PURPOSE

Acquiring multi-planar high resolution magnetic resonance (HR) images of cartilage is a reasonable test in a busy clinical setting. However, reduced SNR and CNR efficiency, radial k-space trajectories, subsampling, and high motion corruption render bSSFP inefficient for cartilage. It was developed a rapid MR technique called VIPR-ATR for obtaining four-dimensional high resolution HR images of the knee joint. The objective of this study was to compare VIPR-ATR with other three-dimensional MR sequences for tissue contrast, cartilage lesion conspicuity and to compare differences in normalized SNR and CNR efficiency values for tissue contrast, clarity of articular surface, cartilage lesion conspicuity, and overall image quality.

METHODS

An MR examination was performed on the left knee of 7 patients by evaluating symptomatic meniscal and osteoarthritic findings. A 3-T Siemens 32-channel 180-channel Discovery MR750 system (GE Healthcare, Waukesha, WI) was used. A balanced steady-state free-precession (bSSFP) sequence was acquired with radial k-space trajectory called vastly under-sampled isotropic assessment and rapid multi-planar imaging of articular cartilage (VIPR-ATR). It was compared with other three-dimensional sequences: IDEAL-GRASS, IDEAL-SPGR, FSE-CUBE, and IDEAL-GRASS, and IDEAL-SPGR, but were normalized to voxel volume. Paired t-tests were used to evaluate differences in SNR and CNR efficiency measurements were performed on all MR examinations. The VIPR-ATR sequence was also able to evaluate the menisci, ligaments, and bone marrow.

RESULTS

VIPR-ATR and HR VIPR-ATR produced high quality multi-planar HR images of the knee joint following a single 5 to 10 minute scan time (Figure 1). VIPR-ATR produced significantly higher SNR and CNR values compared to IDEAL-GRASS and IDEAL-SPGR. HIGH VIPR-ATR and IDEAL-GRASS, and IDEAL-SPGR, but were normalized to voxel volume. Paired t-tests were used to evaluate differences in SNR and CNR efficiency values. The VIPR-ATR sequence was also able to evaluate the menisci, ligaments, and bone marrow. Additional studies are needed to determine the validity of these techniques in clinical practice.

CONCLUSIONS

This study demonstrates that VIPR-ATR, a rapid, multi-planar, high resolution, multi-planar, fat-suppressed sequence for cartilage assessment in the osteoarthritis Initiative produces high quality images of the knee joint. Due to its highly versatile bSSFP tissue contrast, VIPR-ATR makes it optimal for evaluating the articular cartilage of the knee joint. Additional studies are needed to determine the validity of these techniques in clinical practice.

References