DEVELOPMENT OF KINEMATIC MAGNETIC RESONANCE IMAGING (K-MRI) TECHNIQUES FOR STUDYING THE KINEMATICS OF THE SPINE AND JOINTS IN DOGS – PRELIMINARY STUDY ON CADAVERS

M. Vignoli, R. Tamburro, I. Falerno, F. Del Signore, F. Simeoni, F. De Pasquale, A. De Bonis, A. Maraone, A. Paolini, A. Bianchi, M. Rosto, S. Canal.

Service of Small Animal Surgery and Diagnostic Imaging, Faculty of Veterinary Medicine, University of Teramo, Italy.

INTRODUCTION

Kinematic MRI (K-MRI) is a novel imaging technique, recently introduced in people, that couples the excellent soft tissue contrast and multiplanar capabilities of traditional MRI with kinematic potentials. This technique can reveal instability that may not be evident with conventional static MRI. Therefore, the goals of this study are: 1) testing the feasibility of spinal cord and joints k-MRI in veterinary medicine, and 2) evaluate the quality of k-MRI studies as a new diagnostic option in veterinary medicine.

METHODS

A standard MRI (Esaote VETSCAN-GRANDE, 0.25 T) was taken on cervical spine, elbow and stifle joints of 7 cadavers. A static (sagittal T1 and T2 weighted sequences, and transverse T2 weighted sequences) and k-MRI (real-time 2D HYCE S sequence) study was conducted for each region, before and after (Fig.1) a surgical insult was applied to create a certain degree of articular instability. During 2D HYCE S an operator performs extension, flexion, and traction movements (Fig. 2-5).

Fig. 1 - A) before, B) during, and C) after the surgical procedure of ventral slot to remove two intervertebral discs and the dorsal longitudinal ligament.

RESULTS

A total of 56 MRI were performed in 7 cadavers: 7 cervical spinal tracts, 3 elbow and 4 stifle joints were examined. The images were all considered diagnostic, with excellent quality for the stifle joints and good to poor for elbow joints and the spine.

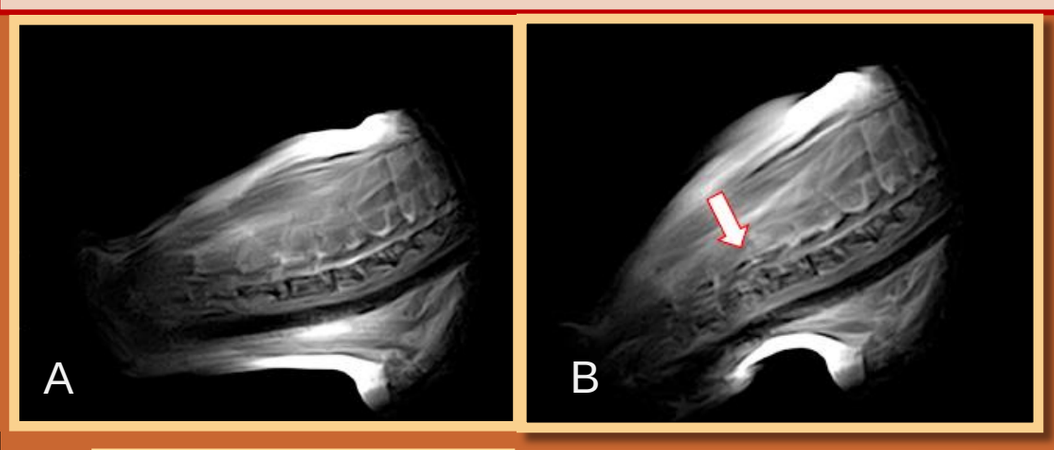

Fig. 2 - Cervical spine k-MRI sample images. A) Starting position, no spinal cord compression is visible. B) Flexion movement, C4-5 mild subluxation is evident (arrow).

SCAN QR Code to watch Kinetic MRI video!

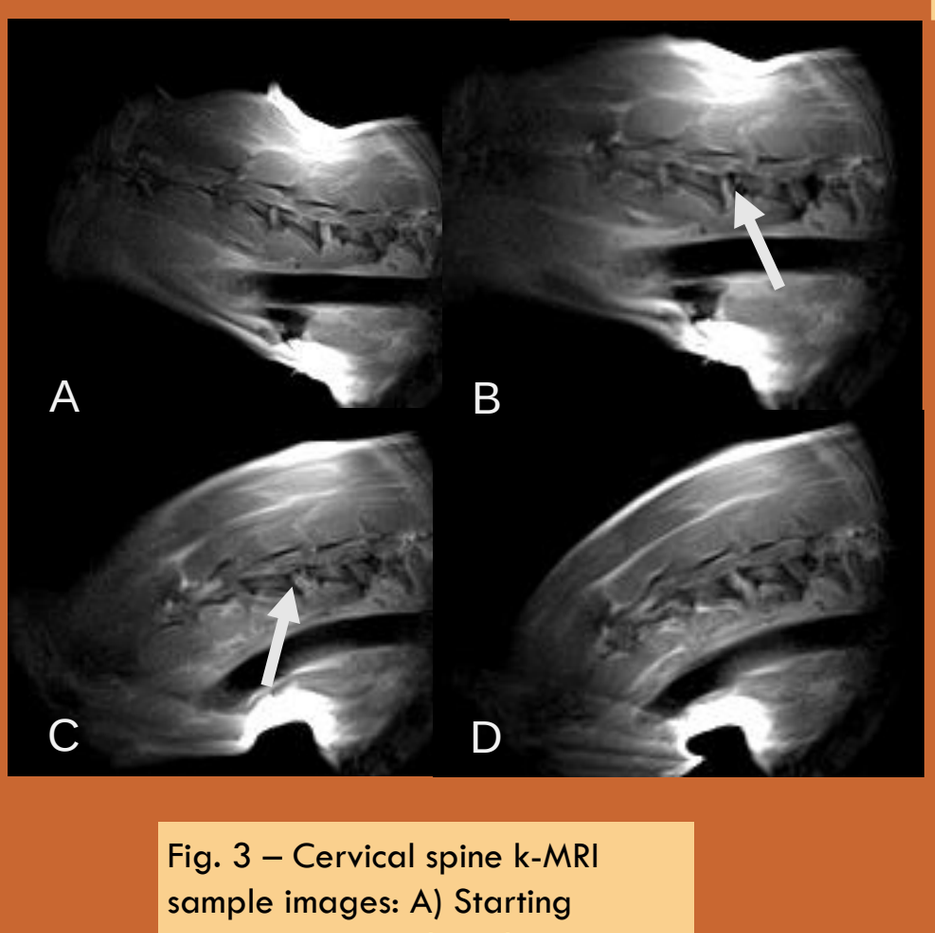

Fig. 3 – Cervical spine k-MRI sample images: A) Starting position, no spinal cord compression visibile. B, C, D) Neck flexion, C4-5 mild dynamic subluxation is visible (arrows).

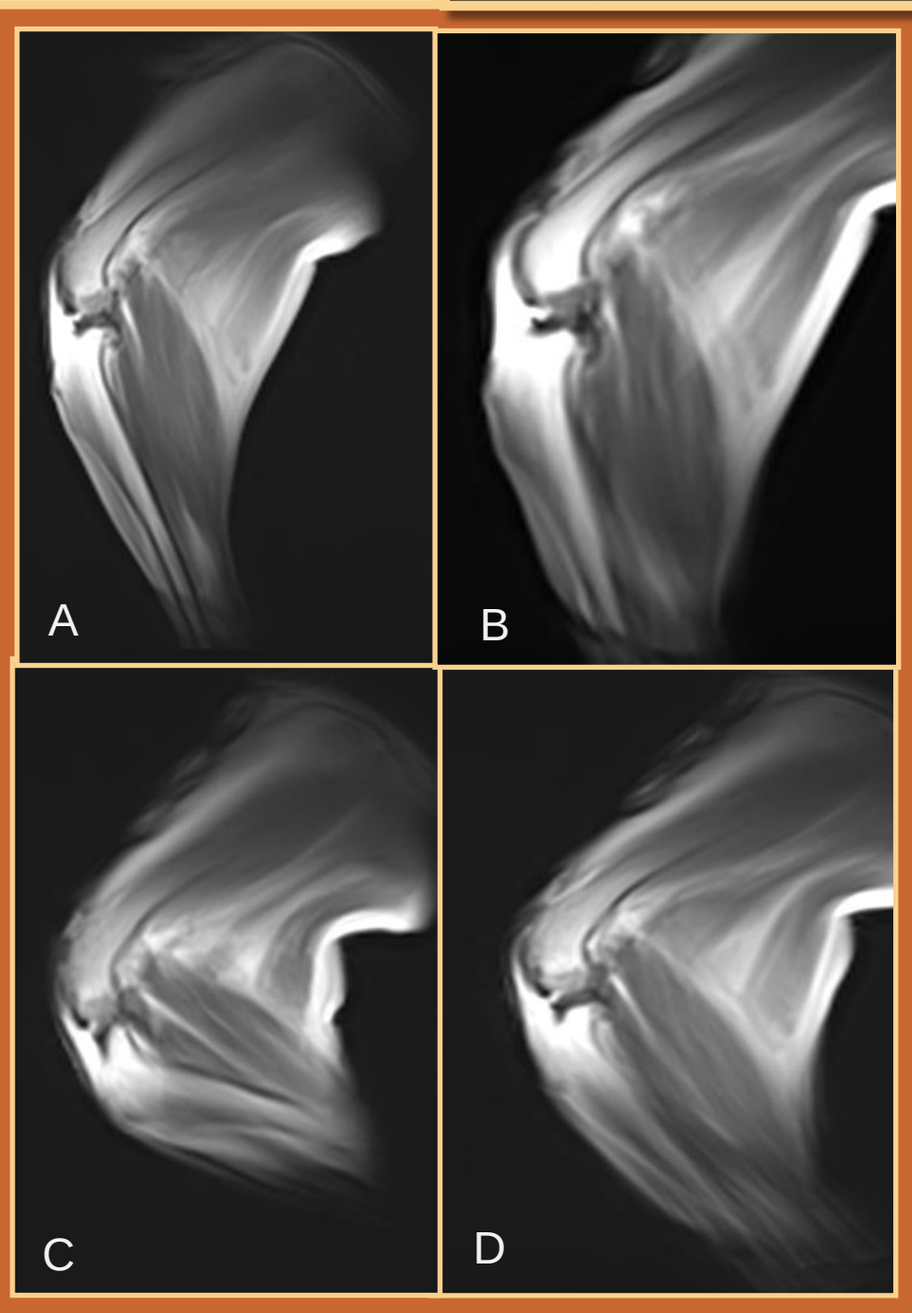

Fig. 4 – Stifle k-MRI sample images: A) Tibial compression test (TCT) at starting position, normal femoro-tibia allignment. B) TCT end point, cranial subluxation of the tibia due to surgical cranial cruciate ligament resection. C) flexion and D) estension movement, no subluxation visible.

Fig. 5 - k-MRI of the elbow. A) starting flexion, B) point of maximum flexion. In this image can be seen bending without artifacts.

CONCLUSION

Based on the results of this proof of concept preliminary cadaveric study, the real-time acquisition technique is a feasible kMRI procedure to be applied to the canine cervical spine, elbow and stifle joints. Additionally, the technique provided good to excellent information about spine and joint instability. Therefore, we could consider k-MRI a promising technique in veterinary medicine. Further studies and an in-vivo settings are needed to increase the quality of the k-MRI images, and to evaluate its clinical and diagnostic usefulness.