^{1,2,3} We hypothesized that DFb- and gene-mediated BMP2 delivery will show equivalent increased bone regeneration in the equine rib defect model.

METHODS: Six skeletally mature horses were used to isolate DFb by full-thickness skin punch biopsy. For each horse, the six rib drill hole defects were created and treated with percutaneous injection of autologous DFb following BMP2 gene transduction (DFb-BMP2; n=6 defects), green fluorescent protein (GFP) gene transduction (DFb-GFP; n=6), DFb alone (DFb; n=6), adenoviral vector carrying BMP2 gene (Ad-BMP2; n=6), Ad-GFP (n=6), or Gay's balanced salt solution (GBSS; n=6). All injections were made two weeks after surgery (Day 14). Six weeks following the injection (Day 56), the horses were euthanized and rib specimens were harvested. Efficacy was assessed by quantitative computed tomography (qCT) and histology. Repeated-measure analysis of variance was used to evaluate the effects of DFb-mediated BMP2 therapy with the post-test multiple comparisons between the treatments.

DATA AND RESULTS: At week 6, both of the DFb-BMP2- and Ad-BMP2-treated rib defects had greater bone filling volume and mineral density, with DFb-BMP2 inducing greater bone volume and maturity in cortical bone aspect of the defect than Ad-BMP2. The transplantation of DFb alone induced modest bone formation. Increased mineral density and bone turnover were evident in the cortical and cancellous bone directly adjacent to the healing drill defects treated with either DFb-BMP2 or Ad-BMP2.

DISCUSSION: Using our cell/vector dosage and model, BMP2, whether delivered by DFb-vector or direct adenoviral vector, induced greater and robust bone regeneration. DFb-mediated BMP2 therapy promoted greater cortical bone regeneration than direct gene delivery, possibly due to an increased cellularity of the bone healing site. BMP2 delivery, regardless of gene delivery method, increased mineral density of neighboring bone which may be beneficial clinically in repairing or weak bone.





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IN-VIVO HIGH-FIELD 3 TESLA MAGNETIC RESONANCE IMAGING TO ASSESS OSTEOCHONDRAL HEALING IN AN EQUINE MODEL

Authors: M Menendez, BVSc, DJ Clark, G. Gia, PhD, S. Choi, PhD, S Sammet, PhD, D Flanigan, MD, MV Knopp, PhD., A Bertone, DVM

Presenter: Maria Menendez, BVSc

INTRODUCTION:

Osteochondral defects are an important model to evaluate cartilage healing *in vivo*. MRI is a well-known noninvasive technique to assess cartilage healing. A challenge with the equine species is the large body size for MR and CT body coils and duration of general anesthesia correlates to complications on recovery. We propose to use a pony knee model and a combination of MR body and knee coils for rapid high-resolution imaging. The delayed gadolinium enhance magnetic resonance imaging (dGEMRIC) is a clinical technique for imaging tissue proteoglycan (PG) content and distribution¹. T2 Mapping is being used to characterize morphologically and quantitatively cartilage repair². Dynamic contrast-enhanced MRI (DCE-MRI) by quantified analysis of time-intensity curve reflects the tissue permeability and vascularity³. The goal of this study was to develop quantitative methods to evaluate knee osteochondral defects at 6, 12, 24 and 52 weeks after surgery using a high-field 3 Tesla MRI combined with knee coils.

METHODS:

Five skeletally mature Shetland ponies, under general anesthesia, had osteochondral defects drilled bilaterally on both the medial and lateral condyles of the distal femur (n=20 defects). The defects were injected with a variety of protocols including viral vectors coding for human bone morphogenetic proteins (BMP-2 and BMP-6). At 6, 12, 24 and 52 weeks, under general anesthesia, the ponies underwent MRI, positioned in right lateral recumbency and standard body coil protocol using a 3-Tesla MRI [Achieva, Philips]. Simultaneously in weeks 12 and 24, a 4-channel array of 10cm surface loop coil was set up on each pony knee. dGEMRIC, T2 mapping and DCE-MRI were performed. All calculations were performed using in-house software written in the IDL environment (Interactive Data Language, ITT Visual Information Systems, Boulder, CO).

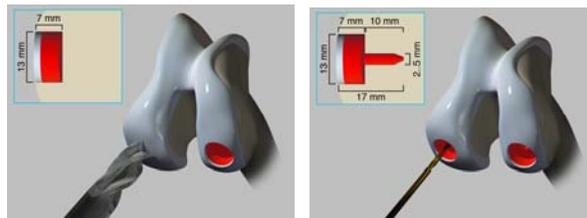


Figure 1: femoral condyle osteochondral defects

DATA AND RESULTS:

The 4-channel arrays of the knee coils were far superior, obtaining higher resolution images compared to the 6 week MRIs performed with only body coils. There was a higher T1 value [dGEMRIC analysis], between healthy cartilage (avg. 731 +/-190 ms) and the cartilage within the defect (1193+/-310ms). There was no significance difference among treatments 12 or 24 weeks for T1 pre-and post-contrast. DCE amplitude was low in healing cartilage (0.027 +/-0.026) and high in the bone defect regions (1.02 +/-0.45) Curves of exercised knees compared to unexercised knees were shifted to the left indicating more rapid distribution to the joint. T2 differences were negligible (healthy: 24.3 +/-4.9ms, injured: 25.9 +/-4.2ms). On 24 weeks DCE-MRI, BMP6 had greater amplitude within the osteochondral lesion.

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IN-VIVO HIGH-FIELD 3 TESLA MAGNETIC RESONANCE IMAGING TO ASSESS OSTEOCHONDRAL HEALING IN AN EQUINE MODEL , CONTINUED

Presenter: Maria Menendez, DVM

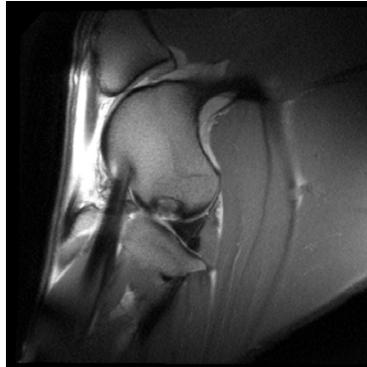


Figure 2: Pony stifle dGEMRIC at 24 weeks.

DISCUSSION:

The knee coil dramatically enhanced the image quality of 3-Tesla imaging of pony knees. Gadolinium contrast enhanced vascular imaging of the healing defects, seen most in subchondral bone. Exercise accelerated the distribution of Gd into cartilage shortening the MRI procedure. Healing cartilage had less GAG (longer T1 relaxation in ms) than surrounding cartilage as expected. In conclusion, dGEMRIC, T2mapping and DCE-MRI Analysis in a pony model using a high-field 3Tesla MRI combined with the surface loop coils produced additional and new information in the assessment of healing osteochondral defects.



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OBLIQUE METATARSAL SHORTENING OSTEOTOMY BY A SINGLE SAW CUT

Authors: Jennifer Trinidad, DPM, Said Atway, DPM

Presenter: Jennifer Trinidad, DPM

INTRODUCTION:

The shortening produced with an oblique resection osteotomy is greater than the thickness of the bone removed and is a function of the angle at which the saw cuts are made. The shortening achieved is equal to the width of bone removed (saw kerf) divided by the cosine of the cutting angle θ . Saw kerf is the amount of material removed with a single pass of a saw blade.

Purpose: To determine a predictable amount of shortening with a single saw pass to remove a cuff of bone.

METHODS:

Part One- Determining saw kerf: Single saw blade used to cut halfway through saw bone material. Saw blade withdrawn. Saw kerf measured with feeler gauge by starting with thinnest leaf and measured to highest tolerance. 5 runs completed. Average measurement tabulated.

Part Two- Measure shortening with single cut technique: Foam block was cut and used as 60° osteotomy guide. Half pins held guide in place over dorsal aspect of lesser metatarsal sawbone and used as a marker to obtain pre-osteotomy measurements with metric digital caliper. Series of 5 oblique osteotomies completed at 60° to lesser metatarsal bone. Foam block osteotomy guide removed. Next a third half pin driven through osteotomy in preparation of fixation. Power pre-drilled half pin and placed partially threaded cannulated screw through osteotomy site. Secured with hand driver and removed third pin. Original proximal and distal half pins replaced back into dorsal osteotomy guide drill holes of metatarsal. Final measurement recorded with digital metric caliper and subtracted from original pin distance to allow recording of shortening.

DATA AND RESULTS:

Part One: The average saw kerf of 5 trial runs was determined to be 0.432mm.

Geometric Hypothetical Shortening (S) S = Saw kerf (K) / cosine cutting angle θ

Saw Kerf = 0.432mm

S= K/cosine θ

S= 0.432/cos 60°

S= 0.432/cos ½

S= 0.432 x 2

S= 0.864mm = Hypothetical Population Mean

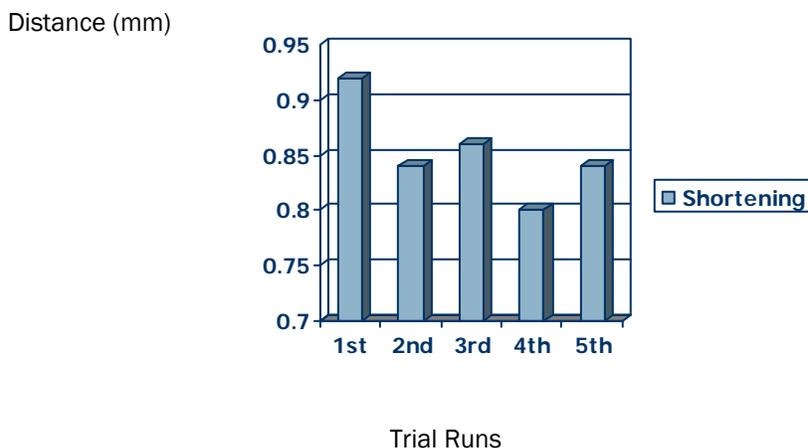
Part Two: The hypothetical geometric shortening of a saw kerf of 0.432mm was noted to be 0.864mm when using cutting angle 60. The actual amount of shortening obtained ranged from 0.80mm to 0.92mm with a sample mean of 0.852mm and a standard deviation of 0.0438mm. Using a single sample student T-Test it was found that the p-value= 0.573, therefore accepting the null hypothesis.

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OBLIQUE METATARSAL SHORTENING OSTEOTOMY BY A SINGLE SAW CUT, CONTINUED...

Presenter: Jennifer Trinidad, DPM



DISCUSSION: This study has shown that the hypothetical geometric equation transfers to a clinical application. The small bones of the feet, metatarsals, at times require shortening osteotomies. In the case of pre-dislocation syndrome, the beginning of a hammertoe, the metatarsophalangeal joint can be decompressed surgically with an osteotomy of the metatarsal. An excess of millimeters of shortening can disrupt the metatarsal parabola and potentially lead to transfer lesions of the other metatarsals. Therefore a predictable amount of shortening is beneficial to maintaining a stable metatarsal parabola. Further studies could lead to a pre-tabulated table with the current commercially available small saw blades with pre-determined amount of shortening when used at a specific cutting angle.



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EVALUATION OF ACL INJURIES IN SOCCER PLAYERS

Authors: Peter Edwards, MD, Ashraf Darwish, MD, Lisa Nicholson, PhD

Presenter: Ashraf Darwish, MD

Introduction: Soccer is the most commonly played sport in the world, with over 250 million active players. The sport has become increasingly popular in the United States among both males and females, with over 18 million Americans now playing soccer. The increase in popularity in the US is in large part due to increasing number of female soccer players. The risk of ACL injuries in female soccer players is six times greater than males. The purpose of this study is to determine the possible differences in ACL injury mechanisms and risk factors in male versus female soccer players.

Methods: ACL reconstructions performed by a single surgeon were both retrospectively and prospectively reviewed to identify tears caused by soccer injury. A chart review was performed to obtain patient information such as age, gender, and Body Mass Index (BMI) at the time of injury. Subjects were also surveyed regarding injury etiology.

Data and results: Of approximately 750 ACL reconstructions performed over a 6 year period, 167 were soccer related. Ninety seven cases (58%) were female and 70 cases (42%) were male. There were 56 cases (33.5%) caused by direct contact and 111 cases (66.5%) by noncontact. Females were significantly more likely than males to experience contact injuries; 71.43% of females compared to 28.57% of males (chi-square=6.16, p=.011). T-tests show that females with contact injuries had significantly lower BMI (22.28 kg/m²) than those with non-contact injuries (23.15 kg/m²) (p=.03), but no relationship between contact and BMI was found among males. No significant difference was observed when comparing dominant versus non-dominant leg in both males and females.

Discussion: In this study population, more ACL tears were sustained as a result of non-contact injury versus those sustained from direct contact. However, females were significantly more likely than males to sustain a contact ACL injury. Furthermore, females with non-contact injuries had a significantly higher BMI than those with contact injury. Previous reports have shown that the cause of the increased risk of ACL injuries in females to be multi-factorial. The findings in this study reinforce the importance of conditioning in reducing the risk of ACL injury in female soccer players.



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BIOMECHANICAL TESTING OF FEMORAL FIXATION DEVICES FOR ANTERIOR CRUCIATE LIGAMENT RECONSTRUCTION USING CADAVERIC HAMSTRING GRAFTS

Authors: Praveen Kanneganti, Daniel Quinn, M.D., Alan Litsky, MD, ScD,
David Flanigan, MD
Presenter: Daniel Quinn, MD

Introduction:

An ACL tear is one of the most common surgically repaired knee injuries. Several different femoral fixation techniques exist, including cortical fixation and transfemoral fixation, which involve indirectly suspending the graft within the bone tunnel, as well as interference screw fixation, which involves using screws that directly compress the graft against the walls of the bone tunnel. The purpose of this study was to compare the performance of newer systems of femoral fixation using the Endobutton Direct (Smith + Nephew, Andover, MA), Femoral Intrafix (Depuy Mitek, Raynham, MA), and AXL Crosspin (Biomet, Warsaw, IN).

Methods:

Eighteen cadaveric bovine knees were used to compare the biomechanical properties of the three different femoral fixation devices (six per group). Paired hamstring tendon allografts were fixed in the femoral tunnel according to each device's specifications. The free ends (tibial side) were fixed to the materials-testing machine (Bionix 858 MTS Corp, Eden Prairie, MN) via custom-made cryoclamps. Failure load, stiffness, and load at 2mm, 3mm, 4mm, and 5mm displacement were measured and compared.

Results:

There were significant differences in the peak load ($p=.002$), stiffness ($p=.022$), and load at 5mm displacement ($p=.012$) between the devices. The AXL crosspin had a significantly higher load to failure than either the Intrafix ($p=.011$) or the Endobutton Direct ($p=.003$), and also a significantly higher load at 5mm displacement than either the Intrafix ($p=.036$) or Endobutton Direct ($p=.016$). Stiffness was not significantly different between the AXL crosspin and Femoral Intrafix devices, but both were significantly more stiff than the Endobutton Direct ($p=.022$ and $p=.006$, respectively).

There were no significant differences between the groups in load at 2mm, 3mm, or 4mm displacements.

Conclusions:

These findings suggest that the AXL Crosspin may have superior biomechanical properties than the either Femoral Intrafix or Endobutton Direct devices, outperforming them in failure load and load at 5mm displacement. The Endobutton Direct was also the least stiff, possibly making it a less desirable option for femoral fixation than the other two. In the range of clinically relevant displacements, all devices performed similarly, suggesting that the choice of devices ultimately depends on the surgeon's preference.

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