

**ABSTRACTS PRESENTED AT THE
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**COMPARISON OF IMMATURE PORCINE AND HUMAN BONE MINERAL DENSITY
IMMATURE PORCINE KNEES ARE INAPPROPRIATE SPECIMENS FOR GRAFT**

PULL-OUT TESTS, Joseph J. Calandra, MD, Medical University of South Carolina,
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Background: Bone mineral density (BMD) and bone mineral content (BMC) are used for assessment of bone quality. The authors were curious as to whether immature porcine knees would be an appropriate model for human graft and hardware pull-out studies.

Hypothesis: Our hypothesis was that immature cadaveric porcine knees (ICPK) would be less dense than those of healthy adult human distal femurs and proximal tibias and thus an inadequate model for human graft and hardware pull-out studies.

Study Design: This was an *in vivo* and *in vitro* comparative laboratory study of BMD and BMC between two human knee groups and ICPK.

Methods: Eleven ICPK 3 months in age (body mass 25.0±3.3 kg) were used. Human Group (HG) 1 consisted of 18 collegiate athletes with a mean age of 19.2 years (body mass 76.1±14.4 kg). HG 2 included 10 people with a mean age of 34.4±9.3 years (body mass 79.3±5.9 kg). BMD and BMC were measured via Lunar 10655/Prodigy DEXA Scanner and software. ANOVA tested differences among the three groups, and post hoc testing assessed differences between the groups.

Results: Differences in BMD were shown among the three groups for distal femur (DF) (ICPK-0.91 ± 0.11 g/cm²; HG1-1.17 ± 0.34 g/cm²; HG2-1.2 ± 0.32 g/cm² {p=0.037}), and proximal tibia (PT) (ICPK-0.94± 0.12 g/cm²; HG1-1.41± 0.22 g/cm²; HG2- 1.26 ± 0.17 g/cm² {p=0.001}). Statistical differences were found among the three groups for femoral BMC (ICPK-3.51±1.25 g; HG1-7.5± 3.06 g; HG 2-11.59± 5.40 g {p=0.001}) and tibial BMC (ICPK-4.58±2.00 g; HG1-9.64 ±3.92 g; HG2-13.07± 5.37 g {p=0.001}).

Conclusion: BMD and BMC in the DF and PT of an immature pig are significantly less than that of an adult human.

Clinical Relevance: Test results involving graft pull out studies using an immature porcine model involving the bones about the knee may not be accurately extrapolated to humans.

WHAT'S HOT IN ANATOMIC ARTHROPLASTY? MANAGEMENT OF POSTERIOR GLENOID EROSION, Garrigues, GE, Duke University Medical Center, Department of Orthopaedic Surgery, Durham, North Carolina

The glenoid component continues to be an area of focus for research and design in anatomic total shoulder arthroplasty (TSA). In particular, posterior glenoid erosion, known as the Walch B2 or biconcave glenoid, presents a frequently encountered challenge with an incidence of approximately 15% in osteoarthritic shoulders and issues of retroversion and bone loss that may compromise stability and proper positioning of standard glenoid implants. Hemiarthroplasty with no glenoid prep has been shown to have poor long-term results in this scenario. Hemiarthroplasty with asymmetric reaming has been described but no results are available in the peer-reviewed literature. TSA with a standard glenoid implant leads to tradeoffs between significant bone removal, residual retroversion, and peg penetration that lead to an unacceptably high failure rate (20% at six years). TSA with a humeral head bone graft in the posterior glenoid defect has been described by multiple authors but also suffers from a high complication rate. Reverse total shoulder arthroplasty with or without bone graft is a well-described option with good results, but the limitations of this prosthesis may not be acceptable in younger, more active patients. Finally, TSA with posterior augmented components holds significant promise as computer modeling studies show improvement in the implant-bone forces and glenoid version can be restored. The existing augmented glenoid components were reviewed and the advantages of new, bone-sparing augmented glenoid technology was described.

INFLUENCE OF TIBIAL BASEPLATE DESIGNS IN PRIMARY TKA ALIGNMENT,

Pier Francesco Indelli, MD, PhD; Angelo Graceffa, MD; Andrea Baldini, MD and Gennaro Pipino, MD, University of New Mexico, Albuquerque, New Mexico

Components rotational alignment in primary total knee arthroplasty (TKA) is fundamental to avoid mid-term postoperative complications. Recently, the industry introduced different tibial baseplate designs in primary TKA: anatomical (asymmetric) designs are substituting more traditional symmetric designs. Different tibial component designs might influence the surgical technique when defining the correct rotational alignment of the tibial baseplate. The objective was to evaluate the influence of the tibial baseplate designs when using the anterior tibial cortex as the primary anatomical rotational landmark ("curve on curve" technique) in primary TKA.

Fifty patients, undergoing primary TKA, were divided in two groups. Group A included 10 males and 15 females (average age 72 years): all patients received a posterior stabilized (PS) TKA (Nex-Gen, Zimmer, USA). This implant is characterized by a symmetric tibial baseplate design. Group B included 12 males and 13 females (average age 69 years): all patients received a posterior-stabilized (PS) TKA (Persona, Zimmer, USA), characterized by an anatomical (asymmetric) tibial baseplate design. The "Persona" tibial baseplate is characterized by an anteromedial and posteromedial asymmetry. Knee preoperative deformity was similar in both groups. Identical surgical technique, including the use of the surgical trans-epicondylar femoral axis (sTEA) and

the anterior tibial cortex (“curve-on-curve”) as rotational alignment landmarks, was used. All patients underwent CT evaluation according to the “Berger Protocol” (1998). Three observers independently measured the rotational alignment of the tibial component in relation to the sTEA in all knees. The reliability of each measurement was then calculated by using the intraclass correlation coefficient for interobserver agreement. The coefficient value is reported as an average of multiple pairwise comparison.

Symmetric baseplate

The rotational alignment measurement of the symmetric tibial baseplate respect to the sTEA showed $0\pm 3^{\circ}$ of rotation of the tibial component in 91% of the knees; all twenty-five tibial components (100%) showed a $0\pm 5^{\circ}$ of rotation respect to the sTEA. Maximum external rotation of the tibial baseplate was 5° , while maximum internal rotation was 1° . The tibial component appeared internally rotated respect to the sTEA in 10 cases, externally rotated in 15 cases. The average intraclass correlation coefficient was 0,927.

Anatomical baseplate

The rotational alignment measurement of the asymmetric (anatomical) tibial baseplate respect to the sTEA showed an external rotation of the tibial component between 3° and 6° in 76% of the knees; 20 tibial components (80%) showed an external rotation between 0° and 5° . Maximum external rotation of the tibial baseplate was 9° , while none of the tibial baseplates demonstrated an internal rotation. In fact, the tibial component appeared externally rotated respect to the sTEA in all cases. The average intraclass correlation coefficient was 0,945.

This study confirms the reliability of the “curve on curve” technique as an anatomical landmark during rotational alignment of the tibial component during TKA procedure. An interesting finding was to discover that the use of an asymmetric tibial baseplate might lead to an excessive external rotation of the tibial baseplate if the “curve-on-curve” technique is used. The risk of excessive external rotation of the asymmetric tibial baseplate is superior when a smaller size is chosen in the case of a borderline measurement between two different components. The clinical value of an excessive external rotation of the tibial component has still to be proven.

C5 PALSY AFTER CERVICAL LAMINECTOMY AND FUSION: DOES WIDTH OF LAMINECTOMY MATTER?, Mitchell R. Klement, MD, Duke University Medical Center, Durham, North Carolina

A common complication of cervical laminectomy and fusion with instrumentation (CLFI) is development of post-operative C5 nerve palsy. A proposed etiology is excess nerve tension from posterior drift of the spinal cord after decompression and may be affected by width of laminectomy trough. The width of laminectomy was measured in a blinded fashion on the postoperative CT scan by two observers in 17 patients with C5 palsy and 12 controls. There was no significant increase in the C3-C7 laminectomy width in patients with postoperative C5 palsy. Reduction in laminectomy width may not reduce rate of postoperative nerve palsy.

BIOMECHANICAL EVALUATION OF A NOVEL LUMBAR FACET FUSION SYSTEM SUITABLE FOR MIS, Gerber, J; Goel, VK; *Lins, RE; Engineering Center for

Orthopaedic Research Excellence (ECORE), Departments of Bioengineering and Orthopaedics, The University of Toledo, Toledo, Ohio; *The Center for Bone and Joint Surgery of the Palm Beaches, Wellington, Florida

Introduction: Design and development of instrumentation for spine fusion suitable for minimal surgical approach is gaining momentum. Various dowel designs for fusion across the facet joint suitable for MIS are available. Z Lift™ is a novel surgical procedure for the treatment of spondylolisthesis, spinal stenosis and disc herniations by unloading the disc through facet translation. The surgical procedure to implant the device involves translation of the superior and inferior facets through the use of customized surgical instruments. Small holes are drilled into the facets and a specially designed bone dowel is impacted into the joint. The bone dowel locks the translation in place resulting in a posterior height increase of 3-4 mm after surgery. This restricts motion between the facets and creates a larger space for exiting nerve roots. By creating more room for the nerve roots patients may experience a decrease in pain due to alleviating pinched nerves. Maintenance of facet translation unloads the disc and may improve pain from disc herniations. This study looks at this novel surgical approach and the implant for its biomechanical stability.

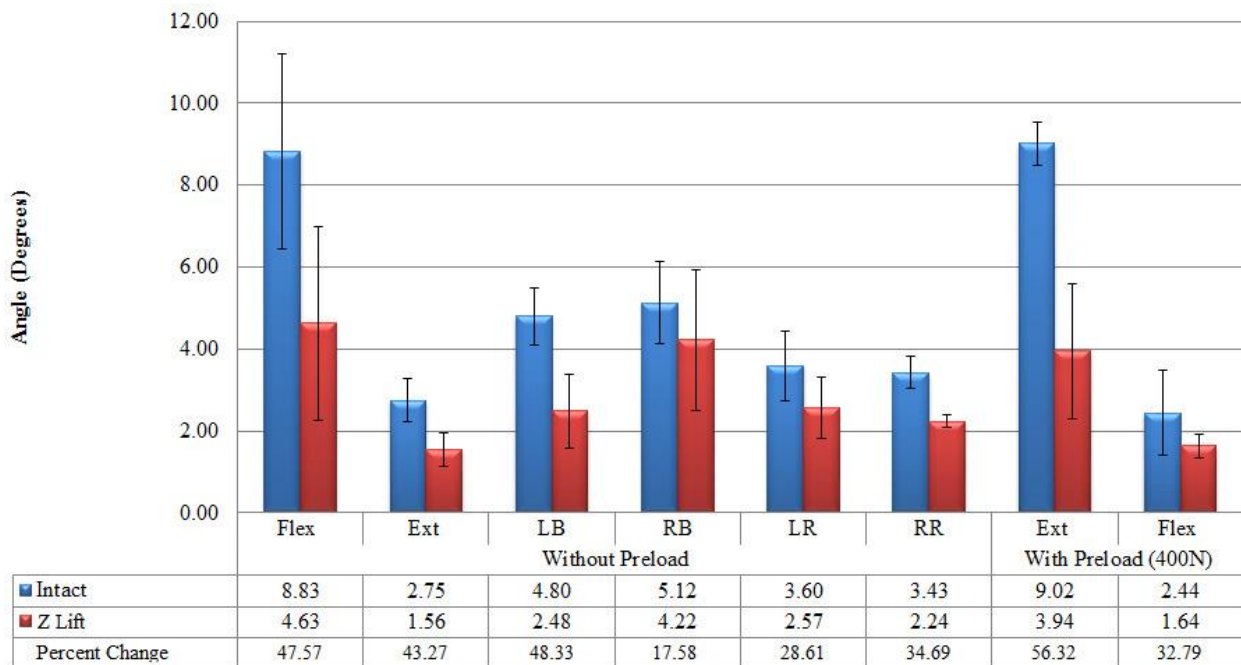
Materials and Methods: We performed a three-part *in-vitro* study to compare the change in range of motion before and after instrumentation with the Z Lift™ system, look at compressive loading to failure, and determine the pullout strength of the implant. Seven ligamentous L4-L5 functional spinal units (FSUs) were prepared and assigned to two groups: pullout testing, and stability of the construct followed by compression to failure. More specimens were assigned to the pull out group. For flexibility and strength tests, the potted caudal ends were bolted to a steel plate and controlled loads were applied to the cranial end. LED markers were attached to the specimen and the Optotrak (NDI, Waterloo, Canada) motion capture system was used to track the motion. Loads were applied in increments of 2.5 Nm up to 10 Nm to produce lateral bending (left and right), axial rotation (left and right), and flexion and extension (with and without a 400 N preload). The load displacement characteristics of the intact specimen were recorded and the FSUs were instrumented with the Z Lift™ system. The testing was repeated after instrumentation and compared to the intact results. Following this physiological testing, each segment underwent compressive loading to failure. A MTS Bionix material testing system was used to apply the load at 5 mm/min and record data. Pullout testing, in the second group, was also performed using the MTS machine. To simulate a compression of about 400 N on the specimen prior to axial pull to the devices, specimens were compressed by 0.5 mm using a C-clamp. The specimens were then fixed in a 3-axis vice and aligned for the pullout force applied along the axis of the implant. A preplaced custom Steinman pin was used to apply the load to the anterior face of the implant. A gripping fixture was used to pull the Steinman pin at a rate of 1 mm/min. After a drop in the applied force was noted, the testing was stopped.

Results: The average range of motion for the intact and instrumented specimens for 10 Nm are shown in the bar graph. During compression testing it was noted that the implants migrated anteriorly. The average compressive force at failure was 8,457 N with

a standard deviation of 1058 N. It was also observed that post compression the dowels migrated anteriorly. The pullout force varied between 364 N and 73 N. The average pullout force for the implants placed across left and right facets were 219 N and 200 N respectively. These values can be seen in the table below.

Discussion: Z Lift™ led to a decrease in range of motion for all loading conditions. However, the greatest changes in ROM were in extension with and without a preload, left bending, and right rotation. This is expected since facet dowels restrict extension. Since the average compression load at failure is 8,457 N (1901 lbs) we can assert that the dowels can withstand compression during the activities of daily living. Assessment of the implants and specimen after failure revealed that there was no damage to the dowels, but rather failure of the underlying facet due to the super physiologic loading. The pullout strength is most likely related to the depth the dowel is implanted. We could not quantify dowel depth during implantation. Some other factors that can affect the pullout strength are the positioning within the facet and properties related to each specimen such as the articular surface area of the facets. It is also important to note that even with the variation in pull out strength the fact that the devices migrated in the anterior direction during compression suggests that under physiologic conditions the implant will not become dislodged in the posterior direction. Additional investigations using the finite element technique are currently being pursued.

Significance: The clinical significance of this study is that it biomechanically validates a novel minimally invasive approach to lumbar spine fusion. By withstanding super physiologic loads to compression, this presents a new alternative to the need for pedicle screw instrumentation and all its attendant surgical morbidity.



Specimen #	1	2	3	4	5	Mean	SD
Left Facet	364	246	73	193	218	219	105
Right Facet	290	123	120	300	167	200	89

SEPTIC ARTHRITIS AND PERICAPSULAR PYOMYOSITIS; AN EVOLVING PARADIGM IN THE MANAGEMENT OF MUSCULOSKELETAL INFECTION ABOUT THE HIP, Gregory A. Mencio, M.D., Vanderbilt Children's Hospital, Nashville, Tennessee

Children with fever, refusal to bear weight and an irritable hip are a diagnostic challenge. Clinical criteria and synovial fluid analysis (cell count, Gram stain, and cultures) developed to guide work-up of septic arthritis are not always reliable. This presentation will discuss an algorithm to differentiate between intra and extracapsular sources of infection and a surgical approach to management of the latter.

MISSION PALESTINE, Jose J. Monsivais, MD, FACS, Medical Director, Hand and Microsurgery Center of El Paso, El Paso, Texas

This presentation reviewed the specific cases performed during my most recent (2014) mission to Palestine. The purpose of my missions with the Palestine Children's Relief Fund is to develop a teaching and research program in Hand Surgery in Hebron, West Bank. No specialized hand-surgery services are available locally for a population of 8-10 million people, and children go without needed care. By training local graduates of orthopedic programs in the sub-specialty skills of hand surgery, they will be able to provide the much needed care locally.

PERIOPERATIVE DEXAMETHASONE ADMINISTRATION DOES NOT INCREASE THE INCIDENCE OF POST-OPERATIVE INFECTION IN TOTAL HIP AND KNEE ARTHROPLASTY: A RETROSPECTIVE ANALYSIS, Andrew B. Richardson, MD;

Abiram Bala, BA; Samuel S. Wellman, MD; David E. Attarian MD, FACS; Stuart A. Grant, MB ChB, Michael P. Bolognesi, MD, Duke University Medical Center, Durham, North Carolina

The incidence of periprosthetic joint infection (PJI) following use of perioperative dexamethasone is not clear. *A retrospective review was conducted of all total hip or knee arthroplasties (N = 6294) between 2002 and 2014 to determine the incidence of PJI in patients who received dexamethasone (N = 557) and those who did not (N = 5737). The Dex group had an incidence of PJI of 1.3% (7/557); while the No Dex group was 1.2% (67/5737). This difference was not significant (p-value = 0.8022). We conclude perioperative dexamethasone does not significantly increase the risk of periprosthetic joint infection.*

REVISION OF THE FAILED THUMB CARPOMETACARPAL ARTHROPLASTY: A REVIEW OF 32 PATIENTS, Loukia K. Papatheodorou¹ MD, Gary M. Lourie², MD, Issei Komatsu¹, MD, Benjamin J. Rogozinski³, MD, Dean G. Sotereanos¹ MD, 1. Orthopaedic Specialists–UPMC, Pittsburgh, Pennsylvania; 2. The Hand and Upper Extremity Center of Georgia, Atlanta, Georgia; 3. Atlanta Medical Center, Atlanta, Georgia

We retrospectively analyzed the outcomes of 32 patients from two experienced surgeons who underwent revision surgery for failed thumb CMC arthroplasty. The

revision surgery included soft-tissue interposition with or without ligament reconstruction and distraction pinning. Eight patients required concomitant metacarpal phalangeal joint fusion and eleven partial excision of trapezoid for scaphotrapezoid arthritis. At a mean follow-up of 57 months, all clinical parameters demonstrated significantly improvement. 27 patients achieved good functional results and 5 patients fair. Revision surgery with soft-tissue interposition with or without ligament reconstruction and distraction pinning for failed CMC arthroplasty of the thumb provides pain relief and improves grip and key pinch strength and range of motion of the thumb.

QUALITY METRICS.... INCENTIVIZING PROVIDERS THROUGH PUNISHMENT,

David C. Urquia, M.D., Augusta Orthopaedics, Augusta, Maine

We presented the Quality Metrics program used by Maine General Health for the Orthopedic Providers. Data presented from on-line national surveys of Duke Piedmont members from 2012 and 2015, reflecting their collective experience with quality monitoring programs. Recent literature 2012 to 2015 presented, summarizing current Government program, and data generated from various quality monitoring programs.

Considerable skepticism expressed whether current Quality Metric programs will actually improve quality of care.