



Western Orthopaedic Association

Scientific Poster Exhibits

July 24-26, 2008

Poster presenters will have an opportunity to report their findings during the Reception on Friday evening 5:30 pm – 7:30 pm and at additional designated times indicated on the Meeting-at-a-Glance Schedule.

Scientific Posters will be on display in the exhibit area during the Scientific Program on Thursday, Friday, and Saturday. Please plan to visit the Scientific Posters.

2008 WOA Poster Presenters

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Poster Abstracts

Poster 1

Total Hip Arthroplasty Through an Anterior Approach: A Comparison of Operating Tables

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Tamara Alexandrov, MD
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Introduction: Total hip arthroplasty through an anterior muscle sparing approach offers advantages over the traditional posterior approach. Because of difficulties with exposure, a traditional fracture table has been used, with risks of nerve palsy, fracture, and expense. To address these concerns, a newer fracture table and a technique using a modified traditional operating table have been developed. The purpose of this paper is to determine any differences in surgical parameters between use of the older fracture table (OFT), a newer fracture table (NFT), and traditional operating table (TOT) for total hip arthroplasty through an anterior approach.

Methods: Charts from anterior approach total hip arthroplasties performed over a five year period at a single institution by a single surgeon were retrospectively reviewed. Cases were divided into three groups according to the table used (OFT, NFT, and TOT). Data regarding surgical parameters was analyzed.

Results: 60 procedures met the study criteria: 18 hips in 14 patients in the OFT group, 38 hips in 33 patients in the NFT group, and 4 hips in 4 patients in the TOT group. Radiographic mean theta angle, stem varus/valgus, and limb length discrepancy were similar between the groups. In unilateral surgeries, the NFT group had decreased mean estimated blood loss, mean set up time, and mean surgical time than the OFT and TOT groups (861cc/53 min/160min [NFT] versus 1500cc/55min/234min [OFT] and 1550cc/71min/194min [TOT]). In bilateral surgeries, the NFT group again had decreased mean parameters (1090cc/86min/327min [NFT] versus 3700cc/77min/405min [OFT]). Complications were similar among the groups.

Discussion and Conclusion: In total hip arthroplasty performed through an anterior approach, the newer fracture table

results in decreased set up time, surgical time, and blood loss when compared to the older fracture table and the traditional table. Using the traditional operating table is feasible for this procedure.

* *The FDA has not cleared the drug and/or medical device for the use described in this presentation. (Refer to page 32.)*

Poster 2

New Surgical Techniques Improve Survivorship Results of Hip Resurfacing in Patients with Risk Factors

Harlan C. Amstutz, MD
Michel J. Le Duff, MA

Introduction: Our previous publications reporting the results of the beginning of our series have highlighted large femoral defect size and small component size as the main risk factors for the survivorship of metal-on-metal hip resurfacing. One possible answer to this issue was to observe a strict patient selection, another was to improve the surgical technique. We chose the later approach and the purpose of the present study is to identify the risk factors for the procedure after modification of the surgical technique.

Materials and Methods: 1000 Conserve⁺Plus were implanted in 838 patients. 75% were males and the average age was 50. Idiopathic OA was the etiology for 69%. 34.7% had femoral head defects > 1cm, 38.5% had a femoral component smaller than 48mm, 5.7 % had undergone previous surgeries, and 52% had a UCLA activity score of 8 or greater. 687 hips (592 patients) cumulated more than one of these risk factors. Surgical techniques related to cleaning (use of a high speed burr), drying (suction and CO2 blow dry), and preparation of the bone-cement interface (number and position of additional drill holes; metaphyseal stem cementation) were altered, based on the review of intra-operative and retrieval photos of the early failed resurfacing cases.

Results: Using any revision as end point, a univariate analysis on the whole cohort that confirmed the detrimental effect of the previously listed variables. However, after mutual adjustment for the other variables, our multivariate analysis pointed

out that surgical technique (1st generation vs. 2nd and 3rd combined) and BMI were the variables currently most significantly influencing the survivorship of the device ($p=0.016$ and $p=0.023$, respectively). A prior surgery ($p=0.771$), patient activity ($p=0.694$), age ($p=0.235$), and the metaphyseal stem / femoral shaft angle ($p=0.757$) did not have any significant effect on prosthetic survival at the current follow-up.

Discussion and Conclusion: Short term complications were eliminated despite the presence of risk factors in patients resurfaced with the Conserve[®]Plus by implementing improvements in surgical technique and by minimizing impact activities. Optimizing technique is essential to improving long-term durability.

* *The FDA has not cleared the drug and/or medical device for the use described in this presentation. (Refer to page 32.)*

Poster 3

Is There a Downside for THR with Large Femoral Heads for Young Patients?

Harlan C. Amstutz, MD
Michel J. Le Duff, MA

Introduction: Metal-on-metal hip resurfacing is regaining popularity as treatment for OA in the young patient because of improved results over earlier generations of implants, stability, leg length equality and ease of revision. Opposing views suggest that with new materials and designs, a THR with a large femoral head could be preferable. Large diameter balls increase jumping distance and have been effective in treatment of dislocation after THR. The purpose of the present study was to review the early results and clinical performance of Big Femoral Heads (BFH[™], Wright Medical Technology Inc., Arlington, TN) used with thin sockets and a metal-on-metal bearing to prevent dislocation.

Methods and Materials: 65 stem-type prostheses were implanted in 61 patients, all articulating with a Conserve[®]Plus metal-on-metal acetabular components. In 47 hips, the socket was inserted at the time of surgery and in 18 hips a conversion of resurfacing to THR was performed where the 5mm porous coated MM socket was maintained. Mean age was 57.7 years (range, 23 to 83 years). 16 patients were 65 years old or more. There were 39 males and 22 females. The initial etiology was idiopathic OA in 68%, ON in 8%, DDH in 8%, Trauma in 6%, LCP in 3% and others in 7%. All femoral stems but 2 were cementless, wedge tapered, made of titanium alloy and grit-

blasted. 34 (52%) of the acetabular components used in this study were thin (3.5mm) shells. There were no dislocation precautions after capsular healing (4-6 weeks).

Results: Median head size was 48mm (36-54). Mean follow-up time was 4.2 years (Range: 2.5-11.0). There were no dislocations and no signs of osteolysis. UCLA hip scores improved for Pain, Walking, Function, and Activity from 4.2, 6.5, 5.9, and 4.9 pre-operatively to 9.3, 8.7, 8.5, and 6.0 post-operatively. Range of motion was comparable to that of resurfacing patients. One femoral stem fractured (the patient was a competitive tennis player) and was revised at 3 years with some difficulty, requiring extended trochanteric osteotomy and a prolonged non-weight bearing period. There were two other complications that resolved promptly: one femoral nerve palsy and one submyocardial infarction, both in the conversion group.

Discussion and Conclusions: This investigation shows excellent clinical results, and suggests that dislocation can be prevented with an anatomic sized metal-on-metal THR using large unipolar femoral heads and thin sockets. While stem fracture with modern TI Alloy stems is rare, the increasing participation of the patients in impact sports will determine whether this was a substrate failure or an anomaly.

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Poster 4

Cementing Techniques for Hip Resurfacing Arthroplasty

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Introduction: In two recent retrieval studies and in a finite element model, over-penetration of cement, incomplete seating of the prosthesis with a resultant polar cement mass, or both, have been associated with femoral failures of current generation resurfacing arthroplasties. It has been frequently stated that hip resurfacing is technique sensitive but scientific investigations into cementing techniques are lacking. We have developed a laboratory model to analyze a number of the associated variables.

Methods: An open-cell reticulated carbon foam was demonstrated to closely simulate human femoral heads as prepared

for resurfacing. We used this *in vitro* femoral resurfacing model to obtain real-time measurements of pressure and temperature and measure cement penetration and distribution as a function of 6 different cementing techniques.

Results: Filling the component with low viscosity cement can lead to over-penetration while filling the component with high viscosity cement increases the resistance to component seating with a resultant polar cement mass (due to incomplete seating). Both conditions result in peak temperatures above 50° C at 5 mm below the foam surface, which can cause thermal necrosis of bone. Manual application of cement directly to the foam (bone) surface provides complete penetration of the available fixation area with the least resistance to component seating and the smallest total cement mass with a peak temperature of 36.0 ± 4.1° C.

Discussion and Conclusion: As the utilization of total hip resurfacing increases, it is increasingly important to understand and minimize short-term failures. Application of the principles elucidated by this *in vitro* model can reduce the risk of cement over-penetration and incomplete seating, thus reducing the risk of short-term resurfacing failure.

Poster 5

Percutaneously Assisted Total Hip Arthroplasty: A Less Invasive Surgical Technique

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Introduction: We have developed and evaluated a new technique for less invasive total hip arthroplasty. The tendon attachments are preserved, while maintaining excellent visualization and access. This paper will describe the technique and present the clinical results.

Methods: The first 250 consecutive patients were followed prospectively for a minimum of 2 years. There are two key differences between the surgical technique for PATH and that for conventional posterior MIS THA. The first is the release of only the piriformis or conjoined tendon and use of modified retractors for exposure. Second, the very low profile 8mm reamer drive shaft is placed in the percutaneous portal to preserve visualization and control. This allows precise reaming of the acetabulum in any direction simply by “steering” the leg to follow where the reamer shaft is directed.

Results: The mean length of the incision was 8.34 cm. Harris Hip scores improved from 48.9 preoperatively to 95.5 postoperatively. EBL averaged 227 cc per hip with a 10% transfusion rate. Component positioning was deemed acceptable in 96% of the patients. There were no dislocations. Hospital stay averaged three days.

Discussion: Compared to reported MIS THA results, the new tissue-preserving PATH technique provided better results with a shorter hospital stay, less blood loss, and fewer transfusions. In addition, our results are comparable to those reported for the traditional THA technique, with fewer complications. We have found no increased risk of component malposition, dislocation, or other adverse effects. Also, we believe this technique has a shorter learning curve than previously described techniques for less invasive THA.

Poster 6

Re-Examination of the Incidence of Slipped Capital Femoral Epiphysis (SCFE) in New Mexico

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Introduction: Past epidemiological studies by Kelsey set the standard for SCFE incidence in the United States. His reports from the 1960s demonstrated a nearly five-fold lower incidence of SCFE in New Mexico (2.13/100,000) compared to Connecticut (10.1/100,000). We sought to re-examine the incidence of SCFE in New Mexico to improve the understanding of this discrepancy.

Methods: The discharge databases for the 11 major medical centers in the state were reviewed and analyzed by comparison with the 2000 New Mexico census data. The incidence data is reported as cases per 100,000 boys ages 10-17 and girls aged 8-15 years.

Results: The incidence of SCFE in New Mexico for the study time period was 5.99, doubling the reported incidence in the 1960s ($p < 0.001$). More detailed analysis of our data demonstrated a statistically significant increase over 3 year intervals: 1995-1997: 2.27; 1998-2000: 2.75; 2001-2003: 4.73; and 2004-2006: 7.38. The mean age of onset was 12.2 years. Relative frequencies by race were: 4.63x for African Americans, 2.20x for Hispanics, and 2.20x for Native Americans. A preponderance of cases was treated at the state's only tertiary

pediatric orthopaedic center: 168 to 15 in the remaining 10 centers.

Discussion: The incidence of SCFE has increased dramatically in New Mexico since Kelsey's epidemiological study in 1970. Obesity is a pertinent patient factor that has changed. According to the National Health and Nutrition Examination Survey Data for 2003/4 the rates of obesity have tripled since 1971. Also, access to pediatric specialists has improved in the state since Kelsey's work. The only pediatric orthopaedic center moved to the population center from a remote site, significantly changing its mission.

Conclusion: Increased obesity in children and improved access to pediatric orthopaedic evaluation may have contributed to an increase in reported incidence of SCFE in New Mexico.

Poster 7

MRI Characterization of Engaging Versus Non-Engaging Hill Sachs Lesions

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Introduction: The purpose of this study is to determine if there are magnetic resonance (MR) imaging characteristics of engaging Hill-Sachs (HS) lesions (probably requiring additional humeral head augmentation surgery) versus non-engaging HS lesions. This may allow better preoperative planning.

Methods: Two orthopedic surgeons performed shoulder arthroscopy on 48 patients with shoulder instability at our institution between 7/28/2005 and 8/30/2007. Of these patients, 33 had HS lesions described in the operative report. The operative notes contained inadequate documentation of humeral head engagement in 15 of the 33 patients, and one other patient did not have available images. This left 17 patients with preoperative MR images and HS lesions intraoperatively classified as engaging (7 patients) or non-engaging (10 patients). The preoperative MRs of the 17 patients were evaluated. The size of the HS lesion was measured in the axial, parasagittal and paracoronal planes. In the axial plane, the angle of the HS deformity at the level of its largest size was measured relative to the glenoid surface just below the level of the coracoid process. The contour was characterized

as either serrated or smooth and the humeral head quadrants that the HS lesion resided in were recorded.

Results: The mean axial dimensions of engaging lesions were 2.1 x 0.5 cm vs. 1.5 x 0.4 cm for non-engaging lesions. In the paracoronal plane, engaging lesions ranged from 1.4 x 0.5 cm to 2.8 x 0.8 cm, and in the parasagittal plane they ranged from 1.6 x 0.3 cm to 3.2 x 0.8 cm. Non-engaging lesions ranged from not seen to 2.6 x 0.8 cm in the paracoronal plain and from not seen to 2.1 x 0.6 cm in the parasagittal plain. The mean angle between the HS deformity and the glenoid surface was 51.5° for engaging lesions, while for non-engaging lesions the mean angle was 26.5°. 5/7 engaging lesions had a HS-Glenoid angle greater than 56 degrees, while 7/8 non-engaging lesions had a HS-Glenoid angle less than 40 degrees. All 4 of the lesions characterized as serrated were engaging. 5 of 8 patients with visible non-engaging lesions had extension into the anterolateral quadrant, while only 2 out of 7 non-engaging lesions extended into the anterolateral quadrant. Two of the engaging lesions extended into the posteromedial quadrant, while none of the non-engaging lesions involved the posteromedial quadrant. Two patients with non-engaging HS lesions described at arthroscopy had no demonstrable Hill-Sachs deformity on MR and therefore were not included in the calculations above.

Discussion and Conclusion: HS lesions that were intraoperatively found to be engaging were both larger and had a larger HS-glenoid angle than lesions found to be non-engaging. All of the lesions classified as serrated were engaging and engaging lesions tended to have a more posterior location on the humeral head. This initial review suggests differentiating MR characteristics of the engaging versus non-engaging HS lesions, which may allow improved pre-operative planning.

Poster 8

Technical Considerations in the Surgical Management of Femoral Neck Fractures in Patients Less Than 50 Years of Age. An Expert Opinion Survey.

Tania Ferguson, MD
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Mark Lee, MD

Introduction: We have identified current opinions and practice trends among orthopaedic traumatologists relating to the

surgical management of femoral neck fractures in young patients (<50 years old).

Methods: We administered a written survey to 102 orthopaedic surgeons identified as experts in traumatology. The survey examined surgeon preferences regarding optimal timing (urgency), the importance of anatomic reduction, and the effect of operating room availability on decision making.

Results: We had a 79% response rate. 86% were currently taking call at a designated level I institution with an average call experience of 10.8 years (range 1-27 years). Of those taking call at level I centers, 80% responded they had trauma room availability five or more days per week. Only 30% of respondents felt the gold standard was to have patients in the OR within 6 hours, 24% within 12 hours, and 31% within 24 hours. Half of the respondents would not start a case after 8 pm if there was a "trauma room" available for a guaranteed first case in the morning. There was a lack of consensus regarding the importance of time to operation on patient outcome. The average numerical response (1-10) was 6.6 with a mean of 7. 38% responded that timing was very important (8-10), 57% somewhat important (4-7), and 5% not important. In contrast, 97.5% felt anatomic reduction was very important for the patient's outcome with an average numerical score of 9.4 and a mean of 10.

Conclusions: While traditionally considered a surgical emergency, our survey demonstrates a change in opinion regarding the acceptable delay to operation in young patients with femoral neck fractures. The emergence of "trauma room" availability has potentially changed the management approach. Most still agree anatomic reduction is important for outcome and reduction takes precedence over timing to operation.

Poster 9

Biomechanical Evaluation of Vertebral Interbody Forces Utilizing Dynamic and Fixed Anterior Cervical Plates with Constrained and Semi-Constrained Screws

John Finkenberg, MD
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Introduction: This study quantified axial force distribution in the vertebral interbody region following discectomy and application of fixed, semi-constrained, dynamic and no anterior cervical plates (ACP).

Methods: 4 plate constructs (Cyprus (constrained and semi-constrained), C-Tek Slotted (dynamic) and VueLock (semi-constrained)) and 1 no plate construct were tested on an Instron DynaMight 8841. Constructs were composed of 2 PCF-15 rigid polyurethane foam blocks (simulating vertebra) and 1 PCF-15 rigid polyurethane foam graft countersunk 2mm between vertebra. Plate constructs were preloaded 50N upon assembly. Axial forces from 25N to 150N were applied to constructs through the posterior third of the graft. Ultra Low Pressure film was placed caudal and cranial to the grafts and data was collected with Topaq System Software. 3 trials were run with each construct. Interbody forces were also quantitated varying the stiffness of the anterior cervical plate only.

Results: Fixed ACP (Cyprus constrained) demonstrated increasing forces anteriorly only, close to the plate. ACP with semi-constrained screws (VueLock and Cyprus) noted initial forces anteriorly but transferred posteriorly with increased pressures. Dynamic ACP (C-Tek Slotted) and no plate constructs noted initial pressures posteriorly that distributed over the graft with increasing pressures. In general, stiffer plates allowed for less transfer of axial force to the graft-vertebra region.

Conclusion: Fixed ACP shifted the intervertebral axial forces anteriorly. Semi-Constrained ACP shifted axial forces more posteriorly but the majority of the forces were still in the anterior 1/3 of the graft. Dynamic ACP and no plate constructs noted increased axial force over the posterior portion of the graft. Stiffer plates allowed for less axial force to distribute to the vertebra-graft interface.

Poster 10

The Course of the Distal Saphenous Nerve: A Cadaveric Investigation with Relation to Clinical Implications

Jennifer L. FitzPatrick, MD
Richard Miller, MD

Introduction: The distal saphenous nerve is not well described and nerve injury has been reported. The purpose of our study was to determine the distal limit of the saphenous nerve and its anatomic relation to other structures.

Methods: Twenty cadaveric ankles were examined at the level of the medial malleolus. An incision 15cm proximal and 15cm distal to the tip of the medial malleolus was made to follow the course of the saphenous nerve under direct visualization.

Results: We recorded the distance from the distal most aspect of the saphenous nerve to the tip of the medial malleolus, the distance to tibialis anterior and the distance between the nerve and the medial arthroscopic portal site. These measurements averaged $-2\text{mm} \pm 4\text{mm}$, $16\text{mm} \pm 3\text{mm}$ and $12\text{mm} \pm 2\text{mm}$ respectively. An anterior and posterior branch of the saphenous nerve followed the saphenous vein in all specimens. Small variations were also noted. The first metatarsal phalangeal joint was innervated by the superficial peroneal nerve in all cases. **Discussion and Conclusion:** While generally predictable, variations exist in the distal course of the saphenous nerve. This has important clinical indications in ankle arthroscopy, tarsal tunnel syndrome and other procedures centered around the medial malleolus. The distal saphenous nerve is not well described and nerve injury has been reported. The purpose of our study was to determine the distal limit of the saphenous nerve and its anatomic relation to other structures. Twenty cadaveric ankles were examined at the level of the medial malleolus. An incision 15cm proximal and 15cm distal to the tip of the medial malleolus was made to follow the course of the saphenous nerve under direct visualization. We recorded the distance from the distal most aspect of the saphenous nerve to the tip of the medial malleolus, the distance to tibialis anterior and the distance between the nerve and the medial arthroscopic portal site. These measurements averaged $-2\text{mm} \pm 4\text{mm}$, $16\text{mm} \pm 3\text{mm}$ and $12\text{mm} \pm 2\text{mm}$ respectively. An anterior and posterior branch of the saphenous nerve followed the saphenous vein in all specimens. Small variations were also noted. The first metatarsal phalangeal joint was innervated by the superficial peroneal nerve in all cases.

Discussion and Conclusion: While generally predictable, variations exist in the distal course of the saphenous nerve. This has important clinical indications in ankle arthroscopy, tarsal tunnel syndrome and other procedures centered around the medial malleolus.

Poster 11

Comparison of Tunnel Widening After ACL Reconstruction Using Different Graft Fixation Methods

David Freccero, MD
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Eric L. Smith
Craig Bottoni, MD

Introduction: We hypothesize bone tunnel expansion after ACL reconstruction differs depending on the method of femoral graft fixation used.

Methods: We retrospectively reviewed the anteroposterior and lateral knee radiographs in 86 patients who underwent primary ACL reconstruction with either autograft hamstring or bone-patellar tendon-bone (BTB) using one of three techniques for femoral graft fixation: cross-pin, an Endobutton®, or a metallic interference screw. Femoral fixation in the autograft hamstring group consisted of either a cross-pin or Endobutton. Femoral fixation in the BTB group consisted solely of an interference screw. Tibial fixation using an interference screw was identical in all patients. The femoral and tibial bone tunnel diameters were measured on all radiographs and the amount of tunnel widening compared between the three groups.

Results: 47 patients underwent femoral fixation with a cross-pin, 28 with an Endobutton, and 11 with a metallic interference screw. On the lateral radiographs, the average femoral tunnel widening in the cross-pin group, the Endobutton group, and the BTB group was 3.3 mm, 5.5 mm, and 1.9 mm, respectively, which was statistically significant. On the anteroposterior radiographs, the average femoral tunnel widening in the cross-pin group, the Endobutton group, and the BTB group was 5.0 mm, 5.4 mm, and 2.6 mm, respectively. The groups were also stratified based on the time at which the radiographs were obtained postoperatively: 0-2 months, 3-8 months, and 8-24 months. There were no differences between the cross-pin and the Endobutton groups when tunnel widening was correlated with time from surgery.

Discussion and Conclusion: The distance from the fixation point of the ACL graft in the femoral tunnel to the knee joint may influence postoperative femoral tunnel widening. We also demonstrated that femoral tunnel widening after ACL reconstruction occurs early after surgery and then remains relatively static through time.

Poster 12

A Biomechanical Comparison of Single and Double Loaded Suture Anchors for Repair of Traumatic Antero-Inferior Labral Injuries

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Introduction: The purpose of this study is to determine if there is a mechanical advantage of double-loaded suture anchors over single-loaded suture anchors in terms of their pull-out strength in the setting of arthroscopic Bankart repair.

Methods: Bankart lesions were created in thirteen paired cadaveric shoulders. The paired lesions were repaired using either three single or double-loaded suture anchor configurations using a standardized technique. Two groups were studied: Group 1 was statically loaded to maximum load to failure, Group 2 was preloaded to 150N and cyclically loaded at 1 Hz for 1000 cycles and then to maximum load to failure. Maximum load to failure and failure mode was recorded and analyzed.

Results: For group 1, the mean load to failure was found to be $341.3N \pm 118.3$ for single loaded anchors and 361.3 ± 94.9 for the double loaded anchors. There was no statistical difference ($p=0.380019$). In group 2, the mean load to failure for the single loaded anchors was found to be $485.5N \pm 140.6$ and for the double loaded anchors was $486.4N \pm 107.4$. There was no significant difference ($p=0.494441$).

Conclusions: This study demonstrates that there is no biomechanical advantage to the use of double loaded anchors for repair of Bankart Lesions using three anchors.

Poster 13

Parental Attendance During Pediatric Reductions

Sean P. Kearney, MD, MPH
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Introduction: Fracture reduction in a pediatric patient can create anxiety for the patient and the parent. Parental attendance is discouraged during painful medical procedures in many healthcare facilities. Studies indicate that parents prefer to remain with their children during some painful medical procedures. No studies have investigated parental attendance during pediatric fracture reductions. The purpose of this study is to investigate parental preferences to remain during pediatric fracture reductions and to make recommendations concerning parental attendance during pediatric reductions.

Methods: Fifteen consecutive parents were retrospectively surveyed about their experience after their child's fracture reduction.

Results: Eleven parents (73%) attended the reduction. Four parents (27%) did not attend, but three wanted to remain.

Overall, fourteen parents (93%) wanted to attend the reduction. Fourteen parents (93%) wanted to be part of the decision of whether they should be permitted to attend the reduction. Twelve parents (80%) wanted the healthcare provider to specifically ask their preference to remain or not. Fourteen parents (93%) were either very or somewhat satisfied with their experience during the reduction regardless of their presence. Of the parents present, ten (91%) believed their presence reduced their child's anxiety and all believed their presence was either very or somewhat helpful for their child. One parent who was not allowed to attend was somewhat dissatisfied with the experience and believed her absence was somewhat harmful to herself and her child. Fourteen parents (93%) would prefer to attend if their child required a future reduction.

Discussion and Conclusion: Most parents prefer to remain with their children during fracture reductions and want to be a part of this decision. Most believe their presence reduces their child's anxiety and most report satisfaction with the experience. It is recommended that healthcare providers ask and allow parents to attend pediatric reductions.

Poster 14

A Meta-Analysis of the Treatment Results of Congenital Tibial Pseudarthrosis

Jeffrey I. Kessler, MD
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Introduction: No meta-analysis on congenital tibial pseudarthrosis (CPT) assessing long-term results exists in the literature. The purpose of this study was to perform such an analysis in order to better understand treatment results and the variables correlating with success or failure.

Methods: Inclusion criteria included English-written articles on CPT in the past 35 years with a minimum 2 year followup since the final surgery. 19 studies fulfilled the criteria. Failure was defined as amputation or persistent nonunion. Variables assessed included the different surgical techniques and their success rates, number/ type of surgeries performed, Boyd Anderson classification, the incidence and success rate of patients with neurofibromatosis (NF), percentage with early and long-term unions, time to union, and incidence of refractures and angular deformities/leg length discrepancies (LLD).

Results: Data was collected on 402 patients. 63.1 % had NF. The most common Boyd classification was type 2.

successful early unions, and 68.9% had successful long-term unions. Only 42.8% with NF had successful long-term unions. There were an average of .36 refractures/ patient for those with long term healing. Patients had an average of 3.61 surgeries performed, 3.26 for those with successful unions and 4.14 for failed unions. Average time to final healing was 4.9 years. Healing rates were 82.4%, 76.9%, 35.1%, 24%, and 11.5% for vascularized bone grafts (VBG), external fixators/ Ilizarovs (EF), intramedullary rods (IMR), bone grafts alone, and bone grafts plus wires, plates, or screws, respectively. In healed patients, 44.8% had residual valgus, 32.8% procurvatum, and average LLD was 2.9cm.

Discussion and Conclusion: This meta-analysis demonstrated long-term healing in just over 2/3 of patients with CPT. VBG's and EF's had the highest success rates. This study once again demonstrates that the treatment period for CPT is prolonged and, even when successful, does not usually leave the patient deformity-free.

Poster 15

Magnetic Resonance Imaging of 3D Knee Kinematics

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Introduction: Abnormal knee kinematics after anterior cruciate ligament (ACL) injury and ACL reconstruction may alter normal mechanical environment for the articular cartilage and can lead to cartilage degeneration and osteoarthritis. The objective of this study was to determine the significance of altered tibiofemoral kinematics following ACL injuries and reconstructions.

Methods: Eight patients (age 31 ± 8 years) with unilateral ACL tears and nine patients (age 32 ± 9) that had unilateral ACL reconstructions were studied. Sagittal plane magnetic resonance images (proton density weighted, in-plane resolution = 0.3 mm, slice thickness = 1.5 mm) of the knee were obtained in a position of full extension and a position of 40° of flexion controlled with a knee positioning plate. During imaging the patient pushed on a foot plate that applied a compressive load of 125 N to simulate weight bearing [1]. MATLAB software was used to segment images and to determine the 3-dimensional positions of the medial and lateral condyle centers, internal rotation of the tibia, and relative positions of the

femur and tibia in both knee positions for both groups of patients. Differences between ACL-deficient (ACLD) and contralateral knees were compared to differences between ACL-reconstructed (ACLR) and contralateral knees.

Results: The anterior-posterior (AP) position of the femur in the ACLD knee is $2.6\text{mm} \pm 1.7$ more posterior than the contralateral normal knee in extension while no differences were observed in flexion. With ACLR, there were no significant difference between the AP position of the femur and the contralateral controls. However, there were significant differences in contact centroids and rotation between ACLD and ACLR. For ACLD knees, the lateral femoral condyle in extension was $3.8 \pm 2.0\text{mm}$ posterior to the contralateral knee, while the ACLR was $0.7 \pm 2.6\text{mm}$ anterior to the contralateral knee. For the medial femoral condyle in extension, the ACLD was $1.4 \pm 2.9\text{mm}$ versus $2.8 \pm 1.9\text{mm}$ anterior to the contralateral knees. This led to a 3.7° less internal rotation of the ACLD versus 3.5° more internal rotation in the ACLR when compared with the contralateral knees.

Discussion: The results suggest that ACL reconstruction restored the AP position of the lateral femoral condyle when compared with the contralateral knee. However, rotational kinematics was not restored following ACLR. These results demonstrated that 3-dimensional in vivo kinematic analyses are important to determine the success of ACL reconstruction. Kinematic MRI can provide in vivo analysis on the significance of various changes in ACL reconstruction techniques.

Poster 16

Posterior Approach to the Pelvis Revisited

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Introduction: The posterior approach to the pelvis has been criticized for being an overly morbid, complication ridden procedure. Previously we have reported on a series of patients that underwent surgery at an academic training institution. There was a low, but persistent level of wound complications reported in that series including a patient that required a gluteal flap. This is a follow-up series done by now fellowship trained orthopedic trauma surgeons at a non academic level I trauma center.

Methods: Retrospective review of a consecutive series of acute trauma patients with posterior pelvic ring injuries requir-

ing ORIF. If a closed reduction could not be obtained, ORIF was performed. This study is a chart review spanning 6 years—the time of arrival at this institution by the primary 2 authors. We were interested in acute surgical complications and reductions. Functional outcomes are beyond the scope of this study. We only looked at our acute fracture group—posterior approaches performed for non/malunion and late reconstructive procedures were excluded. 56 patients with 60 approaches constituted the nonrandomized, consecutive cohort that was identified.

Results: There was one one complication requiring a repeat irrigation and debridement with closure over drains. This was in fact the very first patient in the series. Otherwise there were no reported wound or postoperative new neurologic complications. The majority of the patients had an anatomic reduction (50/60) with the rest having good reductions.

Discussion: Previous series have shown a constant low level of complications. Our series demonstrates that with attention to preservation of the gluteal flap that this surgical approach is safe. While closed reductions are of course less morbid for the patients, when adequate reduction cannot be obtained closed, open reduction is a safe, viable option.

Poster 17

The Role of Modular Necks in THA: Rotating to Success

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Purpose: The current version of a modular neck femoral component was introduced in Italy 20 years ago and approved for use in this country in early 2003. The proposed benefit in THA is greater intra-operative versatility in adjusting leg length and offset, thereby reducing rates of over-lengthening and dislocation. We have retrospectively reviewed over 900 modular femoral neck implants to evaluate this proposed benefit and determine a new level of “fine tuning”.

Methods: Between March 2003 and April 2007 we implanted 922 modular neck femoral components: 857Ti straight stems, 58Ti modular revision stems, and 7 cemented polished Co-Cr. Femoral head size ranged from 28mm to 54mm in the BFH group. Neck options included short, medium, or long, and varus, neutral, or valgus, with 0, 4, 8, 15 degree anteverted or retroverted options of each. Initial choice of head/neck combination was based on patient’s native anteversion, varus/valgus orientation, and offset. Intra-op ROM testing was carried out

in extreme extension and external rotation, flexion 30-70 while adducting 30-45 degrees, and internally rotating as high as 80-90 degrees. The hip was then taken into deep flexion (thigh to chest). Anterior instability was corrected by adding retroversion and/or offset; posterior instability by adding anteversion and/or offset. Offset was increased by either downsizing or seating the femoral component deeper and changing to a longer neck or head. Intra-operative AP pelvis x-ray was taken in all patients to assess leg length, component alignment, and femoral fit.

Results: There have been no modular neck dissociations. There have been no dislocations using a soft tissue sparing, capsule preserving posterior approach. Leg length difference was +/- 0-3mm in 98% of patients.

Discussion: Modular neck femoral components offer unprecedented versatility in THA. After >90,000 implantations worldwide there has been no identified risk associated with third body wear or neck failure.

Poster 18

Strength of an Unlinked Constrained TKR

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Collateral ligament insufficiency presents a great challenge for revision TKR. Although rotating hinge designs have gained popularity in addressing instability, unlinked constrained condylar knee replacements (CCK) offer distinct surgical and physiological advantages. Unfortunately, little is known about the mechanical limitations of constrained condylar knees. In this study, we measured the strength of the constraint mechanism of two sizes of CCK devices under varus/valgus bending and internal and external rotational loads. (70) TKR components (NEXGEN LCKK, Zimmer) were implanted in a composite femur and tibia. The tibia was fixed, and body load was applied to the femur, through a bearing free to rotate in the coronal plane and translate in the transverse plane, located 50cm proximal to the intercondylar notch, producing anatomically correct relationships between load and moment arm. The bearing was adjusted to produce 12 different varus or valgus moment arms. Cyclic load was sinusoidal, with an amplitude that increased until dislocation. Varus-valgus translations of the point of the hip joint reaction force

were measured with a displacement transducer and recorded continuously throughout loading. The applied actuator load, displacement, torsional force, and angular displacement were also recorded continuously. The apparatus was mounted in an MTS biaxial 858 (MTS, Eden Prairie, MN) mini-bionix servo hydraulic load frame.(145) All specimens had 3-20mm of laxity, with 3mm corresponding to 0.5 degrees of abduction/adduction under a preload of 250N. Under varus/valgus bending, failure loads varied from 750-4225N, with strength of the constraint mechanism being higher with greater degrees of knee flexion. In contrast, under axial rotation, failure torques varied from 27-40Nm, withstanding higher rotational forces with lower degrees of knee flexion.(61) The results support the use of unlinked CCK devices with collateral ligament insufficiency while indicating specific extreme biomechanical conditions, which would place the constraint mechanism at risk of failure.

Poster 19

Accuracy of Emergency Room Physicians' Interpretation of Pediatric Elbow Fractures

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Introduction: Elbow fractures are the most common operative upper extremity fracture in children. Although many reports on pediatric elbow fractures are from tertiary care centers with residents available to evaluate the patient, most children present at institutions where the emergency room (ER) physician is the primary point of care. Orthopedic surgeons rely on the ER physician to accurately communicate and convey the nature of the injury. The purpose of this prospective study is to determine the accuracy of radiograph interpretation of pediatric elbow fractures by ER physicians.

Methods: All consecutive pediatric patients with operative elbow fractures that presented to a tertiary care orthopedic referral center over a six month period were included in this prospective study. Thirty fractures were identified. The ER physicians' radiograph interpretation was compared to the final interpretation by the treating, staff pediatric orthopedic surgeon. Accuracy rates were determined for overall agreement, and by fracture subtype. The ER physicians were from a variety of settings, including rural, community, and pediatric hospitals.

Results: Overall accuracy of ER physicians' interpretation was 53% (16/30). The fracture type that was most often accu-

rately described was type III supracondylar humerus fractures (68% accuracy). The fracture type that was most often misdiagnosed was displaced lateral condyle fractures (0% accuracy in this series).

Discussion and Conclusion: ER physicians had difficulty in accurately describing pediatric elbow fractures. This study underscores the importance of educating ER doctors and residents in pediatric fracture interpretation to optimize patient outcomes. Orthopedists need to be vigilant when taking care of these patients to prevent unnecessary complications.

Poster 20

Early Learning Curve of Hip Resurfacing Arthroplasty

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Introduction: Hip resurfacing arthroplasty (HRA) has been suggested as an alternative to total hip replacement (THA) for young, active patients. However, HRA has been criticized as a more difficult surgical procedure, with higher risks and a significant learning curve. This study analyzes the early learning curve for HRA for perioperative data and early radiographic outcomes.

Methods: Records from 25 patients (mean age, 50 years, range 37-65) undergoing HRA (Birmingham Hip Resurfacing) over a 12 month period were analyzed. These patients were divided into two groups to determine differences in outcomes along the learning curve. Surgical time, blood loss (EBL), length of incision (LOI), length of stay (LOS), and the implant position (neck-shaft angle) were compared between the two groups using the Student's t-test.

Results: There were no differences in the LOS (mean 4 days) and the implant position (mean 135 degrees) between the two groups. EBL (mean 740 to 310 ml, $p=0.03$), and LOI (mean 35 cm to 23 cm, $p=0.01$) were significantly decreased in the second group. There was a trend for decreased surgical time with more experience (mean 145 to 119 minutes, $p=0.07$).

Conclusions: HRA showed a significant learning curve that decreased blood loss, surgical time, and incision length with increasing case experience. However, the implant angle, which may be extremely important in overall outcomes in this procedure, was not significantly different.

Poster 21

Lunotriquetral Instability: Treatment Via Dorsal Capsulodesis

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Introduction: Instability of the lunotriquetral (LT) joint is one source of ulnar wrist pain, and symptoms can be disabling. Traditional treatment options have focused either on indirect management via ulnar shortening osteotomies in an effort to tighten all ulnar-sided soft tissue structures or on arthrodesis of the LT joint. Ideally, it would be better to treat the pathology directly while still preserving intercarpal motion. A new technique to achieve that goal is described herein.

Methods: The wrist is approached dorsally and the dorsal intercarpal ligament (DICL) is dissected. A strip of the ligament is harvested from its distal, radial insertion, rotated on its origin off the dorsal triquetrum and then anchored to the lunate. Pin fixation maintains the intercarpal alignment post-operatively while the wrist is casted. Supervised hand therapy follows pin and cast removal. Illustrative Case: A male custodian presented with post-traumatic ulnar-sided wrist pain. Clunking occurred as the injured wrist moved from radial to ulnar deviation. Grip strength was 75% and ROM was 90% vs. the opposite wrist. Fluoroscopy showed LT instability. At surgery, the LT disruption was confirmed arthroscopically. Open reconstruction was performed as described. The cast and K-wires were removed at 8 weeks. Outcome was excellent: return to full activities and labor without pain.

Results: Excellent results were obtained as evidenced by elimination of pain and return of grip strength to nearly match the uninjured side. ROM remained slightly decreased, particularly in flexion, but did not cause functional limitations.

Discussion: The treatment of flexible deformities of the wrist due to intercarpal ligament injuries remains controversial. Tenodeses and arthrodeses have been utilized in the past for LT instability but with problems due to stiffness and non-union. Ulnar shortening has different complications and does not attack the pathology directly. The technique described here was developed in an effort to solve these challenging dilemmas. Favorable results suggest the technique is a valid option that warrants consideration and further investigation.

Poster 22

Patellar Clunk Syndrome: Rotating Platform Versus Fixed-Bearing Total Knee Arthroplasty

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Introduction: Patellar Clunk Syndrome (PCS) following Total Knee Arthroplasty (TKA) is associated with posterior stabilized (PS) femoral components in which a scarred synovial suprapatellar nodule catches on the anterior edge of the femoral intercondylar notch with active extension of the flexed knee. We investigated whether a rotating platform tibial component increases the incidence of PCS.

Methods: From December 1998 to June 2007, a single surgeon performed 785 primary TKAs. 329 fixed-bearing tibial components and 456 rotating platforms were implanted. The same PS femoral component was used in all cases. All components were from the same TKA system. The incidence of PCS requiring reoperation was evaluated prospectively.

Results: Reoperation was performed on 2% of knees (7/329) with a fixed bearing and on 3.5% (16/456) with a rotating platform tibial component. (p=NS) A single arthroscopy was sufficient to eliminate the problem in all fixed bearing knees. However, in the rotating platform group, 5 patients required additional surgery: 2 required one additional arthroscopy, 2 an open debridement, and 1 an additional arthroscopy and an open debridement.

Discussion and Conclusion: The incidence of PCS is not increased by the use of a rotating platform tibial component in TKA. However, the lesion in these knees appears to be more resistant to treatment. The self-aligning property of the rotating platform may improve patellar tracking and cause the extensor mechanism to seat more deeply in the trochlear groove. This may predispose to recurrence of or increased symptoms from the Patellar Clunk lesion.

Poster 23

Comparison of Figure 8 Plate to Staples in Hemiepiphyseodesis of the Lower Extremity

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Purpose: This study compares the figure 8 plate relative to stainless steel staples in hemiepiphyseodesis of the lower extremity. Staples are standard for this procedure, but complications include extrusion, bending, and breaking. The figure 8 plate is advertised as having fewer complications with rapid correction. This study compares correction time and complication rate.

Methods: A retrospective study was done using joint surveys of patients who had hemiepiphyseodesis of the lower extremity using staples or figure 8 plate. Average time to correction was calculated as well as average complication rate. Change in angle was divided by time to correction to produce a correction rate. Mean correction rate was compared using Student's t test. The proportion of patients suffering complications was calculated for both groups. The difference was analyzed using Fisher's exact test.

Results: There were 13 subjects in the eight plate group and 32 in the staples group. Mean correction rate was 7.74 for eight plate and 10.15 for staples. The difference in means was 2.41 (95% confidence interval, -1.66 to 6.47), not significantly different from zero. There was also no appreciable difference in complication rate. 4 of 18 cases in the eight plate group had complications. 4 of 41 cases in the staples group suffered complications. These proportions were not significantly different.

Conclusion: There was no appreciable difference in correction time or complication rate between the figure 8 plate and the staples. The similarity between the two groups suggests that the reliability and efficacy of the figure 8 plate is equal to staples. Most surgeons find that placement of the figure 8 plate is more exacting and its removal is easier, which may cause less physeal trauma.

Poster 24

Acellular Dermal Graft Augmentation in Quadriceps Tendon Rupture Repair

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Although surgical treatment of acute quadriceps tendon ruptures typically results in excellent outcomes, repairs of chronic ruptures associated with either total knee arthroplasty (TKA) or delayed treatment have not exhibited the same satisfactory results. The purpose of this series was to evaluate patients treated with a modified quadricepsplasty procedure augmented with acellular human dermal matrix, "AHDM" (GRAFT JACKET®, Wright Medical Technology, Arlington TN) for repair of chronic quadriceps tendon rupture.

For soft tissue management of knee instability resulting from recurrent quadriceps tendon disruption, an intra-tendon "stent" method of augmentation was developed using AHDM as the auxiliary material. Clinical records for patients treated with this technique were retrospectively reviewed for demographics, surgical history, complications requiring reoperation, and outcomes using the Knee Society (KSS) and Musculoskeletal Tumor Society (MSTS) questionnaires.

Eight knees in seven patients with average age 47 (range, 38-84) were treated using this method. Five procedures were done with total knee arthroplasties in place. Patients had undergone an average of four previous surgeries on the treated knee. One patient died six months after repair secondary to myocardial infarction unrelated to knee surgery. With follow-up of 28 months (range, 18-42 months), KSS improved 23 points on average and MSTS functional scores were 65% (range, 47-100%). Postoperative motion was improved in all knees. There were no repair failures. Two patients had extension lag of 10° and 30°. One knee required reoperation due to recurrent infection 16 months after repair; this was unrelated to the graft which was observed intraoperatively to be well incorporated.

AHDM-augmented quadricepsplasty for recurrent quadriceps tendon rupture, either in the presence or absence of TKA, improves extension function in knees which have failed previous treatment.