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

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***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 artroscopy.**

***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 artroscopy.

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 highr 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 sensibility (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 sensibility of 78% (as against Dixon 89%). The sensibility in detection IV grade lesions was substantial the same (89% Quad and 91% Dixon).

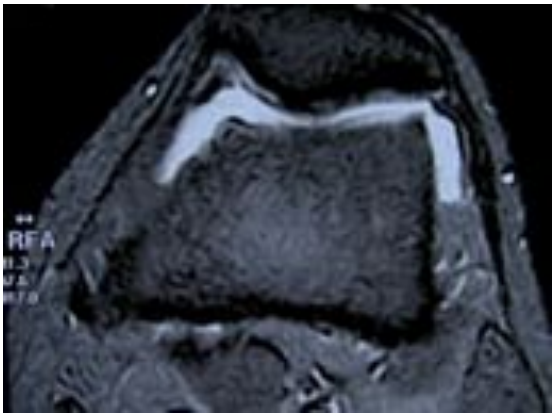

Fig. 1. Grade I of cartilage defect.

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. references.

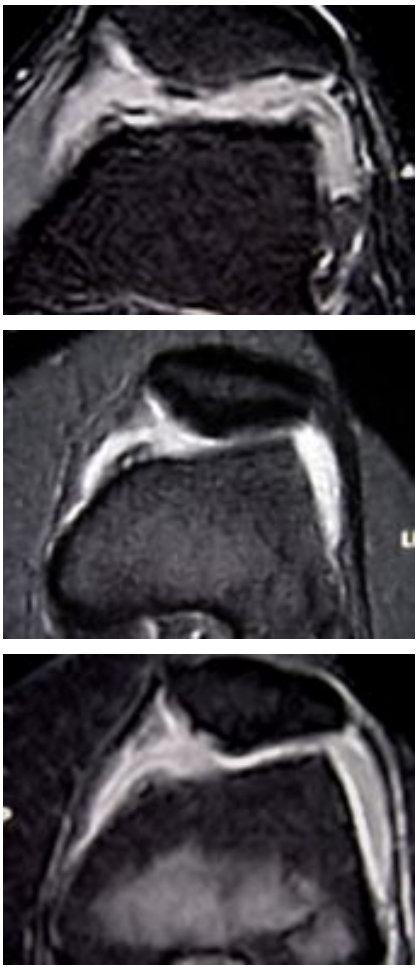

Fig. 2. Grade II of cartilage defect.

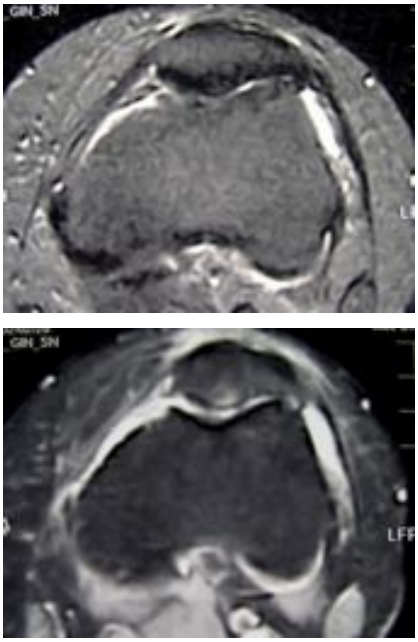

Fig. 3. Lesions with involved sub-condral bone.

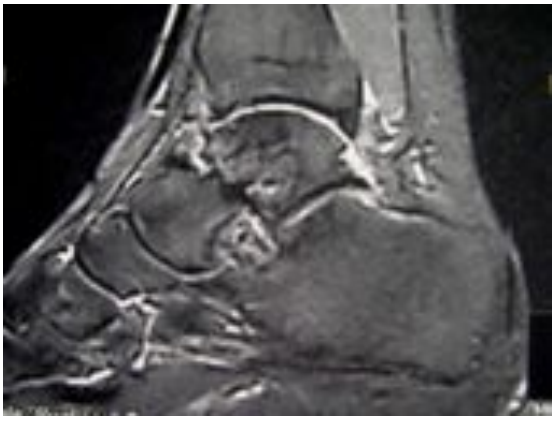

Fig. 4. Grade III lesion.

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