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Part I

1 A COMPARISON OF RADIOFREQUENCY PROBE AND SHARP TRANSECTION FOR TENOSCOPIC-GUIDED DESMOTOMY OF THE ACCESSORY LIGAMENT OF THE SUPERFICIAL DIGITAL FLEXOR TENDON

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Introduction: Desmotomy of the accessory ligament of the superficial digital flexor tendon (AL-SDFT) has been performed in horses. Studies critically evaluating the use of radiofrequency probes (RF) for desmotomy in clinical patients have not been reported. We hypothesized AL-SDFT desmotomy using an RF probe would have decreased operative time and hemorrhage with minimal collateral tissue damage compared to sharp transection.

Materials and Methods: Six horses had tenoscopic AL-SDFT desmotomy performed bilaterally. Desmotomy method (RF probe or sharp transection) was randomly assigned in each limb. Intraoperative desmotomy time and subjective hemorrhage scores were recorded. Post-operatively, surgical incisions, swelling and carpal range of motion were subjectively evaluated and graded. H&E and cell viability staining were performed on the AL-SDFT, flexor carpi radialis tendon, radial head of the deep digital flexor tendon and the deep digital flexor tendon. Variables were compared between desmotomy methods with a repeated measures mixed model and significance set at $P < 0.05$.

Results: AL-SDFT desmotomy was complete in all cases. There was significantly less hemorrhage with the RF method (40%) compared to sharp transection (83.3%) ($P = 0.048$). Carpal sheath effusion was greater in the RF group at day 1 ($P = 0.025$), but there was no difference between methods at any later time point. There was no difference between methods in cell viability staining or in any other parameters.

Discussion/Conclusion: AL-SDFT desmotomy with the RF probe was performed with less observed intra-operative hemorrhage. Tenoscopic-guided AL-SDFT desmotomy with the RF probe appears to be a safe alternative to sharp transection with minimal collateral tissue damage.

Disclosure: No proprietary interest or relevant financial relationship.

2 CLASSIFICATION OF ANTEBRACHIAL LIMB DEFORMITIES: A RETROSPECTIVE REVIEW OF 101 LIMBS FROM 2006–2013

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Introduction: Antebrachial angular limb deformities (ALDs) are commonly diagnosed in dogs. Our hypotheses were that 1) antebrachial ALDs would be more complex with respect to multiplicity in chondrodystrophic dogs, and 2) more complex ALDs would exhibit a higher incidence of concurrent joint pathology in either the carpus or elbow.

Materials and Methods: Medical records of dogs presented to the Veterinary Medical Teaching Hospital with the chief complaint of an antebrachial ALD between 2006 and 2013 were reviewed. Inclusion criteria included either complete orthogonal radiographs utilizing the segmental technique or computed tomography of the affected antebrachium. Deformities were classified using the Center of Rotation of Angulation (CORA) methodology. The pres-

ence of radiographic pathology (including osteoarthritis, incongruity, subluxation, or malformation) of either the elbow or carpus was determined. Deformity classification, adjacent joint pathology, age, and being a chondrodystrophic breed were compared by χ^2 tests ($P < 0.05$).

Results: There were 42 affected limbs of chondrodystrophic dogs and 59 affected limbs of nonchondrodystrophic dogs identified. The incidence of biapical, partially compensated deformities appeared higher in chondrodystrophic versus nonchondrodystrophic dogs, but was not statistically significant ($P = 0.096$). When breeds were combined, biapical, partially compensated deformities were associated with a significantly higher incidence of adjacent joint pathology ($P = 0.04$); more frequently resulting in elbow pathology ($P = 0.004$).

Discussion/Conclusion: Antebrachial ALDs in chondrodystrophic breeds do not appear to be statistically more complex with respect to their multiplicity. However, more complex ALDs do exhibit a higher incidence of concurrent joint pathology, specifically the elbow.

Disclosure: No proprietary interest or relevant financial relationship.

3 COMPUTED TOMOGRAPHIC EVALUATION OF CANINE ELBOW CONGRUITY DURING ARTHROSCOPY IN AN EX-VIVO MODEL

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Introduction: Elbow incongruity is thought to contribute to the development of elbow dysplasia. Elbow congruity is commonly evaluated using arthroscopy. The aim of this study was to assess the effects of arthroscope insertion, using a carbon fibre rod (CFR) model, on humero-radial, humero-ulnar, and radio-ulnar congruity, assessed by computed tomography (CT).

Materials and Methods: Seven cadaveric forelimbs, positioned at a flexion angle of $135 \pm 5^\circ$ using a custom jig, were assessed for congruity with CT. A 36 mm fulcrum induced cubital valgus to facilitate arthroscope insertion (group 1). 1.8 and 2.5 mm CFRs were inserted under arthroscopic guidance, directed at the medial coronoid process (groups 2 and 3, respectively). Repeat CT scans were obtained for both groups and sagittal and parasagittal sections were reconstructed to evaluate medial, axial and lateral positions. Measurements were obtained to assess humero-radial congruity, humero-ulnar congruity, and radio-ulnar step. Differences between groups were assessed using repeated measures analysis of variance.

Results: Mean (\pm SD) change in radio-ulnar step between groups 1 and 3 was 0.6 ± 0.3 mm, 0.8 ± 0.6 mm, and 0.5 ± 0.1 mm for axial, medial, and lateral positions, respectively. Insertion of CFRs induced a significant decrease in RU in all planes. Significant widening of the humero-ulnar joint space and narrowing of the cranial humero-radial joint space were also identified.

Discussion/Conclusion: Insertion of CFRs as a model for elbow arthroscopy induces incongruity. Changes in radio-ulnar congruity are small but the effect of arthroscope diameter should be considered when assessing elbow congruity.

Disclosure: No proprietary interest or relevant financial relationship.

4 CROSS-SECTIONAL AREA AND ASYMMETRY OF LUMBAR PARASPINAL MUSCLES FOR DOGS WITH AND WITHOUT DEGENERATIVE LUMBOSACRAL STENOSIS

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Introduction: Chronic low back pain (CLBP) in humans is associated with lumbar paraspinal muscle atrophy, asymmetry, pain and dysfunction that frequently improve with non-surgical management such as paraspinal muscle strengthening. Degenerative lumbosacral stenosis (DLSS) in dogs has similar manifestations of pain and neurological dysfunction to CLBP. The purpose of this study was to investigate the hypothesis that lumbar paraspinal muscle



mass would be lower and asymmetry indices would be higher for dogs with DLSS than those without.

Materials and Methods: Transverse T2-weighted magnetic resonance images were evaluated for nine dogs with and nine dogs without DLSS. Mean cross-sectional area was measured for the lumbar multifidus and longissimus lumborum muscles bilaterally and the L7 vertebral body at the level of the caudal endplate. Asymmetry indices and cross-sectional areas relative to L7 were compared between study populations for both muscle groups using independent T-tests, with statistical significance set at $p < 0.05$.

Results: Mean muscle-to-L7 cross-sectional area ratios were significantly smaller in the DLSS group for both lumbar multifidus ($p = 0.023$) and longissimus lumborum ($p = 0.011$). Mean lumbar multifidus and longissimus lumborum asymmetry indices were, respectively, 66% and 77% higher for the group with DLSS than for the control group, but differences were not statistically significant.

Discussion/Conclusion: This pilot study demonstrated alterations in lumbar paraspinal muscle size and symmetry as a result of lumbosacral stenosis in dogs. Confirmation of these findings may suggest that targeted rehabilitative therapy for paraspinal muscle strengthening may benefit dogs with DLSS that are not candidates for surgery.

Disclosure: No proprietary interest or relevant financial relationship

5 EFFECTS OF LOW-LEVEL LASER THERAPY ON BONE HEALING AND PAIN IN DOGS FOLLOWING TIBIAL PLATEAU LEVELING OSTEOTOMY

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Introduction: Randomized, double-blinded, controlled prospective study to assess the effect of low-level laser therapy (LLLT) on post-operative pain, limb use, bone healing, and markers of inflammation and osteoarthritis following stifle stabilization surgery. We hypothesized that use of LLLT would decrease pain level and improve limb use and bone healing.

Materials and Methods: Twelve client-owned dogs with spontaneous unilateral cranial cruciate rupture were divided into two groups; LLLT and sham (red LED light) treatments. All dogs underwent arthroscopy and tibial plateau leveling osteotomy (TPLO). Patients were assessed via orthopedic examination, accelerometry, goniometry, force plate analysis, a Canine Brief Pain Inventory survey, radiographic analysis, and synoviocentesis. LLLT or sham treatments were begun immediately prior to surgery and continued for four weeks.

Results: Overall, no significant differences were identified between LLLT and sham therapy groups. Molecular analysis of synovial fluid showed an anti-inflammatory trend of the LLLT group. Ground reaction force analysis suggested improved limb use within the sham group.

Discussion/Conclusion: No statistically significant beneficial effect was consistently demonstrated within this study for the use of LLLT in conjunction with TPLO surgery; however, no harmful effects were identified. Further assessment with increased study power and varying duration/frequency of LLLT protocols should be pursued. Acknowledgements: Funding for this study provided by Erchonia Laser Healthcare and the Comparative Orthopedic Research Laboratory at Washington State University

Disclosure: Authors received funding from Erchonia Laser Healthcare.

6 EQUINE SYNOVIAL FLUID TILUDRONATE CONCENTRATIONS FOLLOWING INTRAVENOUS REGIONAL LIMB PERFUSION WITH LOW OR HIGH DOSE TILUDRONATE

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Introduction: Intravenous regional limb perfusion (IVRLP) with tiludronate is a common treatment for distal limb orthopedic disease, but doses and

protocols are anecdotal. IVRLP exposes articular cartilage within the perfused area to tiludronate, raising concerns about safety of this treatment, as high tiludronate concentrations ($\geq 19\text{mg/L}$) are harmful for cartilage in-vitro. This study evaluated synovial fluid tiludronate concentrations following IVRLP to determine safety for articular cartilage.

Materials and Methods: Synovial fluid cytology variables and tiludronate concentrations were evaluated in navicular bursae, coffin and fetlock joints following IVRLP with low dose (0.5mg) or high dose (50mg) tiludronate. The contralateral limb was perfused with saline. Samples were taken 1 week prior and 30 minutes following IVRLP from all structures and 24 hours post-perfusion from coffin and fetlock joints.

Results: Synovial fluid tiludronate concentrations were $>3\text{mg/L}$ and $<10\text{mg/L}$ in limbs perfused with 50mg and $<0.12\text{mg/L}$ in limbs perfused with 0.5mg at tourniquet release. Only limbs perfused with 50mg had tiludronate present in synovial fluid 24 hours post-perfusion. There were no significant differences in synovial fluid cytology variables between samples from limbs treated with saline vs. tiludronate.

Discussion/Conclusion: IVRLP with tiludronate at doses used did not cause greater synovial inflammation than IVRLP with saline. 0.5mg and 50mg of tiludronate given via IVRLP was safe for articular cartilage, and 50mg results in concentrations that may be beneficial for cartilage. Tiludronate concentrations in bone should be measured to determine possible treatment efficacy and safety for bone.

Disclosure: No proprietary interest or relevant financial relationship.

7 IN-VIVO THREE-DIMENSIONAL STIFLE KINEMATICS DURING DAILY ACTIVITIES IN DOGS

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Introduction: Normal stifle motion during daily activities has not been well described in dogs. The purpose of this study was to measure 3D femorotibial kinematics in dogs during a range of activities, using non-invasive single-plane fluoroscopic analysis. We hypothesized that axial rotational alignment would be coupled with flexion angle for all activities and that stifle kinematics would be dependent on the activity of the dog.

Materials and Methods: Single-plane fluoroscopic images of the stifle were acquired in normal Labrador retrievers undergoing treadmill walk, treadmill trot, stair ascent, and sitting activities. CT-derived bone models were used to determine 3D femorotibial kinematics on fluoroscopic images using a 3D to 2D shape-matching technique. Pearson correlations were calculated to assess for any correlations in motion between each degree of freedom. A paired t-test was used to compare axial alignments at identical flexion angles within and between activities.

Results: Three-dimensional femorotibial kinematics varied between all four activities measured. Strong positive correlations were found between flexion and internal rotation for each activity. Significant differences in axial rotational alignment at identical flexion angles were found within the walk and trot gait-cycles and between activities.

Discussion/Conclusion: Three-dimensional femorotibial kinematics in dogs were complex with an envelope of motion detected in three planes. Kinematics were strongly activity dependent, indicating tight active control of kinematics. This data should be useful as a normal-stifle kinematics baseline, for comparison in future studies and may be used as an outcome-measure standard for stabilizing procedures of the stifle.

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Disclosure: No proprietary interest or relevant financial relationship.



8 CORTICOSTEROIDS SUPPRESS BMP AND TGF-BETA LIGAND EXPRESSION IN ARTICULAR CHONDROCYTES

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Introduction: Corticosteroids (CS) are commonly used to treat arthritis in performance horses. CSs have potent anti-inflammatory effects; however, they have several deleterious side-effects, including suppression of matrix-biosynthesis by chondrocytes. TGF- β and BMP activities are critical for articular cartilage homeostasis. We hypothesized that corticosteroid suppression of articular chondrocyte matrix synthesis is mediated by down-regulation of TGF- β and/or BMP expression.

Materials and Methods: Equine articular chondrocytes were cultured as aggregates in serum-free medium under non-adherent conditions. Triamcinolone acetate (TA) or methylprednisolone acetate (MPA) was administered at 10–10M, 10–7M, and 10–5M for 72 hours. Effects of CSs on BMP and TGF- β ligand expression were assessed by qPCR. Effects of exogenous BMP-2 and TGF- β 1 co-administration on collagen type II (Coll II) and aggrecan/sGAG production were assessed by qPCR, ELISA and DMMB assays.

Results: BMP-2 and -7 mRNAs were significantly down-regulated by both CSs. BMPs-4 and 6 were not affected. TGF- β 1 was also significantly suppressed by both CSs. Exogenous BMP-2 significantly increased Coll II and aggrecan mRNAs in the presence of MPA, but did not significantly affect collagen protein secretion or sGAG levels. TGF- β 1 had no effect.

Discussion/Conclusion: Both CSs down-regulated BMP-2, BMP-7 and TGF- β 1 mRNA expression in articular chondrocytes. These effects were gene-specific, since other ligands were unaffected. BMP-2 (at the dose tested) did not prevent CS-mediated suppression of collagen or proteoglycan synthesis, while TGF- β 1 had no effect on mRNA or protein expression. Other BMP/TGF- β signaling factors might also be impacted by CSs, or other metabolic pathways required for matrix processing could also be targeted by CSs.

Disclosure: No proprietary interest or relevant financial relationship.

9 EFFECTS OF BISPHOSPHONATES ON EQUINE MESENCHYMAL STEM CELL OSTEOGENESIS

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Introduction: In horses, bisphosphonates (BP) are increasingly used to treat skeletal conditions where bone resorption contributes to signs of lameness. BPs exert their effect by targeting osteoclasts; however, peri-/endosteal osteoprogenitor (OPC) populations are also located on bone surfaces and are likely exposed to BPs. This study addressed the hypothesis that BP will inhibit OPC aggregation and subsequent osteogenesis.

Materials and Methods: Bone marrow OCPs were expanded through two passages. A 'scratch test' assay was used to determine the effect of the amino-BP Zoledronate (ZOL) on OPC motility. OPCs were transferred to osteogenic medium +/- ZOL for up to 10 days. OPC aggregation was monitored by direct counting. OPC phenotype was assessed by staining for mineralized matrix (Alizarin red), calcium measurements, alkaline phosphatase (ALP) activity and QPCR of osteogenic genes.

Results: ZOL significantly inhibited OPC motility at all doses tested. OPCs in osteogenic medium formed multicellular nodules that stained intensely with Alizarin Red by day 7. ZOL dose-dependently reduced aggregation and staining. By day 10, deposited calcium in osteogenic cultures was ten-fold above controls. ZOL had no effect on calcium measurements. ALP activity was increased significantly in osteogenic cultures. ZOL suppressed ALP at Day 3, but not at later times. ZOL did not significantly affect Runx2 or ALP expression.

Discussion/Conclusion: BP administration potently inhibited OPC motility and aggregation but did not affect matrix mineralization or other indicators of osteogenesis. Clinically, if OPC migration to sites of skeletal injury is

necessary for efficient repair, prior BP administration could negatively impact this process.

Disclosure: No proprietary interest or relevant financial relationship.

10 MAGNETIC RESONANCE IMAGING (MRI) SCORING OF AN EXPERIMENTAL MODEL OF OSTEOARTHRITIS (OA) IN THE EQUINE CARPUS

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Introduction: MRI allows three-dimensional imaging of all joint components, and has been shown to reliably depict the progression of osteoarthritis in humans. The objective of this study was to compare the severity and progression of pathological changes in experimental carpal OA using MRI. The hypothesis of this study was MRI scores of experimental (OA) joints would be greater than control joints.

Materials and Methods: An osteochondral fragment was created in one middle carpal joint (Day 0) in ten adult, treadmill-conditioned horses free of lameness, and the contralateral limb was sham-operated and served as control. Horses resumed exercise on a high-speed treadmill on Day 14 until the completion of the study (Day 70). MRI examinations performed on Days 0, 14, and 70 were scored using a semi-quantitative whole-organ scoring system and compared using the non-parametric Wilcoxon sign rank test.

Results: On Day 0, no differences were seen between OA and control carpi. On Day 14, there were significant increases in distribution and intensity of bone marrow signal, OCF number and size, synovial effusion, and total score in the OA carpi. Osteophyte/enthesophyte, cartilage abnormality, and subchondral bone irregularity scores were all significantly increased on Day 70 compared to Day 14 in OA carpi. Bone marrow signal intensity and distribution, and OCF number and size scores were significantly decreased on Day 70 when compared to Day 14 in OA carpi.

Discussion/Conclusion: MRI predicted pathological progression seen in an OCF model of OA in the equine carpus.

Disclosure: No proprietary interest or relevant financial relationship.

11 PROXIMAL SESAMOID BONE FRACTURE IS ASSOCIATED WITH FOCAL SUBCHONDRAL BONE RESORPTION IN RACEHORSES

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Introduction: Catastrophic fetlock injuries cause most racehorse deaths, with proximal sesamoid bone (PSB) fracture being the most common. PSBs articulate with the palmar aspect of the metacarpal condyle. Condylar fractures have been associated with focal remodeling and necrosis of palmar subchondral bone. We hypothesized that a similar lesion predisposes to PSB fracture.

Materials and Methods: Bilateral forelimb medial PSBs from 18 Thoroughbred racehorses: 9 with unilateral PSB fracture (5 female, 4 male; 3–4 years) and 9 without PSB fracture (6 female, 3 male; 2–4 years) were studied. PSBs were imaged (37 mm voxel resolution) using a iCT specimen scanner. Bone volume fraction, apparent mineral density, tissue mineral density, and trabecular number and thickness were quantified in a subchondral region of interest. ANOVA was used to determine statistical differences between fractured and non-fractured PSBs at $p < 0.05$.

Results: Bone volume fraction and tissue mineral density were 10–13% and 3–5% lower for fractured bones, and trabecular number was 41–48% greater while trabecular thickness was 45–48% lower, compared to intact contralateral and control bones.

Discussion/Conclusion: A focal region of higher porosity and lower bone mineral density is consistent with changes that predispose PSBs to frac-



ture. Contralateral PSBs had less severe changes. Methods for clinical detection will be useful for injury prevention.

Disclosure: The study was funded by the California Horse Racing Board Racing Safety Program.

12 RESPONSE TO STERNEBRAL BONE MARROW ASPIRATION IN EQUINE PATIENTS – CLINICAL

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Introduction: The response to bone marrow (BM) aspiration in the horse is poorly defined. Our objective was to characterize the response of equine clinical patients to BM aspiration. We hypothesized that there would be minimal horse response to BM aspiration.

Materials and Methods: Twenty equine patients undergoing BM aspiration were included. Horses were placed in stocks and sedated with 0.4 mg/kg xylazine IV, which was time zero. Thereafter, local anesthesia was applied to the skin, SC, and periosteum and BM was collected from 2 sternbral sites. Horses were not restrained by a handler. Head height, sedation scores, and movement (y/n) for head, limbs, and back were recorded until 10 minutes after completion of BM collection. Head height was normalized to the head height during aseptic preparation to minimize variability due to patient size. Differences in movement of the head, limbs, or back (y/n) were tested with McNemar's chi-squared test.

Results: Bone marrow collection was successful in all horses. During site preparation and injection of local anesthetic solution, 2/20 horses needed additional sedation and a lip twitch, and 2/20 horses needed application of a lip twitch. Significantly more horses arched their back during BM aspiration compared to injection of local anesthetic. Significantly more horses moved their limbs during injection of local anesthetic compared to BM aspiration. There was no difference in the number of horses that moved their head or neck during local anesthetic injection compared to BM aspiration.

Discussion/Conclusion: Although horses arch their back in response to BM aspiration, there was minimal horse reaction to BM aspiration from the sternum.

Disclosure: No proprietary interest or relevant financial relationship.

13 THE COMBINED USE OF ARTHROSCOPY AND ULTRASONOGRAPHY FOR IDENTIFICATION OF PATHOLOGIC CHANGES IN THE EQUINE MEDIAL FEMORAL TIBIAL JOINT

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Introduction: Stifle disease is a common source of lameness in horses. Previous work has demonstrated modality-specific limitations in the visualizations of certain portions and structures of the stifle with both arthroscopy and ultrasound. We hypothesize that ultrasound will better detect lesions within the body of the meniscus, whereas arthroscopy will better detect damage to the articular cartilage and subtle injuries including fraying of the cranial meniscal ligament.

Materials and Methods: Retrospective evaluation and subjective grading of ultrasound still images and arthroscopy images of 54 stifles was performed. Structures evaluated included the medial meniscus, cranial meniscal ligament, medial femoral and tibial condyles and medial collateral ligaments.

Results: Significantly more lesions of the medial meniscus were detected using ultrasound than arthroscopy ($p \leq 0.02$). Arthroscopy identified significantly more cartilage lesions that occurred in the absence of subchondral bone injury than ultrasound ($p < 0.001$). Arthroscopy also detected more injuries to the cranial medial meniscal ligament, whereas ultrasound identified more pathologic change of the bone at the insertion of the cranial medial meniscal ligament.

Discussion/Conclusion: Each modality has individual strengths and weaknesses in the evaluation of pathologic changes in the equine stifle. A combined use of these modalities increases the likelihood of lesion detection, which will provide the most complete information for prognosis and treatment.

Disclosure: No proprietary interest or relevant financial relationship.

14 THE INFLUENCE OF SIMULATED SHIPPING ON VIABILITY AND GROWTH FACTOR GENE EXPRESSION OF BONE MARROW-DERIVED AND UMBILICAL-DERIVED MESENCHYMAL STEM CELLS

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Introduction: Little is known about how mesenchymal stem cells (MSCs) are affected by a transport process. The aim of the current study is to determine the effect of shipment from the processing facility to the patient, on the viability and growth factor expression of equine bone marrow-derived (BM) MSCs and umbilical-(Wharton Jelly) derived (UC) MSCs.

Materials and Methods: Three BM-MSC and UC-MSC lines recovered from cryopreservation were grown to 70% confluence prior to resuspension in equine donor serum. After 24 hours of simulated shipping (2–5°C), cell viability and apoptosis were analyzed using 7-AAD exclusion and Annexin V staining. Expression of genes encoding growth factors and matrix molecules were measured including Ang-1, Fgf-2, Hgf, Igf-1, Tgf- β 1, Vegf, Pdgf-a, Col-1 and Col-3.

Results: After simulated shipping, viability exceeded 97% in all BM-MSCs and UC-MSCs. However, BM-MSCs had a significant ($p < 0.05$) decrease in expression of Ang-1 (-4.24 fold, $p = 0.040$), FGF-2 (-7.13 fold, $p = 0.006$), IGF-1 (-7.16 fold, $p = 0.006$), and PDGF-a (-3.75 fold, $p = 0.0329$), and increase in TGF- β 1 (+4.04 fold, $p = 0.002$). Although the trends in fold changes (pos/neg) were identical for the same growth factors analyzed for UC-MSCs after shipping, none of these reached statistical significance.

Discussion/Conclusion: The study reveals that although shipping does not produce a substantial loss of viability, shipping as performed in this study appears to significantly impact gene expression of BM-MSCs. UC-MSCs may be more refractory to shipping effects at the transcriptional level. Shipping practices that reduce impact or even improve paracrine secretion warrant further investigation.

Disclosure: No proprietary interest or relevant financial relationship.

15 A RETROSPECTIVE COMPARISON OF TRAUMA TO DOGS DUE TO DIRECT MOTOR VEHICLE ACCIDENT VS EJECTION OR FALLING OUT OF AN OPEN PICK-UP TRUCK BED IN THE PACIFIC NORTHWEST

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Introduction: The purpose of the present study is to document the incidence and extent of injuries incurred by patients that are traumatized by non-restrained (pick-up truck) related accidents (PUA) compared to cases traumatized by direct impact by a motor vehicle (DVAs) in the Pacific Northwest.

Materials and Methods: The medical records of all dogs previously sustaining injuries due to PUA and due to DVA over a period of 7 years were reviewed from patient accessions at the Veterinary Teaching Hospital at Washington State University. Data collected included signalment, injuries sustained, length of hospitalization, and cost for treatment. An owner's survey was also used to evaluate the perceived impacts on theirs and their pet's quality of life. For data analysis significance was set at $P < 0.05$ for all statistical testing.



Results: 19% of the medical records were identified for the PUA-trauma group while 81% of the records were identified for the DVA-trauma group. The frequency of orthopedic injuries in PUA group was significantly higher than the DVA group. Owners of PUA-injured dogs encountered greater hardships in managing their pets' post-hospitalization care than those owners with DVA injured dogs.

Discussion/Conclusion: PUA-related traumas result in more serious orthopedic injuries than compared to DVA-related traumas. Severe soft tissue injuries were more common with DVA-related trauma. PUA patients had significantly longer recovery periods and more challenging at home post-trauma management care than compared to DVA-injured patients. Proactive public-based strategies to reduce the incidence of PUA-related trauma seen in the Pacific Northwest are warranted.

Disclosure: No proprietary or personal financial gain was obtained from this study. Funding for this study was provided by the Comparative Orthopedic Research Laboratory at Washington State University.

16 ADIPOSE-DERIVED STROMAL CELLS ON DEMINERALIZED BONE MATRIX PERSIST IN CRITICAL SIZED DEFECTS AND IMPROVE BONE FORMATION OVER STROMAL CELLS OR DBM ALONE

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Introduction: The management of critical-sized segmental bone defects caused by trauma or tumor resection continues to be a major clinical challenge. The objective of this study was to quantify and compare new bone formation in critical-sized athymic rat femur bone defects following implantation of adipose-derived stromal cells seeded on demineralized bone matrix (ADSC/DBM), ADSCs alone, DBM alone or no implant. As a secondary objective, we endeavored to determine if GFP-labeled MSCs from ADSC/DBM combination could be detected within the defect for up to 84 days following implantation.

Materials and Methods: Athymic rats had a 5mm defect created in the right femur stabilized with a bone plate. Four treatment groups were: ADSCs seeded on DBM, ADSCs alone, DBM and no treatment. Femurs were radiographed at 0, 21 and 42 days. Rats were sacrificed at 42 days and femurs were harvested for μ CT and histology. Thirty-six rats had identical femur defects created and adipose-derived MSCs from transgenic universally-expressing GFP rats seeded on human DBM (gfpADSC/DBM) were placed in the defect. In-vivo fluorescent imaging (IVIS Xenogen 100) was performed at 0, 3, 7, 14, 21, 56 and 84 days and 8 rats were sacrificed at each imaging time point. Tissues within the femur defect were examined for GFP-expressing cells. Semi-quantitative analysis of GFP-expressing cells in 5 standardized ROIs was performed at each time point.

Results: Quantitative radiographic and μ CT analysis showed that femur defects treated with ADSCs on DBM had the greatest amount of new bone formation at 42 days post-implantation compared with the other treatment groups. Femur defects treated with ADSCs alone showed little to no new bone formation. Histologic evaluation indicated that bone maturation was greatest in defects treated with ADSC/DBM. gfpADSCs persisted within the femur defect for up to 84 days following implantation. Bridging union was noted in ADSC/DBM defects but not in defects treated with ADSCs or DBM alone.

Discussion/Conclusion: New bone formation was greatest in bone defects implanted with ADSC/DBM when compared with DBM alone, ADSC alone, and no treatment. gfpADSCs were evident in the defect throughout the in life period of study up to 84 days post-implantation.

Disclosure: The first author received funding from BioD Inc and Allosource Inc.

17 AGE-RELATED DEGRADATIVE OXIDATION OF ULTRA-HIGH MOLECULAR WEIGHT POLYETHYLENE ACETABULAR INSERTS: IMPLANT FAILURE IN 3 CLINICAL CASES

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A primary clinical concern with UHMWPE is degradative oxidation that occurs when UHMWPE is exposed to gamma radiation in the presence of air. The post-irradiation oxidation that occurs with shelf aging is autocatalytic in the presence of oxygen and leads to a decrease in wear resistance and altered mechanical properties of UHMWPE. Oxidative degradation of UHMWPE leads to increased wear debris and increased incidence of aseptic loosening. We describe three clinical cases in which oxidative degradation resulting from prolonged pre-implantation shelf life resulted in excessive poly wear and failure of the acetabular components. The median time from implantation to revision was 24.6 months (range 7 to 48 months). Acetabular revision was performed in all cases. Differential scanning calorimetric analysis of explants and age-paired controls identified increased oxidation in the aged (expired) explants. Components containing UHMWPE must not be implanted after the expiration date irrespective of sterility. Veterinary surgeons must be conscious of the manufacture recommendations regarding shelf life for products containing UHMWPE.

Disclosure: The first author is a private consultant for Securos.

18 ASSESSMENT OF DIFFERENT IMPLANTS FOR LATERAL PLATING IN FELINE ILIAL FRACTURES AND THE IMPACT ON PELVIC CANAL NARROWING AND ITS CLINICAL RELEVANCE

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Introduction: Lateral plating is commonly used for ilial fractures in cats and has been associated with an increased implant loosening as well as with pelvic canal narrowing. The purpose of this retrospective study was to assess if pelvic canal narrowing and clinical outcome are influenced by the type of implant.

Materials and Methods: Radiographs and medical records of cats with pelvic fractures between 2004 and 2013 were reviewed. Depending on the implant, the fractures were assigned to one of two groups (Dynamic Compression Pate (DCP) and Locking Plate System (LPS). The sacral index (SI) was measured and the quotient between measurement at time of surgery and six weeks later was used as an indicator for pelvic canal narrowing. A multiple regression approach was performed to assess if pelvic canal narrowing is associated with the implant system chosen.

Results: In total 34 cases were included in the study (n=10 DCP and n=24 LPS). In the DCP group 5/10 implants showed screw loosening and 1/24 in LPS group. The mean (95 % CI) of the SI quotient were -0.114 (-0.507; 0.081) for DCP and -0.0012 (-0.199;0.158) for LPS. Pelvic canal narrowing was significantly decreased with LPS compared to DCP (p=0.02). Neither radiologic signs of constipation nor owner reported problems with defecation were present.

Discussion/Conclusion: Implant loosening and pelvic canal narrowing were reduced in the LPS group compared to the DCP group. Pelvic canal narrowing was not associated with clinical symptoms but clinical follow up was not long enough to exclude this.

Disclosure: No proprietary interest or relevant financial relationship.



19 ASSOCIATION OF RADIOGRAPHIC ANATOMIC PARAMETERS OF THE CANINE STIFLE IN THE SAGITTAL PLANE AND CRANIAL CRUCIATE LIGAMENT INJURY

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Introduction: Speculation exists regarding whether certain anatomic risk factors may contribute to cranial cruciate ligament rupture (CrCL) in dogs. The hypothesis of this study was that tibial plateaus of canine stifles with CrCL injuries would be shorter and more convex than those without injuries. **Materials and Methods:** Records and sagittal plane radiographs were retrieved for Labrador retrievers with atraumatic CrCL injuries: CrCL injury group. Sagittal radiographs from non-CrCL injured, age and gender-matched Labrador retrievers were retrieved: CrCL normal group. The following parameters were measured: lateral tibial plateau radius of curvature (TPr-L), lateral femoral condyle radius of curvature (Fr-L), medial femoral condyle radius of curvature (Fr-M), lateral femoral condylar cranio-caudal articular length (FCrCd-L), medial femoral condylar cranio-caudal articular length (FCrCd-M), lateral tibial plateau cranio-caudal length (TPCrCd-L), medial tibial plateau cranio-caudal length (TPCrCd-M). Intraclass correlation coefficients were calculated for each and a Student t-test was used to determine the difference between cohorts (significance = $p < 0.05$).

Results: Twenty dogs were examined in each group. The TPr-L of CrCL normal dogs was greater than that of CrCL injured dogs ($p = 0.02$). The Fr-L: TPr-L ratio was significantly different between groups ($p = 0.001$) indicating dogs with CrCL injuries had a more convex lateral tibial plateau.

Discussion/Conclusion: These results indicate that Labrador retrievers with CrCL injuries may have a more convex tibial plateau, thus resulting in a less stable joint configuration in the sagittal plane.

Disclosure: No proprietary interest or relevant financial relationship.

20 CLOSED REDUCTION AND FLUOROSCOPIC ASSISTED PERCUTANEOUS PINNING OF PHYSEAL FRACTURES IN 27 DOGS AND 4 CATS

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Introduction: Fluoroscopic assisted percutaneous pinning (FAPP) has been described for physal fracture repair. We are unaware of veterinary studies evaluating outcome following FAPP of physal fractures. Alternatives to traditional physal fracture repair, such as FAPP, should be considered in attempt to minimize physal damage, limit iatrogenic trauma, accelerate patient recovery, and improve clinical outcomes. Our objectives were to report complications and clinical outcome of animals that underwent FAPP of physal fractures. We hypothesized FAPP is a safe and effective for physal fracture repair.

Materials and Methods: Records of physal fractures treated with FAPP in three hospitals were identified retrospectively. Pre and post-operative radiographs, complete surgical report, and at least 3-week follow-up were required for inclusion.

Results: Twenty-seven dogs and four cats were included. Weights (1.7–27 kg [mean, 10; median, 9.5]), ages (3–18 months [mean, 7.2; median, 7]), time from trauma to surgery (0–8 days [mean, 2.4; median, 2]), fracture location (proximal tibia [13], distal femur [7], distal tibia [5], proximal humerus [3], distal radius [2], and proximal femur [1]), fracture displacement (minimal [15], moderate [13], severe [2]), surgery time (4–119 min [mean, 42; median, 25]), radiographic union (3–12 weeks [mean, 4.7; median, 4]), complications (minor [2], major [12]), final recheck (2–109 weeks [mean, 16.8; median, 5.5]), and functional outcome (full [24], acceptable[3]) were reported.

Discussion/Conclusion: FAPP of acute physal fractures is associated with good clinical outcomes and complications of mild severity. Future studies comparing FAPP to open techniques are warranted.

Disclosure: No proprietary interest or relevant financial relationship.

21 COMBINED TIBIAL PLATEAU LEVELING OSTEOTOMY AND TIBIAL TUBEROSITY TRANSPOSITION FOR TREATMENT OF CRANIAL CRUCIATE LIGAMENT RUPTURE AND MEDIAL PATELLAR LUXATION

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Introduction: Concomitant treatment of cranial cruciate ligament (CrCL) rupture and medial patellar luxation (MPL) has been described with tibial plateau leveling osteotomy (TPLO) combined with a transverse metaphyseal tibial osteotomy. This technique avoids isolating the tibial tuberosity; however, it is technically demanding and requires supplemental rigid fixation. We investigated a combination TPLO with a tibial tuberosity transposition in the frontal plane (TPLO-TTT). Our objective was to describe the combined TPLO-TTT technique and report the short-term outcome.

Materials and Methods: Medical records were reviewed in all dogs with the TPLO-TTT procedure. Fixation method, radiographic healing score, time to healing, and clinical union were recorded. Surgery consisted of a standard TPLO followed by a TTT in the frontal plane with defined osteotomy landmarks stabilized with 1–2 pins and tension band wire fixation.

Results: Eleven dogs with 15 operated stifles were identified. Of the 13 cases available for in-hospital follow-up, 13/13 achieved clinical union, 3/13 and 10/13 had radiographic healing scores of III/IV and IV/IV, respectively. Mean time to healing was 10.6 (+/-2.9) weeks. All patients showed improved weight bearing (mild or no lameness). No major or catastrophic postoperative complications occurred. Patellar re-luxation was not identified in any patients upon follow-up examination. Other postoperative radiographic findings included progression of osteoarthritis or degenerative joint disease (23.1%); patellar tendon thickening (53.3%), and stifle joint effusion (66.7%); these were considered as minor complications.

Discussion/Conclusion: Short-term outcome of combined TPLO-TTT for the treatment of CrCL rupture and MPL was excellent, with consistent healing and few complications.

Disclosure: No proprietary interest or relevant financial relationship.

22 COMPARISON OF COMPUTED TOMOGRAPHY TO CONVENTIONAL RADIOGRAPHY FOR SCREENING OF ELBOW DYSPLASIA IN DOGS

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Introduction: Screening for elbow dysplasia is typically performed in young dogs using conventional radiographs. However, computed tomography has demonstrated higher diagnostic accuracy in clinically affected individuals. This study compares CT to conventional radiography as a screening tool.

Materials and Methods: Ninety-six young, clinically sound Golden or Labrador retrievers were screened for elbow dysplasia utilizing both CT and a flexed mediolateral radiograph. Images were evaluated by 2 blinded board certified radiologists. Kappa coefficients were utilized to evaluate both the agreement between modalities and the inter-observer error.

Results: Radiologist 1 identified abnormalities in 20 and 15 elbows in CT and radiographic images respectively. Radiologist 2 identified abnormalities in 34 and 3 elbows in CT and radiographic images respectively. Inter-observer agreement for CT images (kappa = 0.41) was higher than for flexed mediolateral radiographs (kappa = 0.2). Agreement between the results of radiographic and CT screening was low (kappa 0.09 to -0.03).



Discussion/Conclusion: Only slight agreement was noted between the results of the two imaging modalities. Computed tomography has a higher inter-observer agreement. Normal anatomic variation of the anconeal process on a flexed mediolateral radiograph can be falsely interpreted as osteophytosis. Conversely summation of structures on plain films can make identification of abnormalities difficult. However, it is possible that the specificity of CT screening is poor. Further research is required to identify the superior technique. Exploration of alternative imaging techniques is particular pertinent as advanced imaging becomes more commonplace. Improved screening may result in more rapid genetic improvement and lower patient morbidity.

Disclosure: Funding was received from the Association for Veterinary Orthopedic Research and Education.

23 COMPUTED TOMOGRAPHIC ASSESSMENT OF PROXIMAL FEMORAL MORPHOLOGY IN DOGS

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Introduction: Proximal femoral morphology is important for implant stability. Various morphologies have been proposed including stovepipe (SP) and normal (C) based upon a cylindrical or more conical shape, respectively. We hypothesized that SP femora would have a larger medullary volume, thinner cortical bone, and less dense cancellous bone than C dogs.

Materials and Methods: Dogs undergoing total hip replacement (THR) were CT scanned to create three-dimensional models of the femora using computer software. Calculations of bone volume of cortical and cancellous bone within the proximal femur were made. Statistical analysis was performed using $p < 0.05$ as significant.

Results: Six dogs with 3 SP and 3 C were used. The mean cortical volume, cortical bone surface area, surface area to volume ratio of cortical bone, the calculated cortical bone volume, and the medullary surface area were similar between groups. The medullary volume, medullary calculated volume, and surface area to volume ratio of the medullary canal were all statistically significantly different between groups.

Discussion/Conclusion: These results supported the hypotheses that the medullary canal would be larger in the SP group and that there is less trabecular bone present in the SP group, but did not support the hypothesis that there was thinner cortical bone in SP femora. This is the first study to assess three-dimensional proximal femoral morphology in dogs with clinical hip dysplasia undergoing THR as well as the first that assesses medullary features that may affect initial press fit of THR implants

Disclosure: An institutional canine grant was received by the primary author.

24 DYNAMIC ALTERATION OF THE LUMBOSACRAL LATERAL INTERVERTEBRAL CANAL AND ITS POTENTIAL CLINICAL RELEVANCE, AS DETERMINED BY CT VOLUME ANALYSIS

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Introduction: Degeneration of the L7/S1 disk in large breed dogs can lead to stenosis of the vertebral canal and/or lateral intervertebral neurovascular canal (L7 foramen). The aim of this study was to investigate the effect of dynamic positioning on the CT volume of the L7 foramen in German Shepherds (GSDs), a breed susceptible to degenerative lumbosacral stenosis (DLSS).

Materials and Methods: 3D CT was used to measure the L7 foraminal volume in 31 dogs. The dogs were positioned in dorsal recumbency with the lumbosacral joint positioned in extension, neutral and flexion according to a standardized protocol. The region of interest excluded bone and annulus fibrosis. Foraminal volumes were compared between unaffected GSDs ($n=10$) and those affected by DLSS ($n=12$) and between GSDs and Greyhound con-

trols ($n=9$). The data was analysed using a Linear mixed-effects model using REML.

Results: Mean foraminal volume in flexion was 584, 614 and 573 mm^3 for affected GSDs, unaffected GSDs and control GHs respectively. Mean foraminal volume in neutral positioning was 132, 174 and 190 mm^3 for affected GSDs, unaffected GSDs and control GHs respectively. Mean foraminal volume in extension was 87, 123 and 145 mm^3 for affected GSDs, unaffected GSDs and control GHs respectively. There was a significant difference between affected and unaffected GSDs ($p=0.04$) and between affected GSDs and greyhounds ($p < 0.01$).

Discussion/Conclusion: Positioning in extension significantly decreases the volume of the L7 foramen. The changes noted with CT imaging under sedation likely mirror the real effect of activity.

Disclosure: No proprietary interest.

25 EVALUATION OF FEMORAL IMAGING ARTIFACTS ASSOCIATED WITH DORSAL RECUMBENCY CRANIOCAUDAL RADIOGRAPHIC POSITIONING AND DESCRIPTION OF A MODIFIED BISECTING ANGLE TECHNIQUE

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Introduction: Craniocaudal (CrCd) radiographic projections are commonly used to evaluate the femur. However, positioning parallel to the cassette is not always possible. It is hypothesized that beyond a certain angle of femoral tilt, significant femoral foreshortening will be appreciated. It is expected that adjustment of the angle of the anode could alleviate the foreshortening artifact.

Materials and Methods: Five pairs of femurs were positioned on an X-ray table. The femurs were tilted from 0 to 50 degrees and the anode of the X-ray machine was tilted from 0 and 40 degrees. Femoral width and length was measured on subsequent images. A geometric model to replicate sagittal femoral positioning was described using trigonometric formulas. The model was compared to the cadaver results and a simplified linear formula to identify the ideal anode angle to alleviate foreshortening.

Results: Femoral tilt of 20 degrees or greater resulted in significant ($P < 0.001$) foreshortening. Femoral width was significantly decreased at higher femoral tilt angles, although less consistently and by a smaller magnitude. Increased anode angle resulted in greater apparent length. The geometric model agreed closely with the cadaver results ($R^2=0.999$) and also to the simplified linear formula. Both the geometry based formula and simplified linear formulas were used to predict the ideal anode angle for use in a modified bisecting angle technique.

Discussion/Conclusion: Femoral tilt of 20 degrees or greater results in image distortion and may warrant alternate radiographic techniques. If the femur is tilted, adjusting the anode angle can alleviate femoral foreshortening.

Disclosure: No proprietary interest or relevant financial relationship.

26 FLUOROSCOPIC ASSISTED LATERAL VERTEBRAL BODY PLATING IN UNSTABLE THORACOLUMBAR SPINAL FRACTURES IN DOGS

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Introduction: Unstable spine fractures require surgical stabilization to optimize outcome. We used a fluoroscopically assisted lateral plating technique for stabilizing thoracolumbar spine fractures.

Materials and Methods: Dogs with unstable traumatic spinal fractures were included. Reduction was fluoroscopically guided and maintained with a string of pearls (SOP) bone plate applied to the lateral vertebral bodies' surface.

Results: Three dogs (5.0, 17.7 and 23.3 kg) with fractures (at T11, L2, and T12, respectively) were stabilized with a (2.0, 2.7 and 3.5, respectively) SOP.



Complete functional recovery was documented in two cases and one dog had a mild residual ataxia.

Discussion/Conclusion: The approach allowed for restoration of spinal alignment, stabilization of the spinal column and decompression of the spinal cord in three dogs of various sizes with thoracolumbar spine fractures. Fluoroscopy was valuable in guiding the surgical procedure including safe implant insertion. Lateral plating of the vertebral bodies optimizes screw insertion.

Disclosure: No proprietary interest or relevant financial relationship.

27 GLYCOSAMINOGLYCAN FORMULATIONS CONTAINING HYALURONIC ACID INCREASE PROLIFERATION AND STEM CELL MARKER EXPRESSION IN ADIPOSE DERIVED STEM CELLS

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Introduction: Glycosaminoglycans (GAG) regulate cellular responses involved in proliferation, migration, and key cellular events during differentiation. GAG activity requires binding to cell surface receptors that initiate signaling cascades to regulate cellular behavior. Effects of GAG formulations on characteristics of adipose derived mesenchymal stem cells (Ad-MSC) *in vitro* were investigated.

Materials and Methods: Adipose derived stromal vascular cells were obtained from canine adipose tissue and human lipoaspirate samples. Primary cell preparations were obtained using a point-of-care tissue processing system. Ad-MSC were obtained by culture of primary cells. Commercially available GAG formulations, a proprietary hyaluronic acid (HA) formulation, and individual GAGs were tested. Assays for cell proliferation, colony forming units (CFU), gene expression analyses, cell surface markers, and chondrogenic and osteogenic differentiation were performed.

Results: Ad-MSC fractions exposed *in vitro* to low concentrations of Polyglycan, HA, or combinations of GAGs containing hyaluronic acid increased cell proliferation and colony forming potential ($P < 0.05$), and enriched the proportion of cultured cells expressing key regenerative cell markers. These formulations significantly increased Sox2 levels, ($P < 0.05$), and appeared to influence cellular pathways key to regulate stem cell proliferation. Effects were markedly dose dependent. These GAGs *in vitro* promoted proliferation and self-renewal, even in the presence of differentiation cues in the culture media. Effects were reversible with efficient differentiation observed in the absence of GAG formulations.

Discussion/Conclusion: The combinatorial use of Ad-MSCs with an optimized GAG carrier formulation may yield enhanced clinical benefit.

Disclosure: The first author is a private consult with ArthroDynamic Technologies, INC.

28 HIGH ENERGY FOCUSED SHOCK WAVE THERAPY ACCELERATES BONE HEALING: A BLINDED, PROSPECTIVE, RANDOMIZED CLINICAL TRIAL

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Introduction: High energy focused shock wave therapy (SWT) has been suggested to accelerate bone healing in dogs and people. Tibial plateau leveling osteotomy (TPLO) makes an ideal and clinically relevant model for evaluation of SWT on bone healing rates. We hypothesized that SWT accelerates bone healing in clinical canine patients undergoing TPLO.

Materials and Methods: This randomized, blinded, prospective clinical study evaluated bone healing in client-owned, healthy dogs undergoing TPLO. Dogs were randomly assigned to the treatment (SWT) or sham (SHAM) group. SWT treatments were performed with an electro-hydraulic shock wave device (VersaTron 4Paws; PulseVet Technologies, Alpharetta, GA) immediately post-operatively and at suture removal (total of 1000

shocks at 0.365 mJ/mm^2). Orthogonal radiographs were performed at 0, 4, 6, 8, and 10 weeks post-operatively. Radiographs were evaluated by a board-certified radiologist with a 10-scale score. A treatment score of ≥ 9 was considered as healed.

Results: 12 dogs (13 stifles) of various breeds (mean weight $32.3 \pm 5 \text{ kg}$; mean age $5 \pm 1.7 \text{ years}$) were included. No major complications were observed. SWT dogs showed significantly higher healing scores than SHAM dogs at week 4 ($p = 0.0014$). At week 6 and 8, the difference in healing scores approached, but did not reach statistical significance ($p = 0.08$ and 0.06 respectively). At week 8, all SWT dogs (6/6) were healed compared to 3/7 SHAM dogs ($p = 0.07$).

Discussion/Conclusion: Electro-hydraulic SWT accelerated early bone healing. The lack of statistical significance at other time points is likely due to the small sample size and the rapid healing observed in both groups.

Disclosure: The first author is a consultant and received funding from PulseVet Technologies.

29 IN-VIVO KINEMATICS OF THE CANINE CRANIAL CRUCIATE LIGAMENT DEFICIENT FEMOROTIBIAL JOINT DURING WALKING

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Introduction: Cranial cruciate ligament rupture produces abnormal femorotibial joint kinematics. The purpose of the study was to accurately and non-invasively define the kinematics of the CrCL deficient canine stifle and compare to experimental studies. We hypothesized that cranial tibial subluxation and increased internal rotation would occur during the stance phase of walking.

Materials and Methods: Affected dogs had unilateral naturally occurring complete CrCL rupture of less than 6-months duration. A control group consisted of 5 normal dogs. Three-dimensional bone models of the femur and tibia were superimposed over 2-dimensional lateral fluoroscopic images during treadmill walking. Flexion angle, cranial-caudal tibial translation, and axial tibial rotation were compared at mid-stance and mid-swing within and between dog groups. T-test, one-sample signed rank test, or Mann-Whitney rank sum test were used as appropriate, with significance set at $p \leq 0.05$.

Results: Seven affected dogs were assessed. There were no significant differences in ages or weights of affected and control groups. Affected dogs maintained the stifle in more flexion throughout the gait cycle and experienced significant cranial tibial translation at mid-stance compared to mid-swing. Affected dogs displayed consistent internal rotation whereas control dogs passed from neutral at mid-stance to internal rotation at mid-swing.

Discussion/Conclusion: This is the first study to accurately and non-invasively define the kinematics of dogs with natural CrCL rupture. Our results show a similar kinematic pattern to that previously reported in experimentally affected dogs. Limitations of this study include small sample size, selective inclusion criteria, and the use of single-plane rather than bi-plane fluoroscopy.

Disclosure: No proprietary interest or relevant financial relationship.

30 LOCALLY-DELIVERED AMNION-DERIVED MULTIPOTENT STROMAL CELLS DIMINISH SEVERITY OF OSTEOMYELITIS IN IMMUNOCOMPROMISED MICE: PROOF-OF-CONCEPT FOR TRANSLATION

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Introduction: Among their many potential therapeutic uses, MSCs have also been shown to have direct antimicrobial properties. The objective of this study was to evaluate the efficacy of a locally-delivered multipotent stromal cells derived from human amnion (hAmSC) to reduce the severity of implant-associated *Staphylococcus aureus* osteomyelitis in an immunosuppressed murine model.



Materials and Methods: Sixteen athymic mice had *S. aureus* osteomyelitis established in the right femoral diaphysis. Fifteen days after infection, mice were randomized to receive a single 0.25 cc injection of hAmSC (n=8) or vehicle (0.9% saline) (n=8) into the soft tissues immediately adjacent to the infected bone. No antibiotics were administered. Mice were imaged twice weekly to assess changes in bioluminescence intensity from baseline. Radiographs were obtained at days -10, 0, 10, 20 and 30 days post-injection and scored for bone changes secondary to osteomyelitis by a reviewer blinded to treatment group. Mice were sacrificed 30 days after treatment and femurs were examined histologically.

Results: Mean bioluminescence intensity decreased from baseline in animals receiving hAmSC and remained below baseline for 28 days, whereas vehicle-treated animals showed an increase in mean bioluminescence intensity throughout the study. Osteomyelitis resolved in 2/8 hAmSC-treated animals and 0/8 vehicle-treated animals as evidenced by bioluminescence imaging and histological examination. Radiograph scores for secondary bone changes and median inflammation scores were lower in mice treated with hAmSC than vehicle.

Discussion/Conclusion: A single injection of hAmSC was effective at reducing severity of *S. aureus* osteomyelitis in immunosuppressed mice without the use of antibiotics. Infection was eliminated in 25% of hAmSC treated mice.

Disclosure: No proprietary interest or relevant financial relationship.

31 MECHANICAL EVALUATION OF K-WIRE ORIENTATION, ALIGNMENT AND TENSION BAND WIRE FIXATION IN A TIBIAL TUBEROSITY OSTEOTOMY MODEL

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Introduction: Since the original description of Tibial Tuberosity Transposition (TTT) in dogs no mechanical studies evaluating K-wire orientation, alignment, or contribution of Tension Band Wire (TBW) to TTT fixation strength have been performed. Furthermore, postoperative tuberosity avulsion is a reported complication following TTT. Using Delrin® blocks to simulate TTT we hypothesised (1) as K-wire insertion-osteotomy angle increases (oriented proximally) so too would construct strength. (2) Vertically aligned K-wires would be stronger than horizontally aligned K-wires. (3) Osteotomies stabilized with TBW would be stronger than K-wire only configurations.

Materials and Methods: Delrin® blocks were secured to one another with paired K-wires at predetermined angle and alignment to simulate TTT (8groups, 56constructs total) with TBW applied additionally in two of these groups. A proximally directed tensile load was applied to tuberosity blocks while a high definition camera recorded displacement. Tensile load and strain energy were calculated and compared between groups at set osteotomy displacements.

Results: In non-TBW constructs the group with caudoproximally oriented K-wires acquired significantly greater strain energy and load-failure than perpendicular, distally or diverging orientations ($p < 0.0001$). Addition of TBW resulted in absorbed strain energy and tensile load greater than the strongest non-TBW group and was strongest when placed around paired rather than single K-wires ($p < 0.0001$).

Discussion/Conclusion: K-wires oriented caudoproximally best resist proximally directed tensile loads. TBW significantly strengthens TTT fixation and should be placed around horizontally rather than vertically aligned K-wires to maximise strength. Studies investigating K-wire number, cyclic loading and direction of tensile load on TTT fixation strength are encouraged.

Disclosure: No proprietary interest or relevant financial relationship.

32 MOTION CAPTURE ANALYSIS OF THE MECHANICAL PERFORMANCE OF A NOVEL PEDICLE SCREW-ROD FIXATION SYSTEM FOR THE CANINE LUMBOSACRAL JOINT

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Introduction: Degenerative disorders of the canine lumbosacral (L-S) joint often result in pain and instability, necessitating surgical decompression and stabilization. The goal of the current study was to determine the effects of a combination of a new poly-axial pedicle screw/rod system (Fitzateur) and a tapered intervertebral traction screw (FITS) on L-S motion. We hypothesized that laminectomy would result in a significant increase in L-S motion as compared with the intact spine, and that the new spinal fixation system would effectively eliminate motion at the L-S joint.

Materials and Methods: Eight cadaveric lumbosacral spines (L4-Cd1) were harvested and prepared for mechanical testing. Specimens were mounted on a 4-point bending jig and tested in flexion, extension and lateral bending using axial loads of between 0 and 150N. Neutral zone and angular displacement were recorded from optical trackers rigidly secured to L6, L7 and S1. Data were collected sequentially from intact spines, after laminectomy at L7-S1, and after surgical stabilization with the new implant system.

Results: As compared with the intact spine, laminectomy resulted in a modest increase in both neutral zone and angular displacement at L6-L7 and a significant increase in both parameters at L7-S1. Instrumentation effectively eliminated motion at L7-S1 with a concomitant increase in motion at the L6-L7 level.

Discussion/Conclusion: The combination of a poly-axial pedicle screw-rod system and interbody spacer provides a versatile solution for surgical stabilization of the L-S joint following surgical decompression in dogs.

Disclosure: The implants were supplied by Fitzbionics, of which one of the authors is a director.

33 NEUROTROPHIC FACTOR EXPRESSION IN CANINE ADIPOSE AND BONE MARROW DERIVED STROMAL CELL PREPARATIONS

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Introduction: Stem cells are applied to many diseases, including spinal cord injury. They can express neurotrophic factors, which play a role in neural tissue regeneration. Bone marrow and adipose tissue stromal cells are available for clinical use, but little information exists to aid in choosing which source to utilize. The objective of this study was to investigate the expression levels of neurotrophic factors. Our null hypothesis was that there was no significant difference in expression between canine stromal cell sources.

Materials and Methods: Bone marrow aspirates and falciform adipose tissue were obtained and assessed for the following neurotrophic factors: glial cell-derived neurotrophic factor (GDNF), brain derived neurotrophic factor (BDNF), nerve growth factor (NGF) and neurotrophin-3 (NT-3). Data was analyzed with Wilcoxon signed-rank test, with a p-value of < 0.05 considered statistically significant.

Results: GDNF had an average expression level of 34.1 pg/ml in bone marrow stromal cells (BMSC) and 21.3 pg/ml in adipose derived stromal cells (ASC), and p-value of 0.091. BDNF had an average expression level of 447.2 pg/ml in BMSC and 249.2 pg/ml in ASC, with a p-value of 0.237. NT-3 had an average expression level of 12 pg/ml for BMSC and 18.1 pg/ml for ASC, with a p-value of 0.893. NGF had minimal expression in either source.

Discussion/Conclusion: Difference in expression levels of neurotrophic factors was not statistically significant. We fail to reject the null hypothesis. There was high variability amongst donors in expression levels. Either BMSC



or ASC appear to be reasonable options for neurologic therapeutic applications.

Disclosure: No proprietary interest or relevant financial relationship.

34 PROPHYLACTIC CERCLAGE WIRE FIXATION TO PROTECT AGAINST TORSION INDUCED PERIPROSTHETIC FEMORAL FRACTURES

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Introduction: The published incidence of femoral fracture associated with the BFX cementless hip ranges from 2.9% to 13.5%, with the most common fractures being created iatrogenically intraoperatively. Adjunctive fixation using cerclage wire is typically used for periprosthetic fissure or fracture, but no studies have evaluated the protective effect of these fixation techniques against fractures.

Materials and Methods: 8 pairs of cadaveric femur were planted with BFX size 8 stems and randomly assigned to a control or treatment group. One femur acted as control and the contralateral received a single double loop Imm cerclage wire proximal to the lesser trochanter. After pre-conditioning each specimen was torqued to failure. The peak torque load at failure was compared between the treated femurs and the control (adjunctive fixation vs. no fixation) using a paired t-test. $P < 0.05$ was considered significant.

Results: The femurs with adjunctive fixation failed at higher loads compared to the femurs without fixation and often in different manners. Significant difference in peak torque at failure between treated femurs and control was found ($p < 0.05$).

Discussion/Conclusion: Based on our results adjunctive fixation with a single double loop cerclage wire placed proximally to the lesser trochanter may decrease the risk of periprosthetic fractures caused by combined torque and compressive forces.

Disclosure: BFX implants were supplied by Biomedtrix.

35 REGENERATIVE MEDICINE THERAPY FOR THE TREATMENT OF SUPRASPINATUS TENDINOPATHY IN DOGS: A RETROSPECTIVE STUDY (B)

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Introduction: Supraspinatus tendinopathy is a common cause of forelimb lameness in dogs. Treatment modalities reported include shock wave and rehabilitation therapy and surgical intervention. However, outcomes are inconsistent. Healing achieved is often by secondary intention or fibrosis. The resulting loss of organized matrix alters biomechanical properties and predisposes tissues to reinjury. Regenerative medicine is an evolving therapeutic approach for treatment of tendinopathies. In veterinary medicine, therapies focus on use of growth factors and adult stem cells, specifically mesenchymal stem cells, derived from bone marrow or adipose tissue and platelet-rich plasma (PRP). These therapies have been used to treat tendon injury in equines and literature reflects encouraging results. Our objective was to report response to combination cultured adipose-derived progenitor cell (ADPC)/PRP therapy in dogs with ST and to describe use of objective gait analysis (Gait-4-Dog) and diagnostic musculoskeletal ultrasound to assess therapeutic response.

Materials and Methods: Medical records of 57 dogs diagnosed with unilateral ST treated with ADPC/PRP were reviewed. We compared pre- and 90-day post-treatment results of gait analysis in 25 cases and tendon size and architecture in 55 cases.

Results: We found 88% of dogs were sound on gait analysis; 12% improved. Improved fiber pattern and reduced tendon size was recorded in all cases with 82% attaining the size of the unaffected contralateral tendon.

Discussion/Conclusion: Our findings show Gait-4-Dog provides accurate assessment of limb load and diagnostic musculoskeletal ultrasound provides a non-invasive, real-time method to measure changes in tendon size and architecture. Our findings suggest combination ADPC/PRP should be considered for dogs with ST.

Disclosure: No proprietary interest or relevant financial relationship.

36 RELATIONSHIP OF PENNHIP DISTRACTION INDEX TO CLINICAL SIGNS OF CANINE HIP DYSPLASIA

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Introduction: The relationship of radiographic signs of canine hip dysplasia (CHD) to clinical signs (CS) of the disease has been poorly studied. Our purpose was to correlate the distraction index (DI) to radiographic osteoarthritis (OA) and clinical signs of CHD.

Materials and Methods: The design was a cross-sectional retrospective study. The PennHIP database was queried for dogs entered since 2005 yielding a sample of 45,740 dogs (265 breeds). Factors included in the statistical model were hip laxity as measured by the PennHIP DI, age, weight, presence of OA and the degree of CS, categorized as positive CS, no CS or CS not evaluated.

Results: Presence of radiographic OA correlated positively with the magnitude of DI. Age, DI and CS were significant risk factors for OA but weight did not correlate with OA or CS. The odds for concurrent OA increased 2.2 times if CS were observed. The probability of showing CS with a DI of < 0.3 ranged from 0–2.8% regardless of being positive or negative for hip OA.

Discussion/Conclusion: Results from a large sampling of dogs, consisting of multiple breeds, found both DI and OA to correlate with CS. This is the first study to relate DI to CS. Dogs with tight hips are not only at an extremely low risk of developing OA, they are also at a very low risk of having CS associated with CHD.

Disclosure: No proprietary interest or relevant financial relationship.

37 ROLE OF THERAPY WITH GROWTH FACTORS IN THE MANAGEMENT OF PAIN PERCEPTION NEGATIVE DOGS DUE TO THORACOLUMBAR DISK EXTRUSIONS

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Introduction: The purpose of this prospective pilot study was to examine the hypothesis that dogs with an acute onset of paraplegia and absent pain perception treated with either subdural platelet rich plasma injections or the intravenous application of erythropoietin at the time of decompressive surgery will have a higher likelihood of a functional recovery than dogs treated with surgery alone.

Materials and Methods: Inclusion criteria included chondrodystrophic dogs presenting with acute thoracolumbar disk extrusion, paraplegia, and absent pain perception. All dogs underwent decompression within 24 hours after admission and were randomly assigned to: 1) saline subdural, 2) autologous platelet rich plasma subdural and 3) erythropoietin (EPO) IV. Initial and follow-up examinations were performed at the time of admission, 1,3,7,14,42 and 84 days post-surgery, with a focus on ambulation and fecal/urinary continence. Statistical analysis was performed with SPSS for windows 20 software. The level of significance was defined as $p < 0.1$.

Results: The median age of the 32 dogs enrolled was 5 years. Dachshunds were the most common breed. One dog developed myelomalacia 4 days post-surgery and was euthanized. Three month post-surgery 24/31 (78%) dogs regained ambulatory function whereas 7/31 (22%) did not. There was no overall difference between groups, although dogs treated with EPO had a trend towards an improved overall outcome with a reduction in incontinence (Chi Square, $p = 0.081$).



Discussion/Conclusion: Despite the good outcome in all the groups, the application of erythropoietin might be beneficial. Future studies should be directed towards the application of EPO in a larger group of dogs.

Disclosure: No proprietary interest or relevant financial relationship.

38 SUPRASPINATUS TENDINOPATHY IN 203 DOGS: A RETROSPECTIVE STUDY

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Introduction: Supraspinatus tendinopathy (ST) is a common condition identified in dogs with forelimb lameness. However, diagnosis and treatment remain challenging. Our objective was to report global clinical findings for dogs with ST including signalment, history, prior treatments, physical examination, objective gait analysis (Gait-4-Dog), imaging (radiographs, MRI and diagnostic musculoskeletal ultrasound), arthroscopy and concurrent shoulder and elbow pathologies. Quantitative ultrasound (QUS) methods are commonly used in human and equine medicine to evaluate tendon architecture for diagnosis and response to treatment of tendon conditions. As diagnostic musculoskeletal ultrasound is increasingly used in small animal medicine an objective methodology is needed. Our objective was to develop QUS methodology for shoulder pathology in the dog.

Materials and Methods: We reviewed medical records of 203 dogs diagnosed with ST (2006–2012) and aggregated findings.

Results: We found 50.2% of dogs failed to respond to NSAIDs and 40% failed to respond to rehabilitation therapy. The most common findings on shoulder arthroscopy were subscapularis pathology (92.6%) and supraspinatus bulge (91.9%). Elbow pathology was recorded in 64.7% of dogs. Common ultrasound findings included increased tendon size (50.6%), irregular fiber pattern (52.5%), and non-homogeneous echogenicity (82.9%).

Discussion/Conclusion: Our findings suggest concurrent shoulder and/or elbow pathology is not uncommon in dogs with ST. Further, response to rehabilitation therapy is inconsistent. Based on our findings, we developed the Ultrasound Shoulder Pathology Rating Scale (USPRS) Canine. This scale provides QUS methodology for shoulder pathology as well as a foundation for QUS methodology for other musculoskeletal tissues in the dog.

Disclosure: No proprietary interest or relevant financial relationship.

39 SURFACE ELECTROMYOGRAPHY OF THE GASTROCNEMIUS, VASTUS LATERALIS AND BICEPS FEMORIS MUSCLES AT TROT IN NORMAL DOGS

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Introduction: Surface electromyography (sEMG) of the vastus lateralis (VL) muscle has been described in normal dogs and the biceps femoris (BF) and gluteus medius (GM) muscles in normal dogs and dogs with hip osteoarthritis. The purpose of this study was to describe the sEMG activity pattern of the gastrocnemius muscle (GN) simultaneously with VL and BF muscles in normal dogs at a trot.

Materials and Methods: Six client-owned normal dogs were selected for the study. sEMG electrodes were strategically placed on the GN, VL and BF muscles. EMG data was telemetrically transmitted to a receiver and computer while simultaneously collecting ground reaction force measurements during trotting.

Results: GN sEMG activity had a two-phase peak maximum and a two-phase sEMG minimum during one gait cycle. VL sEMG activity had a two-phase peak maximum and a two phase EMG minimum during one gait cycle. BF had only one sEMG maximum during one gait cycle.

Discussion/Conclusion: The sEMG activity observed in this study for the VL and BL is similar to previous reports in dogs. This is the first report of GN sEMG activity during gait. The addition of GN sEMG data may enhance bio-

mechanical modeling of the canine stifle, provide diagnostic features for, and/or aid in the current and future therapeutic development of stifle joint-related diseases.

Disclosure: No proprietary interest or relevant financial relationship.

40 SURGICAL NAVIGATION IMPROVES TIBIAL COMPONENT ALIGNMENT IN CANINE TOTAL KNEE REPLACEMENT

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Introduction: Long-term outcomes of total joint replacement depend on accurate implant alignment. In humans, errors in positioning of the tibial and/or femoral components are associated with an increased risk of poor outcomes, including implant failure. The goal of the current study was to determine whether computer-assisted surgical navigation improves the accuracy of tibial component alignment in canine total knee replacement (TKR).

Materials and Methods: 17 sets of TKR radiographs were reviewed to determine the incidence and magnitude of tibial component malalignment. A cadaveric study was then performed on 12 stifle joints to compare tibial component alignment in the frontal and sagittal planes following (1) standard (surgeon-guided) placement and (2) computer-assisted (navigation-guided) placement. Results were compared against the current gold standard recommendations of a neutral (0° varus-valgus) cut in the frontal plane and 6° of caudal slope in the sagittal plane.

Results: Errors of >3° in frontal and sagittal plane alignment were seen in 12% and 24% of radiographs respectively. In cadavers, frontal plane alignment was significantly better in navigated stifles (mean 0.41°, range -0.71° to -0.81°) than in non-navigated stifles (mean 1.24°, range -2.35° to +1.93°) (p<0.05). Sagittal plane alignment was also better in the navigated group (mean 6.46°, range 5.13° to 7.59° vs. 7.08°, range 2.23° to 10.81°) (P<0.05).

Discussion/Conclusion: Surgical navigation significantly improves accuracy and decreases variability in tibial component alignment. Clinical trials are now needed to determine whether these improvements in surgical accuracy lead to better clinical outcomes in terms of joint function and implant longevity.

Disclosure: No proprietary interest.

41 THE EFFECT OF CEFPODOXIME AND CEFOVECIN ON TIBIAL PLATEAU LEVELING OSTEOTOMY INFECTION RATES: A PROSPECTIVE RANDOMIZED CLINICAL TRIAL

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Introduction: Recent studies have shown a decrease in surgical site infection (SSI) if post-operative antimicrobials are administered. The objective of this study was to compare the incidence of SSI following TPLO with two different antimicrobial protocols. We hypothesized that patients treated with cefovecin would have a lower incidence of SSI than patients treated with cefpodoxime due to better compliancy of dosage.

Materials and Methods: Dogs presenting to a single referral hospital for cranial cruciate ligament rupture to be treated with routine TPLO were eligible to be enrolled in the study. Enrolled dogs were randomly assigned to two treatment groups. The cefpodoxime group was administered cefpodoxime at 5 mg/kg PO for seven days beginning the first day post-operative. The cefovecin group received a single SQ injection of cefovecin at 8 mg/kg the first day post-operative. Dogs were monitored for the following 42 days for signs of SSI.

Results: 139 dogs in the cefovecin group and 137 dogs in the cefpodoxime group were enrolled. Eight dogs (5.76%) in the cefovecin group were diagnosed with SSI and 17 dogs (12.41%) in the cefpodoxime group were diagnosed with SSI. There was no statistically significant difference in infection rates between groups (P = 0.0544). Bacterial isolates were similar for both groups with methicillin-resistant staphylococcus species being most common.



Discussion/Conclusion: The results of this study suggest that cefovecin and cefpodoxime perform similarly in TPLO SSI prophylaxis. Cefovecin should be considered when oral antimicrobial administration compliance may be compromised.

Disclosure: Funding for the study was provided by Zoetis.

42 THE EFFECT OF INTRA-ARTICULAR BOTULINUM TOXIN A ON PEAK VERTICAL FORCE IN DOGS WITH ELBOW ARTHRITIS

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Introduction: Elbow osteoarthritis secondary to elbow dysplasia can be a debilitating disease for many canine patients. Medical and surgical treatment for elbow arthritis can be successful in treating the clinical manifestations in some patients but the current standard of medical and/or surgical treatment may not be options in other patients. The purpose of the information presented here is to determine if intra-articular Botulinum Toxin A (Botox) has an effect on force platform gait analysis in dogs with naturally occurring elbow arthritis. We hypothesized that there will be a difference in gait analysis between dogs receiving intra-articular Botox and dogs that receive intra-articular saline with a positive improvement in ground reaction forces in the dogs receiving Botox.

Materials and Methods: This is a prospective placebo-controlled double-blinded randomized study design enrolling dogs with naturally occurring elbow osteoarthritis and measurable forelimb lameness. Each dog underwent force platform gait analysis at the initial evaluation and at 2, 3 and 6 months after receiving either intra-articular Botox or saline. A two-sample t-test was used to compare the ground reaction force changes (expressed as percent change from the baseline peak vertical force) between the two groups of dogs at each time point.

Results: Nine dogs were enrolled in each group. At the 2-month force platform gait analysis there was no significant difference in the peak vertical force of the groups ($p=0.92$). At the 3 month analysis there was a significant difference ($p=0.05$) between the percent change in peak vertical force from baseline with the saline group showing a mean improvement of 14.6% above baseline, while the Botox group mean was improved by 0.2% above baseline. At the 6-month analysis there was a significant difference ($p=0.01$) where the saline group was at 13.7% above baseline and the Botox group was 4.9% below baseline.

Discussion/Conclusion: Based on the data derived from the study there was a difference between the saline placebo group and the Botox group. However, intra-articular Botox did not positively affect force platform analysis, as was hypothesized. The data presented here is a portion of an on-going prospective placebo-controlled double-blinded randomized study looking at intra-articular Botox injections as an alternative or adjunctive treatment for elbow osteoarthritis. Other outcome measures included (visual analogue lameness score, Canine Brief Pain Inventory owner questionnaire, and elbow range of motion measured by goniometry) may provide insightful information for intra-articular Botox injections as a treatment for elbow osteoarthritis. Also, results may vary as we are completing compilation of the remaining dogs currently enrolled in the study.

Disclosure: Botox was provided by Allergan.

43 THE EFFECT OF TRANSCUTANEOUS SEQUENTIAL ELECTRICAL STIMULATION OF THE THIGH MUSCLES ON A CANINE MODEL OF STIFLE OSTEOARTHRITIS

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Introduction: Sequential electrical stimulation (SES) has been examined as an alternative to traditional muscle strengthening in people with osteoarthritis (OA). The purpose of this study was to examine the effect of SES of the thigh muscles on markers of joint inflammation and ground reaction forces in dogs with experimentally induced stifle OA and lameness.

Materials and Methods: Dogs with induced chronic stifle OA were randomly assigned to treatment ($n=6$) or control ($n=5$) groups. Surface electrodes were placed over the cranial and caudal thigh musculature and stimulated for a set protocol over 12 weeks (treatment) or had electrodes without stimulation (control). Synoviocentesis was performed on alternate weeks and assayed for sGAG, albumin, HA, MMP-3 and soluble collagen. Chymopapain was injected IA to initiate joint inflammation alternate to synoviocentesis. Ground reaction forces including Peak Vertical Force (PVF) and Vertical Impulse (VI) were assessed weekly. Data were analyzed using repeated measures ANOVA with Tukey's post-hoc test. Linear regression analysis compared groups for PVF and VI to evaluate trends. Significance was set at a $P<0.05$.

Results: No significant differences were seen between groups for sGAG, HA or MMP-3. Significant differences in albumin at T12 ($p=0.0026$) soluble collagen at T6 ($P=0.0001$), T10 ($P<0.0001$), and T12 ($P<0.0001$) were seen in the treatment group compared to control. PVF and VI increased over time for the treatment group, but was not significantly different than control.

Discussion/Conclusion: SES of the thigh muscles may result in improvement in joint inflammation and weight bearing in a canine model of stifle OA.

Disclosure: RS Medical funded this project.

44 VARIATIONS IN LUMBOSACRAL INTERVERTEBRAL FORAMINAL DIMENSIONS COMPARING PARASAGITTAL STANDARD AND OBLIQUE MAGNETIC RESONANCE IMAGING MEASUREMENTS IN DOGS WITH HYPER-EXTENDED AND NEUTRAL POSITIONING

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Fitzpatrick Referrals

Introduction: Lumbosacral disease in dogs is characterized by neurological deficits resulting from compression of the cauda equina or L7 nerve roots. MRI is employed to subjectively evaluate the dimensions of neuroforaminae with parasagittal images. The purpose of this study was to compare standard parasagittal measurements with those obtained in an oblique plane perpendicular to nerve roots, comparing these measurements in neutral and hyperextended positions.

Materials and Methods: MRI imaging was carried out in a Siemens Symphony 1.5T. On T2 weighted images, left and right foraminal apertures were evaluated for entry, middle and exit zones in standard and oblique parasagittal planes and in neutral and hyperextended positions.

Results: MRI images from 30 dogs were evaluated. All were clinically affected by lumbosacral disc disease. 16 female and 14 male dogs were included with mean age of 4.7 years and mean weight of 23.4 kg. Results reveal that the neuroforaminal area acquired using oblique planar acquisition was significantly smaller than standard parasagittal measurements. Neuroforaminal dimensions in hyperextended position were significantly smaller than in neutral position.

Discussion/Conclusion: Positioning of the dog has a significant effect on neuroforaminal dimension which provides corroborative evidence that spinal position may influence neural claudication in clinically affected patients. Nerve root compression being more pronounced on oblique planar images



suggests that this plane may be a useful imaging tool to interrogate more subtle L7 nerve root encroachment than standard parasagittal imaging. This may represent a potentially objective measure of lumbosacral neuroforaminal stenosis but requires further evaluation by cohort analysis.

Disclosure: No proprietary interest or relevant financial relationship.

ESVOT International Resident Award Winners

45 BIOMECHANICAL COMPARISON OF PIN AND TENSION-BAND WIRE VS. NOVEL LOCKING PLATE FIXATION IN A TRANSVERSE PATELLAR FRACTURE MODEL IN THE DOG

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Introduction: Patella fracture repair with pin/figure-of-8 tension-band wiring is recommended in dogs, but without overall documentation of success. Additionally, there is broad consensus (unpublished) that this technique is generally not successful in the dog. Our objective was to evaluate prototype locking plate vs. tension-band wire patellar fracture repair in an ex vivo experimental dog model.

Materials and Methods: Paired cadaveric canine stifle joints (n=10) with mid-transverse osteotomies were randomly stabilized with either tension-band wire or locking plates. Cyclic loads, at 100% body weight, 1 Hz for 500 cycles, were applied from 90–135° joint extension. Success/failure was defined as ≤2 mm/>2 mm distraction at the fracture gap, respectively. Number of cycles at failure and distraction gap were compared with paired Student's t tests; all surviving constructs were tested destructively in load to failure; stiffness and yield strength were similarly evaluated. Significance was set at P<0.05.

Results: All 10/10 locking plate and 3/10 tension-band wire constructs survived cyclic testing; failure in the 7/10 constructs occurred at 3±3 cycles (P=0.0013). Distraction gap with plate (0.27±0.39 mm) and tension-band wire (1.70 ±0.52 mm) fixation were significantly different (P<0.0001). Construct stiffness and yield strength were not significantly different.

Discussion/Conclusion: The locking plate demonstrated significantly better fixation during cyclic loading. Too few tension-band fixations survived to perform an adequate statistical analysis with destructive testing. The failure mode (distraction) with tension-band wire was consistent with failures observed clinically. The prototype locking plate system may offer a potential new option for fracture fixation, but needs further clinical corroboration.

Acknowledgement: Funded by the ECVS Surgeon-in-Training Research Grant and the Orthopedic Biomechanics Laboratory at Tufts Cummings School of Veterinary Medicine.

Disclosure: Implants were donated by RISystem AG, Davos Platz, SW. R. Matthys and R. Nützi are employed by RISystem AG, Davos Platz, CH.

46 RISK FACTORS FOR TIBIAL TUBEROSITY FRACTURE AFTER TIBIAL TUBEROSITY ADVANCEMENT IN DOGS

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Introduction: Fracture of the tibial tuberosity (TT) is a recognized major complication after tibial tuberosity advancement (TTA) surgery in dogs. This report identified 13 cases of TT fracture, which occurred during 202 TTA surgeries between 2008 and 2013 at Glasgow University and University College Dublin Veterinary Teaching Hospitals. The purpose of the study was to retrospectively identify factors that predispose to TT fracture, and to test the hypothesis that fracture is associated with technical inaccuracies.

Materials and Methods: The medical records and radiographs of a group of dogs that had TTA surgery were evaluated to determine the effect of surgical

technique on tibial tuberosity or tibial crest fractures. Multivariable logistic regression was performed with the occurrence of TT fracture as the outcome variable of interest.

Results: Thirteen fractures were diagnosed in 12 dogs (6.5% of surgeries). Six were TT avulsions and seven were comminuted. Retrievers were the most common breed both overall (68) and in the group which sustained a fracture (3). Plate position (P=0.009, OR=9.47, 95%CI=1.77–50.57), cage position (P=0.039, OR=8.28, 95%CI=1.11–61.86), and osteotomy shape (P=0.003, OR=9.27, 95%CI=2.13–40.37) were found to be significant factors associated with TT fracture.

Discussion: This study provides data to support the hypothesis that poor plate position, cage position and osteotomy shape are associated with TT fracture after TTA. We conclude that placement of the plate on the cranial aspect of the tibial crest, correct cage positioning, and adequate distal osteotomy width will reduce the occurrence of TT fracture.

Disclosure: No proprietary interest or relevant financial relationship.

Australian College of Veterinary Scientists (Surgery Chapter) International Resident Award Winner

47 COMPUTER-ASSISTED PLANNING AND THREE-DIMENSIONAL MODELING FOR SURGICAL CORRECTION OF ANTEBRACHIAL DEFORMITIES IN DOGS

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Introduction: Correction of antebrachial deformity should address malalignment, length discrepancy and joint incongruity. This study reports the development of a technique to correct angular limb deformity with three-dimensional planning, computer simulated surgery and translation of the planned correction to theatre with custom printed surgical guides.

Materials and Methods: Six limbs of five dogs were operated with this new method. Data was acquired with computed tomography. The data was converted to a stereolithography file and manipulated in CAD software (CopyCADPro). In the final case the STL files were also imported into the medical software program, 'Osteotomy'. Virtual surgery was performed in CopyCAD-Pro to correct radial joint angles and torsion. Individual surgical guides were printed in ABS plastic. All dogs had a single closing wedge osteotomy fixated with plating osteosynthesis. Follow-up was performed with post-operative radiographs 8–12 weeks after surgery and telephone interview at least 1 year later.

Results: No complications were reported and all dogs progressed to bony union by 12 weeks. Radiographs showed good correction in all cases, and owners reported cosmetic and exercise outcome measures as good or excellent.

Conclusion: 3D surgical planning improves measurements of a deformity and fabrication of custom guides can translate this to the surgical field. Further study of 3D radial anatomy and comparison to traditional techniques is needed to assess the true benefit of this method.

Disclosure: No proprietary interest or relevant financial relationship.



Association Française des Vétérinaires pour Animaux de Compagnie (AFVAC) International Resident Award Winner

48 COMPARISON OF RADIOGRAPHIC MEASUREMENTS OF THE PATELLAR TENDON-TIBIAL PLATEAU ANGLE WITH ANATOMIC MEASUREMENTS IN DOGS: VALIDITY OF THE COMMON TANGENT AND TIBIAL PLATEAU METHODS

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Introduction: Two techniques have been described to measure patellar tendon-tibial plateau angle (PTA): the conventional and the common tangent methods, methods that have never been validated anatomically. The objective of this study is to evaluate the validity of the two methods.

Material and methods: 20 cadaver hind legs free of orthopedic disorder were studied. A radiograph centered over the stifle was obtained with the leg positioned at 135±1° in true lateral positioning and maintained with a custom-made external skeletal fixator. Stifles were then dissected after materialization of the patellar tendon by a perpendicular K-wire inserted in the tibial tuberosity at the exact insertion of the patellar tendon. The tibial plateau was defined with 2 K-wires. The anatomic PTA was measured on a photograph of the proximal tibia. The agreement between the measurements of radiographic PTAs (6 observers) and the anatomic PTA (1 blinded observer) was assessed using the intraclass correlation coefficient (ICC).

Results: Global ICCs for the common tangent and the conventional methods were 0.44 and 0.4 respectively meaning that their global validity is poor. Measurements obtained with the common tangent and the conventional methods were systematically below and above those obtained with the anatomic angle respectively.

Discussion/Conclusions: Both methods have poor agreement with the anatomic PTA with an underestimation and an overestimation with the common tangent and the conventional method respectively. More studies are necessary to confirm the results of the present study, the impact on the advancement and the cage size used and the clinical implications.

Disclosure: There was no proprietary interest or funding provided for this project.

49 ARTHRODESIS OF THE EQUINE PROXIMAL INTERPHALANGEAL JOINT: A BIOMECHANICAL COMPARISON OF ONE 3-HOLE 4.5-MM NARROW DYNAMIC COMPRESSION PLATE WITH TWO 5.5MM OBLIQUE CORTEX SCREWS TECHNIQUE AND ONE 7-HOLE 5.0MM LOCKING COMPRESSION PLATE TECHNIQUE

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Introduction: Surgical arthrodesis of the proximal interphalangeal joint using internal fixation has been indicated as a treatment of such conditions that can provide pain relief. The objective of this study was to compare the biomechanical properties of two PIP arthrodesis techniques using 4.5mm dynamic compression plate (DCP) in conjunction with two oblique abaxial transarticular 5.5mm cortical screws inserted in lag fashion and a 5.0mm Y locking compression plate (Y-LCP) with unicortical locking screws and one axial transarticular 4.5mm cortex screw inserted in lag fashion through the middle plate hole.

Materials and Methods: For this project twelve cadaveric adult equine forelimbs were collected. After full-limb preparations, each forelimb pair was randomly assigned to one of two treatment groups. Constructs were submitted to an axial compression single cycle to test biomechanical failure. The failure of the screws, plate or bone, and the force that the constructs resisted was evaluated.

Results: There were no significant differences in the construct stiffness or max force when loaded to failure, between the DCP and Y-LCP treatment groups. Even though there were no construct stiffness differences between the two techniques, the Y-LCP technique provided the possibility of a less invasive procedure with a shorter surgical time. To apply of this technique one clinical case was performed. A 15 year old male crossbreed was presented at the Veterinary Hospital with 4/5 lameness without history. At the clinical exam there was swelling in the fetlock and pastern joints of the front right limb and it was diagnosed in the x-rays as a luxation of the PIP joint. Surgical arthrodesis was performed with a dorsally placed 5.0mm 7 hole inverted Y-LCP. A lower limb fiberglass cast was applied for 5 weeks, non-steroidal anti-inflammatory was applied for 18 days, opioid for 5 days, and regional antibiotics were given 3 times every 48 hours. After 5 months the horse presented 2/5 lameness without swelling. The x-rays showed periarticular reaction and decrease of the articular space of the PIP joint.

Discussion/Conclusion: In conclusion, the biomechanical properties of both fixation techniques (DCP and Y-LCP) are equivalent under the test conditions used. The fixation with Y-LCP showed good stabilization of the joint with the advantage of it being a quick and less invasive technique.

Disclosure: No proprietary interest or relevant financial relationship.

50 BIOMECHANICAL BENDING STUDY IN EQUINE MANDIBLE OSTEOTOMIZED FIXED WITH LCP PLATES AND TRANS-DENTAL LC-DCP PLATES

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Introduction: Fractures of the rostral aspect of the mandible frequently occur when the horse suddenly pulls back or tries to escape while the incisors or mandible are trapped on a fixed object or as a consequence of a severe blunt trauma, such as kicks. The aim of this study was to evaluate the biomechanical characteristics of 2 fixation techniques of mandibular fractures in horses.

Materials and Methods: The osteotomy was done 1cm rostral to the mental foramen in the jaw of horses aged between 2 and 18 years old. The specimens were divided into 2 fixation groups (n = 8): locking compression plate (LCP) and low contact dynamic compression-plate (LC-DCP) fixed trans-dentally. At the control group eight intact mandibles were tested and it was possible to reproduce the fractures of the rostral aspect. The jaws were subjected to a single bending test until their failure. The angular displacement data were derived from recorded measurements provided by extensometers placed across the osteotomy site. The osteotomy gap data obtained during the test at 50 and 100Nm were selected for the standardized comparison of gap width before testing and at the failure point in all constructs tested. Stiffness, yield strength and failure strength were determined from bending displacement and were compared using the ANOVA test and other appropriate statistical tests when indicated. Axial tomography and calcified histological cuts were obtained from the teeth submitted for the trans-dental screw implants.

Results: The biomechanical characteristics at the failure moment were greatest for intact mandibles. Among the osteotomized mandibles the biomechanical characteristics at 50 and 100 Nm were not significantly different (P>0.05) between LCP constructs and trans dental LC-DCP constructs. In this study, the axial tomography and calcified histological cuts obtained from the teeth submitted to trans-dental screws showed that the pulp cavity was penetrated (incisors teeth, 71% and check teeth, 43%) by the trans-dental implants.



Discussion/Conclusion: An important advantage of the LCP system is the possibility to use a monocortical screw for stable fixation. The mandibular osteotomies fixation with trans-dental implants is a complex technique that requires an experienced surgeon. Also, the plate must be pre-bent so that only minor adjustments need to be made during the surgery to prevent the procedure from being too long. In conclusion, these techniques were biomechanically similar and they are suitable for fixing the osteotomies in the equine mandibular at the interdental space, but it is necessary to determine the consequences of the trans-dental technique in living animals in the long term.

Disclosure: No proprietary interest or relevant financial relationship.

51 CASTOR OIL POLYMER/BONE TISSUE BIOLOGICAL INTERACTION IN HORSES: A HISTOPATHOLOGICAL STUDY

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Introduction: Light microscopy (LM) is a tool for objective analysis of tissues. Scanning electron microscopy (SEM) is used to evaluate the surface of biomaterials. Transmission electron microscopy (TEM) is used for cell and organelle morphology. The purpose of this histological study was to evaluate the bone healing process following implantation of a ricin polyurethane/calcium carbonate biopolymer in horses.

Materials and Methods: An experimental bone defect was created in the right and left third metacarpal bone of six adult horses. One defect selected for treatment with the biopolymer while the contralateral defect was left untreated. Bone biopsies were collected from the mature bone/biopolymer interface or the new bone/mature bone (treated and control limbs respectively) 120 days after surgery.

Results: LM analysis the new bone tissue mean surface area was significantly smaller ($p < 0.001$; Wilcoxon test) in the treated group. New bone tissue of similar aspect and characterized by disorganized new bone matrix was observed at new bone/mature bone interface in treated and control groups. No signs of fibrotic or foreign body reaction were noted in the treated group. SEM analysis revealed new bone of similar characteristics to primary bone at the new bone/mature bone interface in control defects. TEM analysis revealed intense cellular activity and collagen secretion at the new bone/mature bone interface. Collagen-filled areas were observed in the polymer matrix in some areas.

Discussion/Conclusion: Based on the results of this study, castor oil polymer has mild osteoconductivity, does not interfere with the original tissue architecture or hinder cell activity, and is compatible with the equine bone tissue.

Disclosure: No proprietary interest or relevant financial relationship.

52 CLINICAL FOLLOW-UP OF HORSES TREATED WITH INTRA-SYNOVIAL PLATELET-RICH PLASMA FOR MUSCULO-SKELETAL LESIONS

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Introduction: Platelet-rich plasma (PRP) is increasingly being used in equine practice but there are no studies of its use intra-synovially in clinical cases. Our hypothesis was that PRP would aid in the treatment of complex intra-synovial disorders, leading to a satisfactory outcome with minimal adverse side effects. The aim of the study was to test this hypothesis and additionally to compare the incidence of side-effects between two different types of preparation.

Materials and Methods: Clinical cases were prospectively databased and followed-up. PRP was from either a filter system (E PET, Pall Corporation) or a centrifuge system (ACP[®], Arthrex Inc) and directly injected into the target synovial cavity using standard sterile techniques.

Results: 30 horses were treated. A total of 45 structures were treated: 25 stifles, 8 coffin joints, 7 navicular bursas, 3 fetlocks and two digital flexor tendon sheaths. One third received ACP[®] and two-thirds filter system PRP. No adverse reactions or flares were noted in any case. 23/30 medications were after surgery. Long-term follow-up was available on 16 cases. 4 were lost to follow-up, three failed because of other injuries and 7 are still in rehabilitation. 13/16 (81%) have returned to full work. One (6%) returned to a lower level of work and 2 (13%) had recurrence or persistence of lameness.

Discussion/Conclusion: There was a lack of adverse reactions in a variety of situations and an encouragingly positive outcome. Further studies are justified and case numbers need to be increased to allow more accurate comparison between the different preparations.

Disclosure: No proprietary interest or relevant financial relationship.

53 EVALUATION OF A SYNTHETIC OSTEOCHONDRAL IMPLANT FOR SURGICALLY CREATED SUBCHONDRAL BONE DEFECTS OF THE MEDIAL FEMORAL CONDYLE IN NORMAL HORSES

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Introduction: Osteochondrosis (OC) and subchondral cystic lesions (SCLs) often result in lameness in horses. This pilot project was designed to evaluate placement of a synthetic osteochondral implant in the medial femoral condyle (MFC) of normal horses to assess bony ingrowth, integration characteristics, and tolerance of the implant to determine potential as a treatment for MFC SCLs.

Materials and Methods: Six mature horses with radiographically normal stifles that were free of hindlimb lameness were included in the study. Horses were anesthetized and bilateral femorotibial arthrotomies were performed and one 20 mm x 8 mm implant was placed in a randomly selected MFC while the contralateral stifle served as a sham. Objective lameness evaluations were performed monthly post-operatively. Synovial fluid was collected pre-op, at 30 days, 90 days, and 120 days post-op. Radiographs were performed pre-operatively and at 6 months after surgery. Horses were euthanized 6 months post-operatively and the stifle joints were harvested for gross and histopathologic evaluation.

Results: There was no significant difference in lameness of the implant limb pre-operatively versus post-operatively. No significant differences were detected in synovial fluid parameters, and no significant changes occurred radiographically over time in the implant stifle. Histopathologic assessment revealed no differences between implant and sham synovial biopsies, and integration of the implant was graded as good in 4/5 sections.

Discussion/Conclusion: The implant was well tolerated in the MFC over a 6-month period. Additional cadaver and live horse studies are required to fully evaluate the surgical technique.

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Part II to follow in the next issue.