Magic Angle Effect in Normal Collateral Ligaments of the Distal Interphalangeal Joint in Horses Imaged With a High-Field Magnetic Resonance Imaging System

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Depending on the positioning of the limb and the sequences used for imaging, magic angle effect should be considered as a possible cause of an asymmetrical signal pattern when evaluating the collateral ligaments of the distal interphalangeal joint on images acquired with a high-field magnetic resonance imaging system that has a horizontally oriented main magnetic field. Authors’ address: Gail Holmes Equine Orthopaedic Research Center, Colorado State University Veterinary Teaching Hospital, Fort Collins, Colorado 80523; e-mail: nmwerpy@colostate.edu. © 2009 AAEP.

1. Introduction
The signal intensity of normal collateral ligaments of the distal interphalangeal (DIP) joint were imaged using short- and long-time echo sequences with the limbs at different angles relative to the main magnet in a high-field magnetic resonance (MR) system. The purpose of this study was to evaluate these images to show the influence of the magic angle effect on the signal intensity of these ligaments.

2. Methods and Materials
Feet were imaged in a neutral position with the long axis of the limb parallel to the main magnetic field using T1-weighted spoiled gradient echo (SPGR), T2*-weighted gradient echo (GRE), proton-density turbo spin echo (TSE), short tau inversion recovery (STIR), and T2-weighted fast-spin echo (FSE) sequences using an ONI 1.0-Tesla Pegasus and a 1.5-Tesla GE Signa magnet. The limbs were angled at 4, 8, 12, 16, and 20° away from the central axis of the main magnetic field and imaged using the same protocol.

3. Results
The scores of asymmetry obtained at 4, 8, 12, 16 and 20 degrees on the proton density TSE, T1-weighted SPGR, and STIR sequences are significantly different than the asymmetry score obtained at 0 degrees. The scores of asymmetry obtained at 8, 12, 16 and 20 degrees on the T2*-weighted GRE sequence are significantly different than the asymmetry score obtained at 0 degrees. The scores of asymmetry...
obtained at 12, 16, and 20 degrees on the T2 FSE sequences are significantly different than the asymmetry score obtained at 0 degrees. The mean signal intensity at angles 4, 8, 12, 16, 20 on the proton density TSE, T1-weighted SPGR, T2*-weighted GRE and STIR sequences is significantly different from the signal intensity at 0 degrees. There was no statistically significant difference in the mean signal intensity of the ligaments on the T2-weighted FSE images.

4. Discussion
This study showed the presence of the magic angle effect in the collateral ligaments of the DIP joints at the level of the middle phalanx when imaged using a horizontal-bore, high-field magnet.

Footnotes

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