Comparison of three-point Dixon Chemical-Shift Sequence with Quad-Field-Echo Sequence on a Low-Field-Strength Open Magnet for evaluating articular cartilage defects

Pier Paolo Arcuri,1 Giancarlo Tripodi,2 Vincenzo Arcuri,1 and Fortunato Serrao1
1: Radiology, Pugliese-Ciaccio Hospital, Catanzaro, Italy
2: Orthopaedic, Pugliese-Ciaccio Hospital, Catanzaro, Italy
arppaolo@alice.it, giancarlotripodi@alice.it, varcuri@aocatanzaro.it

Abstract—Few studies have specifically addressed the capabilities of low-field strength MR imaging in the evaluation of articular cartilage defects [1], [2]. A method for fat suppression using a low-field magnet is the phase-contrast method, described by Dixon [3] that is based on the chemical-shift phenomenon. An alternative imaging method using a low-field magnet is the modified three-point Dixon sequence with a single radiofrequency echo single-scan for water and fat separation [4]. The purpose of our study was to compare the diagnostic ability of the three-point Dixon sequence with Quad-Field-Echo sequence for evaluating articular cartilage defects on a 0.35 T open magnet, correlated with arthroscopy.

Index Terms—Three-point Dixon Chemical-Shift Sequence, Quad-Field-Echo Sequence, articular cartilage defects, arthroscopy, MRI.

I. PURPOSE/INTRODUCTION

Some studies have specifically addressed the capabilities of low-field strength MR imaging in the evaluation of articular cartilage defects [1], [2]. A method for fat suppression using a low-field magnet is the phase-contrast method, described by Dixon [3] that is based on the chemical-shift phenomenon. An alternative imaging method using a low-field magnet is the modified three-point Dixon sequence with a single radiofrequency echo single-scan for water and fat separation [4]. The purpose of our study was to compare the diagnostic ability of the three-point Dixon sequence with Quad-Field-Echo sequence for evaluating articular cartilage defects on a 0.35 T open magnet, correlated with arthroscopy.

II. SUBJECT AND METHODS

We prospectively studied 167 patients. The images were obtained with an 0.35 T open magnet (OPART, Toshiba). Were studied patellar and talus cartilage. Imaging parameters were: Quad Field-Echo 2D (TR/TE, 834/40; flip angle, 23°) and Water-Fat Spin-Echo Three-Point Dixon (TR/TE, 1200/36).

III. RESULTS

The axial plane showed higher sensitivity and specificity (respectively 77% and 89%) than sagittal plane (63% and 71%). Were identified 64 cartilage defects: 18 grade I, 37 grade II, 7 grade III and only 2 grade IV. Three-point Dixon sequence showed higher sensitivity (81%) than Quad-Field-echo sequence (72%) in detection grade I and II of cartilage defects (Fig. 1, 2). In lesions with involved sub-condral bone (Fig. 3) and lesion grade III (Fig. 4), Quad-Field-Echo recorded a sensitivity of 78% (as against Dixon 89%). The sensitivity in detection IV grade lesions was substantial the same (89% Quad and 91% Dixon).

IV. DISCUSSION/CONCLUSION

At a low field strength, the time needed for the water and fat signals to transition from in-phase to out-of-phase is longer than at a high field strength. Therefore, both in -phase and out-of-phase data can be acquired after a single excitation, in contrast to the other Dixon methods that required 2 or 3 excitations. Our Dixon method uses a single radiofrequency echo, which leads to a considerable reduction in imaging time for this sequence. Our study showed that cartilage defects can be evaluated reliably with low-field-strength MR imaging using the modified three-point Dixon sequence.
Fig. 2. Grade II of cartilage defect.

Fig. 3. Lesions with involved sub-condral bone.

Fig. 4. Grade III lesion.

REFERENCES


