THE MENISCUL KINETIC CHANGE OF PORCINE KNEE: MOTION KNEE MRI

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INTRODUCTION

Meniscus of the knee is fibrocartilaginous structures which has a role in load transmission, shock absorption, proprioception, improvement of stability and lubrication of the knee. To perform these roles efficiently meniscus is deformed and displaced in response to the loading and the bending motion of the knee joint.Magnetic resonance imaging (MRI) has demonstrated good image quality of both bone and soft tissue noninvasively, and has used successfully in previous studies involving meniscal kinematics. However, previous MR studies investigating meniscal dynamics have been performed only in static state. We presumed that meniscus, whose elasticity is much lower than bone, shows different shape between functional movement and static state.

To investigate the meniscus role during functional movement, we took MRI during flexion/extension movement of porcine knee joint.

MATERIALS AND METHODS

Five porcine knee were included in this study. All subjects underwent MRI using a 1.5-Tesla MR scanner. We manufactured the custom-made device for knee motion, which enable to stabilize the femur and to move the lower leg smoothly. First, we took MRI of porcine knee in static state at phased flexion angles of 0 degree, 15degrees, 30degrees, 45degrees, and 60degrees, and took motion MRI with the device during the flexion/extension movement of the knee. Then lateral meniscal root tears were created and took static images and motion images. As comparison items meniscal slope and the aspect ratio of meniscus were measured. Motion images, which was taken during movement from extended position to flexed position, corresponding to the flexion angle of the five static images were selected and compared before and after lateral meniscal

root tear. We measured meniscal slope with reference to recent literature, but on basis of tibial grows plate because porcine knee's tibial surface is not plateau. Aspect ratio is ratio of vertical and horizontal length of meniscus if the line on the grows plate of sagittal image is defined as vertical axis

RESULTS

The influence of lateral meniscal tear to lateral meniscal slope was 2.23±0.20 degrees in static images, and 5.75±0.89 degrees in motion images ($p<0.01$) and to medial meniscal slope was 1.08±0.70 degrees in static images, and 0.78±1.26 degrees in motion images ($p=0.47$). The influence of lateral meniscal tear to the aspect ratio of lateral posterior horn in motion images were larger than in static images ($p=0.014$). The aspect ratio of lateral posterior horn after created tear in motion images were similar to that of both static images. The aspect ratio of lateral anterior horn and medial anterior and posterior horn showed no significant change before and after lateral meniscal tear.

	Static state (degrees)	Motion (degrees)
Lateral meniscus	2.23±0.20	5.75±0.89
Medial meniscus	1.08±0.70	0.78±1.26

Table 1: Meniscal slope change before and after lateral meniscal root tears

DISCUSSION

This study is the first report to investigate meniscal kinetics during movement by MR images. It is suggested that during flexion movement, meniscus is flatter than in static state even if the knee is flexed to the same angle. Meniscal kinetics may be different between in motion and in static state and motion MRI will be necessary to understand meniscal function in vivo.

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DISCLOSURES

The authors declare no conflict of interest associated with this manuscript.