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Part II: Podium & Poster Presentations

38 Influence of Locking and Non-Locking Plate-Screw Constructs on Postoperative and Long-Term Tibial Plateau Angle after Tibial Plateau Leveling Osteotomy in Dogs

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Introduction: The objective was to determine the differences of the tibial plateau angle (TPA) post-operatively and long-term between pre-contoured locking plate-screw constructs and conventional surgeon-contoured non-locking plate-screw constructs after tibial plateau leveling osteotomy (TPLO) in dogs.

Materials and Methods: The medical records of 97 stifles receiving a TPLO for treatment of cruciate insufficiency were evaluated retrospectively. Patient age, weight, sex, plate type (locking vs. non-locking), plate size, affected side, pre-operative (PreTPA), postoperative (PostTPA), long-term TPA (LongTPA), were recorded. The amount of TPA rotation achieved during surgery (RotaTPA) and TPA shift during healing (ShiftTPA) were calculated. Radiographic healing was evaluated. Variables were compared by plate type using a two-sample t-test or chi-square as appropriate.

Results: Median (range) time to last radiographic follow-up was 74 (43 – 2815) days. The PreTPA of locking and non-locking plates was 29.1° and 28.3°, respectively (P=0.3). PostTPA (8° and 13.2°), RotaTPA (21.1° and 15.0°) and LongTPA (10.4° and 15.1°) for locking and non-locking constructs, respectively, were all significantly different (P<0.0001). ShiftTPA (2.3 and 1.8°, respectively) was not significantly different (P =0.4).

Discussion/Conclusion: A higher degree of tibial plateau rotation was achieved and maintained in osteotomies that had the locking plate-screw construct applied. These results may suggest that rotation of the proximal tibial segment is better maintained during application of a locking plate-screw construct than a conventional plate screw construct.

Acknowledgments: None.

39 Short-term Outcome Measurements of Pelvic Limb Bone Mineral Density in Dogs with Cranial Cruciate Ligament Rupture Treated with Medical Management or a Combination of Medical Management and Surgery

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Introduction: Cranial cruciate ligament rupture is common in dogs and often a tibial plateau leveling osteotomy (TPLO) is preformed for surgical correction. DEXA scan measurements of bone mineral density (BMD) may give us an indication of how much an affected limb is load bearing. We hypothesized that dogs with TPLO surgery and medical management will have significantly higher BMD than those with medical management alone.

Materials and Methods: Prospective randomized study comparing pelvic limb bone mineral density in dogs with cranial cruciate ligament ruptures treated with medical management (strict rest, weight loss, physical therapy, and NSAIDs) or TPLO surgery followed by medical management. 40 client-owned dogs were used with DEXA measurements at 0 and 12 weeks. The DEXA results were compared using t-tests with significance set at P<0.05.

Results: The combined treatment limb had a mean BMD of 0.800 g/cm² at Day 0 and 0.766 g/cm² at the 12-week mark, which was significantly lower (p-values: 0003 and 00005, respectively) from the control limb with a BMD of 0.885 at Day 0 and 0.858 at the 12 week mark. There were no significant differences in BMD between the surgical and non-surgical groups at any time point.

Discussion/Conclusion: Medical management of cranial cruciate ligament disease using physical therapy, strict rest, and non-steroidal anti-inflammatory medications showed similar BMD as patients treated with a TPLO. Surgeons should consider first trying medical management in these cases.

Acknowledgments: We would like to acknowledge Novartis for funding this study.

40 Ex vivo Performance Testing of Two Arcuate Oscillating Saw Blades Designed for Use during Tibial Plateau Leveling Osteotomy

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Introduction: This study was designed to test the cutting performance of two commercially available oscillating saws designed for use during tibial plateau leveling osteotomy (TPLO) and to evaluate the influence of saline irrigation on cutting performance.

Materials and Methods: Controlled-force cutting tests were performed using custom-made laminated polyurethane test blocks to model the canine proximal tibia. Two designs of 24mm TPLO saw blades (Synthes and Slocum Enterprises) were tested. Half of the trials were irrigated with 0.9% saline. Outcome measures were test block temperature (measured 15mm from the cutting zone), cutting rate and cutting surface wear. Durability was measured by recording change in performance over multiple consecutive trials.

Results: The Synthes blade cut the test blocks with approximately 64% less heat generation and at a 63% faster cutting rate. Although wear of the Synthes blade was approximately 50% greater after 19 uses, this did not negatively impact cutting performance. Saline irrigation produced no significant effect on peak cutting temperature but significantly reduced cutting rate for both saws.

Discussion/Conclusion: Our results favor the Synthes blade in terms of cutting performance and the Slocum blade in terms of wear resistance. Regardless of blade design, significant temperature elevation should be expected during TPLO and limited efficacy of saline irrigation should also be assumed.

Acknowledgments: The authors would like to thank AO Vet for funding this study.

41 Heat Generation by Two Different Saw Blades used for Tibial Plateau Leveling Osteotomies in Canine Cadaveric Tibiae

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Introduction: During tibial plateau leveling osteotomy (TPLO) saw blades produce heat in contact with bone. Irrigation of the blade and bone has been recommended to prevent thermal damage. We hypothesized that New Generation Devices (NGD) and Slocum Enterprises (SE) saw blades generate substantial heat up to bone damage thresholds. We also hypothesized that saw blade design and irrigation of the blades would influence amount and duration of heat generated during the TPLO. The purpose of this study was to evaluate and compare heat generated by NGD and SE TPLO blade designs with or without irrigation in cadaveric canine tibiae.

Materials and Methods: 36 paired tibiae were used. Each pair was assigned to irrigation or non-irrigation. Each tibia within a pair was osteotomized using the NGD or SE blade. Osteotomy temperatures were continuously monitored on the

cis- and trans-cortex. Blade exit temperature was recorded. Temperatures were compared for all combinations of blade type/cortex/irrigation settings.

Results: The SE blade generated more heat than the NGD blade ($p=0.0258$) in the cis-cortex. The NGD blade reached significantly lower temperatures than the SE blade ($p=0.0034$). A significant difference existed in blade temperature with non- irrigation ($p=0.0156$). For all variables considered bone and blade temperatures were significantly lower with irrigation than without (p -values <0.05). No osteotomy reached time and temperature damaging thresholds.

Discussion/Conclusion: The potential for bone thermal damage during the TPLO procedure is low when irrigation is used with either saw blade design. Irrigation of the blade and bone is recommended during the TPLO.

Acknowledgments: Supported by the Comparative Orthopedics Research Laboratory, WSU, Pullman, WA; NGD saw blade donated by NGD enterprises, Glen Rock, NJ.

42 Incidence of Trans-Cortical Tibial Fractures with Self-Tapping and Non-Self-Tapping Screws in a TPLO Model

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Introduction: Investigation of self-tapping screws (STS) and non-self-tapping screws (NSTS) has yet to determine the superior screw type. In this retrospective study we compared the two screw types in a clinical setting. The objective of this study was to compare the incidence of radiographically apparent trans-cortical diaphyseal tibial fractures between STS and NSTS in a tibial plateau leveling osteotomy (TPLO) model.

Materials and Methods: STS and NSTS were compared by reviewing postoperative TPLO radiographs. Three screws distal to the tibial osteotomy served as the *in vivo* model for canine cortical bone. A trans-cortical fracture was defined as the presence of a saucer-shaped radiolucent defect on the periosteal surface of the trans-cortex surrounding the screw and the presence of radio-opaque material (bone) separate from the trans-cortical periosteal surface. The effects of screw type and screw composition on the incidence of trans-cortical fractures were evaluated.

Results: STS had a significantly higher ($P = 0.006$) incidence of trans-cortical fractures (18.0%) compared to NSTS (0.8%). The effect of screw material on the incidence of trans-cortical fractures was not statistically significantly different ($P=0.485$).

Discussion/Conclusion: Systemic conditions that compromise diaphyseal bone quality may warrant the use of NSTS when internal fixation is required. We suspect the increased incidence of trans-cortical fractures in STS is attributed to the shorter cutting flute compared to that of a tap used with a NSTS.

Acknowledgments: None.

43 The Effect of Preoperative Planning Method upon the Recommended Tibial Tuberosity Advancement Cage Size

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Introduction: Tibial tuberosity advancement (TTA) seeks to stabilize the cruciate ligament-deficient stifle by orienting the patellar tendon angle (PTA) to $= 90^\circ$ during weight bearing. Preoperative TTA planning in clinical practice uses various techniques to determine the advancement required to attain $PTA = 90^\circ$. We hypothesized that different preoperative planning methods lead to variable TTA cage size recommendations.

Materials and Methods: Mediolateral radiographs were made of 14 large-breed canine stifles. TTA was planned on each radiograph using 2 sets of tibial plateau landmarks (anatomic – [A] vs. femorotibial common tangent – [T]) and 2 advancement measurement techniques (transparent overlay – [O] vs. simulated TTA using imaging software – [S]) for a total of 4 different methods (AO, AS, TO and TS). Data was tabulated and statistically analyzed.

Results: The mean recommended advancements (\pm SD) were: $TO^* = 7.5 \pm 2.0$ mm; $TS = 10.0 \pm 3.2$ mm; $AO = 10.1 \pm 3.3$ mm; and $AS^* = 11.5 \pm 3.6$ mm (* de-

notes statistical difference). Larger advancement was associated with use of anatomic landmarks (vs. common tangent) and imaging software to simulate TTA (vs. overlays). In the 14 stifles studied, these planning methods would have led to four different cage size recommendations in 1 stifle, three different recommendations in 8, two different recommendations in 3, and one recommendation in 2 stifles.

Discussion/Conclusion: Preoperative planning techniques currently practiced lead to variable TTA cage size recommendations and may be a source of inconsistent outcomes.

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44 Incidence and Risk Factors of Postliminary Meniscal Injury following Tibial Tuberosity Advancement in 116 Dogs

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Introduction: The most common major complication following tibial tuberosity advancement (TTA) is postliminary meniscal injury (PMI). The purpose of this retrospective study was to identify risk factors for PMI following arthroscopically-assisted TTA.

Materials and Methods: Medical records of dogs that underwent TTA between January 2008 and August 2009 were reviewed. All stifles with meniscal injury at the time of surgery as diagnosed by arthroscopy were excluded. Data were analyzed for variables contributing to PMI. Calculated advancement (CA) and measured advancement (MA) of the tibial tuberosity were determined from pre and postoperative radiographs respectively. Difference (D) was defined as MA minus CA.

Results: 116 TTA surgeries were performed, of which 85 stifles had normal menisci. Of these 85 stifles, 24 (28%) developed PMI, as diagnosed by second look arthroscopy. Factors having a significant association with PMI included younger age, higher CA, and $D = 15$ mm.

Discussion/Conclusion: A high rate of PMI following TTA was documented in this study. Younger dogs and stifles with a high CA were at higher risk of PMI. Stifles where $D=15$ mm were at highest risk of PMI. Our data appears to corroborate the manufacturer's, Kyon, Zurich, Switzerland, suggestion that under-advancement is a risk factor for PMI.

Acknowledgments: There was no financial support of this study.

45 Percutaneous Pinning of Growth Plate Fractures in Dogs

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Introduction: Growth plate fractures are common traumatic injuries in immature dogs. The purpose of this clinical retrospective study was to evaluate percutaneous pinning of distal femoral fractures and proximal humeral fractures.

Materials and Methods: Dogs that received consecutively percutaneous pinning for growth plate fractures were retrospectively evaluated. Fluoroscopy was used to perform indirect reduction and to facilitate accurate placement of the pins. For fixation of distal femoral fractures, the cranial aspect of Blumensaat's line was used as the landmark for pin insertion on the lateral fluoroscopic view.

Results: Three dogs were treated for distal femoral fractures (Salter Harris 2) and two dogs were treated for proximal humeral fractures (Salter Harris 2). The mean \pm SD age at presentation was 6.2 ± 1.15 months. The mean \pm SD body weight was 50.4 ± 1.8 kg. The duration from trauma to surgery was 2.2 ± 1.8 days. Bone healing was achieved in 3.5 ± 0.58 weeks. No major complications occurred. Mild rotational malalignment occurred in one of the humeral fractures. Good function was achieved in all cases.

Discussion/Conclusion: Our early experience using percutaneous pinning for growth plate fractures has yielded promising clinical results with no complication and rapid development of bone union. The results suggest that percutaneous pinning is an acceptable surgical technique for growth plate fractures.
Acknowledgments: None.

46 Fractures of the Radius and Ulna in the Dog: 71 Cases (2003–2010)

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Introduction: The objective of this study was to report on 71 dogs undergoing surgical stabilization of radius and ulna (R/U) fractures between the years 2003 and 2010.

Materials and Methods: Medical records were reviewed retrospectively for dogs undergoing surgical repair of R/U fractures. Data collected on each case included signalment, fracture site, fracture type, fixation method, time to fixation, time to union, post-operative complications, and functional outcome.

Results: Seventy-one dogs underwent surgical repair of 73 R/U fractures. Toy and small breed dogs were most commonly affected. Mean age was 2.7 years. Five fractures with previous external coaptation were referred for delayed union, nonunion, or malunion. Complete medical records were available in 34 cases. Mean time to union was 8.3 weeks. Complications resulting in subsequent surgeries occurred in 9 of 34 fractures. These included implant removal, subsequent fractures, and malunion revision. Functional outcome was reported by 28 owners to be excellent to good in 24 cases, fair in 2 cases, and poor in 2 cases.

Discussion/Conclusion: In this retrospective study, 93% of 28 fractures had an excellent to good or fair return to function as evaluated by the owners. Three of 34 (9%) fractures with complete follow-up resulted in failure, and 6/34 (18%) of fractures required implant removal. The complication rate was higher than expected, but given the large number of cases lost to complete follow-up, the number of complications may have been over or under-represented. We feel the lack of nonunion in this high population of toy breeds is superb compared to historical data using external coaptation.

Acknowledgments: None.

47 Investigations into the Aetiology of Tarsal Slab Fractures in Thoroughbred Racehorses

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Introduction: Tarsal slab fractures are a significant problem in TB racehorses, but the aetiology is unknown. Our hypothesis was that tarsal slab fractures are another form of fatigue fracture.

Materials and Methods: Hindlimbs were obtained from 36 TB horses, with known signalment and exercise history, destroyed for reasons other than hock fractures. All specimens were radiographed. Dorsolateral (DL) and dorsomedial (DM) slabs were cut from the dorsal aspect the central (Tc) and third (TIII) tarsal bones. A quantitative index of apparent bone mineral density (ABD) was obtained from digital radiographs of 2 or 3.5mm plane parallel sections. Backscattered electron microscopy (BSE) was performed on PMMA embedded sections. ANOVA was used to test for significant relationships between the ABD and other parameters.

Results: Digital radiography revealed a wide variation in ABD of the compact and cancellous bone. Training caused an increased density of both compact and cancellous bone, more apparent on the DL aspect. The ABD was significantly influenced by training status ($p < 0.001$), previous exercise history ($p < 0.001$), and age ($p < 0.001$); and there was an increase in ABD with training. BSE explained the changes identified on radiography. Creases and indentations were identified in the calcified cartilage layer, associated with a high concentration of healing

microfractures. Many microfractures were evident within the calcified cartilage of TIII, in comparison to Tc.

Discussion/Conclusion: Marked adaptive remodeling occurs, and is most marked in the predilection site for slab fractures, supporting our hypothesis. BSE demonstrated potential stress-risers.

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48 The Relationship between Radiographic Changes of the Medial Femoral Condyle and Performance in Quarter Horse Cutting Horses

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Introduction: While multiple studies have compared radiographic repository findings and performance outcomes in Thoroughbred racehorses, little literature exists for other disciplines. This study examined the correlation between radiographic changes of the medial femoral condyle (MFC) and performance outcomes in Quarter Horse cutting horses.

Materials and Methods: Changes of the MFC on repository radiographs of 432 horses were compared to performance. The MFC grading scale was as follows: grade 1 – flattened contour; grade 2 – subchondral bone sclerosis and/or incomplete defects in subchondral bone; grade 3 – wide, shallow complete subchondral defects; grade 4 – subchondral cystic lesion. Outcome parameters included whether the horse competed and amount of money earned. Data were obtained through the horses' four-year-old year. For horses that did not compete, follow-up information was obtained as to the reason for not competing.

Results: No significant association was found between the objective outcome parameters and any grade of MFC lesion. There were 201 horses that did not earn money. Follow-up information was obtained on 127 of the 201 horses that did not earn money, of which 93 did not compete.

Discussion/Conclusion: The findings of this study can help veterinarians in pre-sale situations to better advise their clients on the likelihood of radiographic lesions of the MFC to affect certain performance outcomes. Further research examining how these lesions are associated with lameness would be useful. Breed and discipline-specific studies of radiographic repositories are warranted to determine the relationship between radiographic lesions and performance.

Acknowledgments: None.

49 Application of Novel Endo- and Exoprostheses to the Calcaneus of the Dog and Cat following Distal Limb Amputation

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Introduction: The objective of this study was to report application of an intracalcaneal intra-osseous transcuteaneous amputation prosthesis (ITAP) for distal limb salvage in a dog and a cat and evolution of exoprosthesis design to assist normalization of gait and preserve endoprosthesis integrity.

Materials and Methods: Both a three-year old cat and a three-year old German shepherd dog sustained irreparable trauma at proximal metatarsal level to both and one distal pelvic limbs, respectively. CT images facilitated ITAP design comprising a titanium alloy intramedullary stem, perforated umbrella-shaped flange for skin in-growth and peg for exoprosthesis attachment. 3D modeling of ITAP facilitated finite element analysis and superimposition on a radiograph of the contralateral limb facilitated measurement of length, angle and shape of the proposed exoprosthesis. Optimal combination of material, cross section and alignment of the exoprosthesis was elucidated to stress-protect the ITAP.

Results: All three ITAPs achieved dermal integration by three weeks, pain free ambulation by eight weeks and osseous integration by 12 weeks. Normal quality of life and satisfactory gait pattern has been maintained at one year for the cat and four months for the dog.

Discussion/Conclusion: Preservation of the talocrural joint minimized gait pattern disruption. The ground reaction force was considered in exoprosthesis development to allow "rocker motion" at the calcaneus, ensure symmetrical gait, provide ground-surface friction and optimise shock absorption. ITAP application to the calcaneus is feasible, can result in favourable functional outcomes, and may be considered viable for limb salvage in dogs and cats.

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Poster Presentations

50 Novel Bone Anchor System facilitating Intra-Articular Cranial Cruciate Ligament Restoration in the Dog: Modification Review

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Introduction: The purpose of this submission is to report causes for revision and present modifications that have been made to the technique since its' introduction in February 2010. In the original group of 23 knees, 4 implants have failed to date. Each failure occurred at the same site of femoral cortical exit.

Materials and Methods: Materials include standard orthopedic tools, sterile polymethylmethacrylate (PMMA), 250-pound test monofilament nylon, and a properly sized two channel metal crimp. Two newly fabricated tools have been added to contour the insertion tunnel, which has proven to be the site of occasional implant failure. A standard lateral parapatellar arthrotomy is performed. Previously described femoral (origin) and proximomedial tibial (insertion) tunnels are prepared using standard drills and burr tip. The origin tunnel exit point is additionally enhanced in diameter and rounded to remove knife edged cortical bone. A loop of monofilament nylon is threaded into the femoral tunnel and the free ends placed into the tibial insertion tunnel. The femoral component is cemented into place using PMMA. Care is taken to pack, contour, and smooth the PMMA and to completely encase the nylon and avoid bony contact during the semi-solid to solid transition phase. The free ends are tensioned, crimped and encased in PMMA recessing this segment into the proximal tibia as previously described. Routine closure is performed.

Results: Since introduction of this modification in May 2010, in a study group of 5 knees, there have been no implant failures.

Discussion/Conclusion: All prior implant failures have occurred at the femoral origin. This method may serve to further reduce revision rates. Long-term efficacy of this technique has yet to be established.

Acknowledgments: Sara Ciscel, Daniel Guss, my family, and staff for their ongoing encouragement.

51 Assessment of Acetabular Cup Positioning following Total Hip Replacement from a Lateral Radiographic Projection

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Introduction: Hip luxation is the most commonly reported complication for total hip replacement (THR). It is difficult to identify craniocaudal pelvic tilt (CPT) using VD radiographs. Study aims: 1) To evaluate the effect of CPT on measurements of version, lateral opening, and angle of inclination on a VD radiograph and 2) To validate postoperative assessment of acetabular cup position (ACP) from a lateral radiograph.

Materials and Methods: Eleven VD radiographs were obtained after insertion of a BioMedtrix CFX cup into a Sawbones acetabulum at a fixed angle. For each radiograph, the pelvis was placed in varying degrees of CPT. Fifteen lateral radiographs were obtained of a Sawbones pelvis with the acetabular cup implanted in varying angles of coronal retroversion and lateral opening. Blinded observers measured the angles of ACP on each VD and lateral radiograph.

Results: An almost perfect level of agreement was observed between the observers for the repeatability of both the VD and lateral radiographs. When varying degrees of CPT were introduced, there was no agreement in the measurements of ACP from VD radiographs. At all cup positions, measurements taken from the lateral radiograph were in agreement.

Discussion/Conclusion: CPT causes significant variability in the measurements of ACP on VD radiographs. Accurate and consistent measurements of ACP can be obtained from a lateral radiograph. Using lateral radiographs to measure coronal retroversion and lateral opening of the acetabular cup following THR would allow for a more precise investigation of the influence of ACP on the incidence of luxation.

Acknowledgments: None

52 Medial Tibial Plateau Angle in the Ovine Knee

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Introduction: Comparative animal models are needed to develop orthopedic treatments for the human knee. The ideal animal model approximates human body weight, joint size and biomechanics. The posterodistal slope of the tibial plateau, measured as the tibial plateau angle (TPA), influences knee biomechanics and alters the implantation of total knee arthroplasty (TKA) systems. Compared with the human knee, the canine knee is much smaller and has a much steeper TPA. The ovine more closely approximates the joint size and body weight of the human, but the TPA of the ovine knee has not been extensively studied. The purpose of our study was to define the TPA of the adult ovine knee.

Materials and Methods: Pelvic limbs of thirty-six, skeletally mature, female, Columbia-Rambouillet sheep were harvested immediately following euthanasia for reasons unrelated to this investigation. Digital mediolateral radiographs were made of 72 tibiae and TPA was measured using Orthoplan software according to previously described methods.

Results: The mean TPA was $12.6^\circ \pm 2.8^\circ$ (range 8.0–22), $12.7^\circ \pm 2.6^\circ$ (range 8–20) and $12.5^\circ \pm 3.5^\circ$ (range 8.5–22) for all limbs, left limbs and right limbs, respectively.

Discussion/Conclusion: The TPA of the ovine knee approximates the relatively flat TPA of human knees. When combined with the relative ease of animal husbandry, the body weight, joint size, and, now, TPA, of the ovine makes it a leading animal model for treatments of the human knee including anterior cruciate ligament (ACL) reconstruction, TKA, hemiarthroplasty, and meniscal repair.

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53 Use of Hinged Circular Fixator Constructs for the Correction of Crural Deformities in Three Dogs

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Introduction: Hinged circular external fixator constructs perform gradual progressive correction of angular limb deformities, often with resultant limb segment lengthening, via distraction osteogenesis. Several reports describe the use of these constructs for correction of antebrachial deformities in dogs, however, there is little information regarding their use on other limb segments. The purpose of this report was to describe the use of hinged circular fixator constructs for the correction of crural deformities in three dogs.

Materials and Methods: Three skeletally immature large or giant breed dogs underwent corrective surgery for acquired angular deformities of the crus utilizing hinged circular external fixators. Two dogs had purely frontal plane deformities, one valgus and one varus, and one dog had significant valgus and recurvatum. Tibial length discrepancies of 12% and 22% were also present in two dogs.

Results: At the time of long-term follow-up, angulation compared to the contralateral limb improved from 30° of valgus to 5°, 40° of valgus to 22°, and 20° of varus to 1°. The length discrepancies improved to 5.8% and 9.8% of the contralateral tibial length. Compensatory growth of the ipsilateral femur in both dogs negated the need for subsequent tibial lengthening.

Discussion/Conclusion: These cases illustrate that hinged circular external fixation and distraction osteogenesis are a viable option for correction of tibial deformities. All dogs had excellent functional outcomes following a single surgical procedure. Minor complications that occurred in these dogs mirror those described in previous reports regarding the use of circular fixators in dogs.

Acknowledgments: The authors have no proprietary interests regarding this project and received no financial support.

54 Tarsometatarsal Arthrodesis using Tarsometatarsal Intramedullary Pin Stabilization

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Introduction: Tarsometatarsal luxation is an uncommon injury in which arthrodesis is recommended to restore long-term stability of the joint. Several methods of arthrodesis of the tarsometatarsal joint have been described, including intramedullary pin and cross-pins, pin and tension band, external fixation, and bone plate. The objective of this study is to report the results and clinical application of a tarsometatarsal intramedullary pin stabilization (TIPS) technique for arthrodesis of the tarsometatarsal joint.

Materials and Methods: TIPS was performed on 12 dogs and 1 cat with tarsometatarsal instability. A dorsal approach was made to the tarsometatarsal joint, and the articular surface was removed. Intramedullary pins were then inserted through each tarsometatarsal bone into the distal tarsal bones to stabilize the joint, after which bone regeneration material was placed within the joint. Stabilization was supplemented with external coaptation for the duration of healing. The intramedullary pins were removed after radiographic evidence of arthrodesis.

Results: All cases went on to form radiographic evidence of bony fusion across the tarsometatarsal joint. No major complications were observed. Long-term follow-up was available in 12 cases at a mean of 114 weeks after surgery. Eleven patients were reported to be completely sound, and one dog was reported to ambulate normally when walking and favor the leg when running.

Discussion/Conclusion: TIPS is a simple and effective method of arthrodesis for treatment of tarsometatarsal instability, with excellent owner satisfaction and a minimal risk of major complications.

Acknowledgments: None.

55 Long-term Follow-up of Cranial Cruciate Ligament Techniques

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Introduction: To compare long term outcomes of dogs undergoing TPLO, TTA and TightRope extracapsular repair.

Materials and Methods: Retrospective case series consisting of cranial cruciate ligament deficient animals presented to University of Missouri Veterinary Medical Teaching Hospital between November 2006 and April 2009. Medical records and a questionnaire evaluating post op discomfort and return to function were collected. Cases were included only if complete records and questionnaire were available for primary surgical repair. Complications were classified as minor, major, or catastrophic. Return to function was owner evaluated as full function, acceptable, or unacceptable as well as a scale of 0–100. All patients were at least one-year post surgery.

Results: Overall 49% of the questionnaires were returned. The TPLO and TR had an 18.5% and 8.9% major complication rate while the TTA had a 38.9% major complication rate with a 12.3%, 6.3%, and a 27.8% postoperative meniscal in-

jury respectively. The TPLO and TR had a 76.9% and 75.9% return to full function, respectively while the TTA showed only 44.4%.

Discussion/Conclusion: In this group of dogs, the TightRope showed significantly fewer major complications than the TPLO and TTA including fewer post-operative meniscal tears. There was no significant difference between the three procedures in regards to long-term post operative discomfort. However the TPLO and TR showed a significantly higher return to full function than the TTA patients.

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56 Complications and Biostatistics Associated with Tibial Plateau Leveling Osteotomy from 2005 to 2009, 1519 Cases

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Introduction: Prior studies have reported TPLO complication rates up to 28%. We hypothesize the level of complications reported will be lower and less severe in a private referral center with experienced surgeons.

Materials and Methods: Medical records were reviewed of TPLO surgeries from January 2005 until December 2009. Statistical analysis performed on all complications within 6 months after surgery. Age, weight, sex, lameness time, tibial plateau angle, meniscal appearance and therapy, cruciate tear, blade size, plate size, other implants, antibiotics, complication category, days to complications, prior orthopedic problems, subsequent meniscal tears, anesthesia time, surgery time and complications were recorded for each surgery.

Results: 1231 dogs reviewed. At presentation, 13.9% (171) dogs had bilateral cruciate ruptures. The meniscus was torn in 40% (611) of dogs. There were 60% (908) of the dogs with intact menisci and of those, 30% (452) were released during the initial surgery. The cruciate ligament was fully torn in 86% (1305) of dogs and partially torn 13% (195) of the knees. Total and major complication rate of 11.4% and 3.1% respectively. Bilateral cruciate ruptures occurring before the first surgery had a complication rate of 13.9%. Newfoundland and German Shepherd dogs had a complication rate of 24% and 31.03% respectively. TPA >30; Increasing weight, being a German Shepherd dog and having a forelimb orthopedic abnormality were predictive for complications.

Discussion/Conclusion: This is the lowest complication rate yet described for TPLO surgeries. TPLO in the hands of experienced surgeons have a low complication rate.

Acknowledgments: Veterinary Specialty Services.

57 Distraction Osteogenesis Using a Hinged Circular Fixator for Correction of a Metatarsal Deformity in a Foal

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Introduction: A 5-week-old American Quarter Horse colt presented for varus deformity with recurvatum of the left metatarsus. Computed tomography (CT) revealed 35 mm shortening, 17° varus and 21° recurvatum centered in the mid-diaphysis of the left third metatarsal bone, likely secondary to intra-uterine fracture malunion.

Materials and Methods: A complete oblique osteotomy was performed and two double ring blocks (118 mm internal diameter complete rings) were fixed in each bone segment with 4 mm diameter positive-profile, partially threaded fixation pins. Angular hinges were placed plantarolateral and plantaromedial, with a corresponding dorsomedial angular motor. Following fracture of fixation pins, the construct was reinforced with five 1.8 mm diameter olive wires tensioned to 120 kg. Distraction was performed at 1.25 mm/day for 11 days when the deformities were visually corrected. Complications included incisional dehiscence and pin tract drainage. All threaded pins were replaced with tensioned olive wires 34 days

following the initial procedure. The drainage ceased and the fixator was maintained for 16 weeks.

Results: CT performed following fixator removal revealed smooth marginated mineralized callus around the osteotomy, with varus deformity of 8° with 10° recurvatum and nominal external rotation. The left and right third metatarsal bones measured 259 mm and 281 mm long respectively.

Discussion/Conclusion: This is the first report of distraction osteogenesis utilizing a hinged circular external fixator to correct an angular limb deformity in a foal. Tensioned olive wires incited minimal morbidity and may be more suitable fixation elements than fixation pins.

Acknowledgments: No financial support or materials were provided.

58 The Relationship of the Canine Femoral Head to the Femoral Neck: An Anatomic Study with Relevance for Hip Arthroplasty Implant Design and Surgical Technique

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Introduction: Studies that have quantified the angle of inclination of the canine femoral neck relative to the femoral diaphysis have defined the femoral neck axis using landmarks associated with the femoral head; no studies have evaluated the relationship of the femoral head to the neck. The objective of this cadaveric study was to describe a method for characterizing this relationship and to determine whether the femoral head is offset from the femoral neck as is the case in humans.

Materials and Methods: Femurs were photographed in frontal and sagittal planes simultaneously using 2 cameras positioned orthogonally. Twelve measurements were made by two independent observers and correlation and agreement assessed using a Pearson product moment coefficient and a T-test or rank sum test.

Results: Observer correlations were excellent and no significant differences between mean values were identified for measurements of femoral head offset and angles describing the femoral neck to diaphysis relationship (i.e. angle of inclination and angle of anteversion). The data indicate dogs have a substantial cranial and ventral offset of the femoral head from the femoral neck.

Discussion/Conclusion: Femoral head replacement prostheses, such as human resurfacing implants and the Helica Hip, fail to reproduce native anatomy if positioned within the center of the femoral neck. The described methodology can be used to assist design of anatomically and mechanically optimal implants and can be used as an outcome measure to assess instruments that are designed to improve accuracy of prosthesis implantation within the femoral neck.

Acknowledgments: None.

59 Management of Canine Shoulder Instability: A Retrospective Evaluation

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Introduction: Numerous management strategies have been used for treatment of medial, lateral, and multidirectional shoulder instability including nonsurgical management, radiofrequency (RF) capsulorrhaphy, and ligament reconstruction. Optimal treatment protocols have yet to be established. The purpose of this multi-center retrospective study is to evaluate a series of medial, lateral, and multidirectional instability cases and compare outcomes among cohorts.

Materials and Methods: A multi-center review was performed on all cases seen over the last 3 years. Cases were categorized as medial, lateral, or multidirectional instability and according to treatment (non-surgical, RF, reconstruction). Outcomes with greater than 1 year follow-up were classified as full, acceptable, or unacceptable function based upon owner input and re-examination when possible. Success was defined as full or acceptable function.

Results: Medial shoulder instability was most common with 101 cases. Success was obtained in 69% with non-surgical management, 80% of RF cases, and 87% with reconstruction. Success rates were 100% for both non-surgical management (n=2) and reconstruction (n=5) for lateral instability. Success was achieved in 66% of patients with multi-directional instability using non-surgical management and in 83% of those treated with reconstruction.

Discussion/Conclusion: Medial shoulder instability is more common than lateral and multi-directional instability. Success rates appeared higher for cases of lateral instability regardless of whether surgical or non-surgical management was employed when compared to cases of medial and multidirectional instability. Controlled prospective studies are needed to determine whether success rates for shoulder instability vary depending on the management used.

Acknowledgments: None.

60 Effects of Humeral Rotational Osteotomy on Contact Mechanism of the Canine Elbow Joint: An ex vivo Study

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Introduction: The purpose of this study was to evaluate the effect of an external humeral rotational osteotomy on the forces acting in the canine elbow joint. Our hypothesis was that external humeral rotation of 15° would shift the peak pressure location and the center of pressure laterally.

Materials and Methods: Eight canine forelimbs were used. A pressure sensor was fixed in a transverse subchondral osteotomy distal to the elbow joint, and each leg was mounted in the testing apparatus. Measurements were taken in the following sequence: (1) normal, and (2) after 15° of external rotation. The distal humerus was rotated by a mid-diaphyseal humeral osteotomy and stabilized with an internal fixator. Contact area, peak and mean contact pressure, peak pressure location, center of pressure, and total force were acquired. Data was analyzed using paired T-tests. Significance was set at p=0.05.

Results: Peak pressure location and center of pressure shifted laterally after 15° of external rotation by 37.56 ± 15.9% (p=0.0001) and 21.5 ± 6.8% (p=0.0001) respectively. No statistically significant differences were found between conditions for the contact area, peak and mean contact pressure, and total force.

Discussion/Conclusion: The lateral shift of peak pressure and center of pressure may be beneficial in dogs with medial compartment disease. Since this is an ex vivo study, care must be taken before extrapolating these results onto a population of affected patients. Further studies are needed to evaluate clinical effects.

Acknowledgments: None.

61 A Biomechanical Evaluation of the Effect of Three Drop Wire Configurations on the Stiffness of Single Ring External Fixator Constructs

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Introduction: Drop wires are often incorporated in circular and hybrid fixator constructs to improve construct stability. The purpose of this study was to evaluate the biomechanical benefit of a drop wire to a single ring construct during loading. We hypothesized that a drop wire would increase stiffness values of single ring constructs.

Materials and Methods: Five construct designs were constructed using 66 mm diameter rings and 1.6 mm olive wires. Construct designs included: single ring, single ring with drop wire (5.5 mm, 10.5 mm, or 24 mm from ring surface), and a double ring construct. Constructs were tested in an MTS in bending, torsion, and axial compression. Stiffness values were calculated from construct load displacement curves.

Results: Addition of any drop wire increased single ring construct stiffness in axial compression, mediolateral bending and torsion but was not comparable to

the double ring construct. Effect was increased with increasing drop wire distance from ring.

Discussion/Conclusion: The results demonstrate that drop wires can increase circular fixator stiffness. We recommend the clinical use of drop wires positioned distant to the ring in circular fixator constructs.

Acknowledgments: IMEX Veterinary Inc. provided materials free of charge for this study.

62 Hemilaminectomy for Thoracolumbar Hansen Type I Intervertebral Disk Disease in Ambulatory Dogs with or without Neurologic Deficits: 45 Cases (2007–2010)

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Introduction: Though previous reports have investigated outcome/prognosis of dogs with thoracolumbar intervertebral disk disease (IVDD) with signs from paralysis to back pain alone, none have yet focused on describing these factors within the category of ambulatory dogs with or without neurologic deficits (modified Frankel scores I and II). Conflicting reports exist regarding correlation between presenting neurologic grade and hemilaminectomy outcome in nonambulatory patients. The goal of this study is to determine whether degree of neurologic deficits, as determined by assessment of conscious proprioception (CP), is a prognostic factor in the outcome of ambulatory dogs having hemilaminectomy for Hansen Type 1 IVDD.

Materials and Methods: Medical records on dogs having hemilaminectomy for IVDD from Jan 2007–May 2010 were reviewed. Dogs found to have ambulation preoperatively and type I disks at surgery were evaluated for signalment, duration of signs, degree of deficits, and time to recovery.

Results: Increasing degree of CP deficits preoperatively was found to be significantly correlated with longer time to ambulation ($p=0.005$) as well as longer time to normal CP ($p=0.01$) postoperatively. Other factors such as breed and duration of signs were not found to be correlated with time to ambulation or time to CP normal for either grade I or II dogs.

Discussion/Conclusion: These findings, combined with prior evidence that spinal compression may be significant in dogs with mild clinical signs, suggest that among ambulatory dogs timely diagnosis and treatment is beneficial to provide optimal recovery time and outcome.

Acknowledgments: No funding has been provided for this study.

63 Treatment of Avascular Necrosis of the Femoral Head in Small Dogs with Cemented Micro Total Hip Replacement

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Introduction: Avascular necrosis (AVN) of the femoral head is a developmental condition that affects small breed dogs. AVN is an autosomal recessive trait. The pathophysiology is well described. The contemporary treatment for AVN is femoral head ostectomy with fair to good subjective results. Total hip replacement (THR) is used to manage hip diseases in dogs to eliminate pain and re-establish normal function. THR has been recommended as a treatment of AVN, but clinical outcome studies are lacking. The purpose of our study was to evaluate treatment of AVN with the Micro THR system.

Materials and Methods: This was a non-randomized, phase 2, retrospective study. The records of seven dogs (7 hips) treated with Micro THR were evaluated. All dogs were evaluated at least 6 months after Micro THR. Signalment, physical, orthopedic, neurologic and radiographic examination, owner questionnaire, thigh girth, and ground reaction forces were evaluated.

Results: There was no correlation between age, sex, and breed for the development of AVN in this study. Thigh girth and ground reaction forces showed no statistical difference between operated Micro THR limb and contralateral normal limb.

Discussion/Conclusion: Micro THR is a surgical treatment option for AVN in small dogs.

Acknowledgments: None.

64 Hip Toggle Stabilization Using the TightRope® System In 9 Dogs

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Introduction: Toggle rod stabilization for coxofemoral luxation (CFL) has been described using many variations of prosthetic ligament of the head of the femur (LHF) including absorbable and non-absorbable suture material. Our objectives were to describe the technique and to report clinical outcome in 9 dogs that had toggle rod stabilization for CFL using the TightRope® system as the prosthetic LHF.

Materials and Methods: Medical records including radiographs (9 limbs) with CFL repaired using the TightRope® system were retrospectively reviewed to assess outcome using this technique. Follow-up (>3 months) was obtained by phone interview of owners. Five dogs were available for re-evaluation and gait analysis.

Results: Follow-up (mean, 8 months; range, 3–24 months) was available for 9 dogs (by phone). Re-evaluation was performed in 5 dogs (mean, 8 months; range, 3–24 months). A single case of relaxation was reported. Eight of nine owners reported limb function as being excellent. For five dogs evaluated by a veterinarian >3 months following surgery, objective gait analysis revealed pelvic limb symmetry. Radiographs (3–24 months post surgery) of five dogs showed minimal to no progression of osteoarthritis compared to the contralateral hip.

Discussion/Conclusion: Hip toggle with the TightRope® system produced a favorable clinical outcome with high owner acceptance. Repair of CFL with the TightRope® system is a clinically applicable technique and may offer advantages over other materials used for hip toggle repair in respect to postoperative complications.

Acknowledgments: None.

65 Development of an Ovine Model to Influence Growth with Extracorporeal Shock Wave Therapy (ESWT)

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Introduction: ESWT could provide a means to non-invasively manipulate growth in mammals.

Materials and Methods: Four 3-week-old lambs were used with diagonal fore- and hindlimbs selected for treatment and the contra-lateral diagonal pair as control. Four distal physes were each treated once (day 0) with 1000 pulses of ESWT of 4 different energy levels in a Latin square design. Calcein was injected on project day -5, day 0 and day 5. The lambs were examined daily and necropsied at day 6. Fluorochrome inter-band distances and total and zonal physal heights were measured from fluorescence and HE micrographs using image analysis software. Least square means from 4x20 data points per physis were used in an ANOVA. A positive control experiment was performed using 10 000 shocks at 1.5 mJ/mm².

Results: No clinical or necropsy abnormalities were found. The positive control had macro- and microscopic findings. Repeatability for inter-band-distances and physal height was 3% and 4%. Treatment tended ($p=0.096$) to reduce post-treatment growth. Treatment also tended to reduce post- compared with pre-treatment growth within one physis ($p=0.164$). No site effects were found. Total and zonal physal heights of treated and controls were not significantly different.

Discussion/Conclusion: The absence of morbidity and the results are encouraging to further develop the lamb model.

Acknowledgments: The project was supported by a Massey grant and with materials from Pulse Veterinary Technologies.

66 Retrospective Evaluation of Tibial Plateau Angle Change after Tibial Plateau Leveling Osteotomy using a Single Locking Screw Proximal and Distal to the Osteotomy

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Introduction: One complication of the tibial plateau leveling osteotomy (TPLO) is change in the tibial plateau angle (TPA) during healing. We hypothesized that utilization of a single locking screw proximally and distally would be as stable as the use of all locking screws. We were curious when the change in tibial angle occurs and if the degree of fragment rotation affects the amount of change.

Materials and Methods: Consecutive radiographs of dogs treated by TPLO were reviewed. The images were blocked and TPA was measured by a single experienced reviewer. Statistical student's t test analysis was performed on the data ($p < 0.05$).

Results: Tibial plateau angle change did occur. Most of the change occurred in the first four weeks. Average postoperative TPA=6.1, four week TPA=7.3 and eight week TPA=6.8. Patients where the TPA was initially rotated < 20 degrees experienced less change during healing than patients where TPA was changed 20 degrees or more (0.4 degrees vs. 2.6 degrees). At eight weeks there was no significant change in TPA in patients with < 20 degrees of initial rotation.

Discussion/Conclusion: The amount of TPA change during healing using our described method is less than that noted using all locking screws. The initial change of TPA during surgery appears to have an effect on maintenance of desired TPA. Changes of 20 degrees or more resulted in more TPA change during healing.

Acknowledgments: Doctors and Staff of Sierra Veterinary Specialists for their time and input in making this study possible and their patients.

67 Novel Knotless Extracapsular Stifle Stabilization Technique using Two Bone Anchor Systems and Braided Multi-Filament Suture

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Introduction: Objective – To describe a novel technique for extracapsular stabilization utilizing two bone anchor systems (Arthrex PushLock [PL] and SwiveLock [SL]) and braided multifilament suture (Fibertape [FT]) in the canine stifle based on isometric points.

Materials and Methods: Thirty-five dogs with cranial cruciate ligament rupture [CrCLR] treated by PL or SL and FT were identified through medical records. Follow-up was through in-hospital examinations and owner questionnaire. Surgical Technique – A lateral incision was made at the level of the fabel-la. A Kirschner wire or spade-tipped drill bit was drilled at the F2 site and advanced towards the patella to form the femoral tunnel. A tibial tunnel was drilled from the T3 site through the tibia. After loading a suture button, the FT was passed through the bone tunnel and the button was pulled flush against the tibial cortex. The ends of the FT suture were placed through the eyelet of the bone anchor. The anchor was partially advanced into the femoral tunnel and tension was tested by placing the joint through physiologic range of motion and drawer. After confirming proper tension, the anchor was fully advanced, the driver removed, and the FT cut at the level of the bone.

Results: Twenty-five dogs returned for in-hospital follow-up. Ninety-two percent had improved lameness from pre-surgical examination. Eleven owners responded to the questionnaire, and all noted significant improvement in lameness.

Discussion/Conclusion: Placement of implants in an isometric position through minimally invasive technique is suitable for clinical use in dogs with CrCLR.

Acknowledgments: SwiveLock and PushLock bone anchor devices are patent-protected properties of Arthrex Vet Systems, Naples, FL, USA.

68 Evaluation of Antebrachial Rotation and Radial Head Subluxation in the Presence of Angular Limb Deformity via Computed Tomography and Multiplanar Reconstruction in Clinical Cases

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Introduction: Three-dimensional (3D) computed tomographic (CT) imaging offers many advantages for defining the magnitude of the rotational deformity. The goal of this retrospective is to evaluate both pre and post-operative clinical cases of angular limb deformities utilizing CT imaging. A focus of this study is to evaluate the position of the radial head in relation to the humerus and ulna.

Materials and Methods: 14 limbs and 15 CT scans were evaluated for radial torsion by three clinical observers. The CT scans were evaluated via MPR and 3D computed tomographic CT imaging software provided by B&M Services. The landmarks used were previously described by Meola et al. Observations of all three investigators were combined and correlated.

Results: All observers had no difficulty indentifying the described lend marks. The interobserver variability was within the previously described 4-degree threshold for angular radiographic measurement. External rotation varied between -3 and 40 degrees, when the proximal radius was compared to the distal radius. The position of the radial head in relation to the humeral condyles varied between -4 and 30 degrees of external rotation.

Discussion/Conclusion: Our findings concur with the findings described in the human literature concerning the use of MPR and 3D reconstructions. The ability to manipulate the bisecting planes give the observer the opportunity to easily indentify the necessary land marks and measure rotational as well as changes on the dorsal and sagittal plains.

Acknowledgments: B&M Services, Bulgaria provided the 3D and MPR imaging software used in this study.

69 Canal Flare Index in German Shepherd Dogs, Golden Retrievers and Labrador Retrievers presenting for Total Hip Replacement: Implications for Femoral Implant Selection

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Introduction: Canal flare index (CFI), the ratio of the intracortical diameter at the lesser trochanter divided by that at the mid-diaphysis, has been used to assess proximal femoral geometry in total hip replacement (THR) patients. A CFI of ≈ 1.8 is classified as stovepipe morphology, while 1.8–2.5 is considered normal. The aim of this study was to compare CFI in three dog breeds commonly referred for THR. We hypothesized that German Shepherd Dogs (GSD) would have lower CFI than Golden Retrievers (GR) or Labrador Retrievers (LR).

Materials and Methods: Thirty-two dogs of each breed were identified from a THR database. CFI values were calculated from ventrodorsal pelvic radiographs. One-way analysis of variance (ANOVA) was used to compare CFI, body weight and age in the three groups. Changes in CFI with age were assessed using linear regression. Implant use (CFX versus BFX stem) was compared using Chi-squared test.

Results: Mean CFI values were lowest in GSD (1.57 versus 1.78 in GR and 1.84 for LR; $p = 0.001$). Age distributions were similar in the 3 groups but differences in body weight existed (GSD > GR; $p = 0.007$). The relationship between age and CFI was weak and not significant ($p > 0.05$ for all breeds). The use of BFX and CFX implants differed in the three breeds ($p = 0.00014$) and dogs receiving BFX had higher CFI than those receiving CFX stems ($p = 0.003$).

Discussion/Conclusion: Breed-specific variations in CFI have not been reported in dogs. GSD have a stovepipe femoral morphology and CFX implants are used more frequently in this breed.

Acknowledgments: None.

70 Structural Properties of a Fourth-Generation Composite Cylinder as a Model for Equine Third Metacarpus for Biomechanical Testing of Orthopedic Implants

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Introduction: Composite synthetic models of human bones are available as substitutes for cadaveric specimens. Their rapid acceptance was justified by the advantages they offer as a substitute for real bones that can be applied in the veterinary field as well. Our objective was to compare the mechanical properties of a fourth generation of composite tube (4GCT) with those of intact equine 3rd metacarpal bones (MC3).

Materials and Methods: 4GCT=8 units; Equine (>450-kg) MC3=14 units. (1) Four 4GCT and 6 MC3 were tested under 4-point bending single cycle to failure; (2) Three 4GCT and 6 MC3 were tested under torsion single cycle to failure. (3) One 4GCT and 2 MC3 were utilized for screw pull out.

Results: Four-point bending single cycle to failure, failure load ($P=0.41$) and failure bending moment ($P=0.18$) were similar between both materials; composite rigidity was significantly lower for the 4GCT ($P=0.0001$). Under torsional testing in single cycle to failure, mean composite rigidity was significantly higher for the 4GCT ($P=0.0001$). None of the 4GCT failed in torsion. The screw pull out force was significantly greater for 4GCT ($P=0.03$) and pull out displacement was similar for both materials ($P=0.14$).

Discussion/Conclusion: In general, forces and displacement of the 4GCT were similar to the MC3 in 4-point bending and screw pull out. Torsional structural properties and screw pull out forces were higher for 4GCT. The 4GCT is a reasonable biomechanical analogue to the MC3 and it can be employed for *in vitro* testing for biomechanical assessments of implants designed for horses.

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71 In vitro Biomechanical Evaluation and Comparison between a New Prototype Locking Compression Plate and Limited-Contact Dynamic Compression Plate for Equine Fracture Repair

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Introduction: The implants designed to repair equine fractures have to be strong enough to withstand the high loads during weight bearing. Our objective is to compare the mechanical properties of a newly designed 4.5-mm broad locking compression plate (ND-LCP) with those of a 4.5-mm broad limited contact dynamic compression plate (LC-DCP), and to compare the bending and torsional properties of the ND-LCP and LC-DCP when used 3rd metacarpal bones (MC3).

Materials and Methods: ND-LCP and LC-DCP ($n=15$ each). Equine (>450-kg) MC3 ($n=12$ pairs). Plates were tested in 4-point bending single cycle to failure ($n=3$ each). MC3-plate constructs were created with mid-diaphyseal osteotomies with a 1-cm gap. Constructs were tested in (1) 4-point bending single cycle to failure; (2) 4-point bending cyclic fatigue; and (3) torsion single cycle to failure (4 pairs each).

Results: No significant differences ($p=0.11$) in bending strength and stiffness between the two implants were found. The MC3-ND-LCP was significantly stiffer ($p=0.02$) than the MC3-LC-DCP in bending. No other biomechanical differences were found in bending ($p=0.3$), yield load in torsion ($p=0.085$), or mean composite rigidity ($p=0.056$). Mean cycles to failure for bending fatigue testing were similar ($p=0.97$) for both constructs.

Discussion/Conclusion: The ND-LCP was similar to the LC-DCP in intrinsic, structural properties. The ND-LCP construct was more rigid than the LC-DCP construct under 4-point bending and both constructs behaved similarly under 4-point bending cyclic fatigue testing and torsion single cycle to failure. The new ND-LCP implant fixation is biomechanically similar to the LC-DCP in a simulated MC3 fracture.

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72 Resistance to Lateral Luxation of Two Canine Total Elbow Replacement Systems under Variable Mechanical Loads

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Introduction: Total elbow replacements (TER) fail from lateral luxation, infection and fracture. A modification of the original Iowa State University (ISU) elbow implant was designed to reduce lateral luxation. We hypothesized that a new elbow implant will parallel resistance to lateral luxation of a normal canine elbow with the ligaments and joint capsule removed closer than the ISU implant. **Materials and Methods:** Torque forces needed for luxation were identified on potted cadaver elbows under variable axial loads and compared to ISU implants and new design implants. Medial and lateral shear forces were identified in canine elbows using a 10N axial load. Shear force needed to create medial and lateral luxation were collected at 10N, 110N, 220N and 300N of axial load for the two implant designs.

Results: The new implants luxated at 5 to 7 times higher torque loads than the ISU implant and cadavers elbows for both internal and external rotation. Luxation during shear testing was significantly higher in cadaver elbows when compared to either implant, but the new implant was 4 to 7 times more resistant than the ISU implant.

Discussion/Conclusion: The new TER implant may reduce lateral luxation *in vivo* by increased resistant to shear and torsional forces.

Acknowledgments: None.

73 Juvenile Pubic Symphysectomy

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Introduction: Hip dysplasia is one of the most common orthopaedic diseases of large-breed dogs. Current topics on hip surgery involve the technique of juvenile pubic symphysiodesis (JPS). The primary researcher proposes a modified technique: juvenile pubic symphysectomy (JPsec). It is anticipated that the dorsal pelvis and sacrum will grow normally in width, yet cause a quicker ventrolateral rotation of the acetabular borders.

Materials and Methods: With the JPsec the entire growth plate of the pubis is removed, including all the germinal chondrocytes. The 3 study groups were the JPsec group 1a ($N=7$), the JPS group 1b ($N=7$) and a non-surgical control group 2 ($N=9$). The pelvic angles were assessed at 16 weeks pre-and post-operatively (between 24–48 hours) and at 20 and 24 weeks.

Results: JPsec resulted in improved hip conformation of up to 5% of lateral centre-edge angle and acetabular angle, directly postoperatively. JPsec did result in a greater and faster dorsal acetabular covering than JPS. JPsec did not have a significant effect on the sacral width and conformation.

Discussion/Conclusion: The patient's postoperative care was uncomplicated. The technique of JPsec requires the fixation of the pubic bones and symphysis with orthopedic wire and it will serve as an indicator of a previous corrective surgical procedure. A faster ventroversion angles was achieved. The fact that a

relative good ventroversion is achieved, an over correction is possible. Both techniques are acceptable for the correction of early-diagnosed hip dysplasia.

Acknowledgments: The patients' nutritional requirements were sponsored by Nestlé Purina South Africa. The University of Pretoria contributed \$2000 US towards this study.

74 Use of Three Dimensional Dynamic Computed Tomography for Surgical Planning and Post-Operative Assessment of Dogs with Degenerative Lumbar Stenosis

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Introduction: The diagnosis of degenerative lumbar stenosis (DLSS) in dogs is based on typical clinical signs in combination with advanced imaging. CT provides better resolution of the vertebrae than MRI and the ability to perform 3D reconstructions. In combination with flexed/neutral and extended positioning, CT is useful to determine the extent of canal and foraminal stenosis due to dynamic instability or osteophytosis.

Materials and Methods: The authors are investigating the use of 3D volume rendering to assess canal and foraminal stenosis in dogs with DLSS in comparison to controls and to guide surgical decision making in clinically affected animals (mostly working Police German Shepherd dogs). Post-operatively a CT is performed and 3D reconstruction is used to assess the effect of surgery at eliminating neural impingement.

Results: Typical lesions associated with clinical signs of DLSS include elongation of the lamina of S1 causing dorsal compression, facet remodeling and synovial hypertrophy/cysts, disc prolapse, both dynamic and static L7 neuroforaminal compression and multiple forms of transitional vertebrae. Post-operative 3D CT images have confirmed the efficacy of the dorso-lateral foraminotomy.

Discussion/Conclusion: In our hands CT data and especially 3D imaging is very useful for surgical planning, allowing for a better understanding of each dog's unique anatomy and is key to an accurately performed dorsolateral foraminotomy.

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