Chemical Shift Artifact in Center-Out Radial Sampling: A Potential Pitfall in Clinical Diagnosis

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Introduction

Chemical shift artifact is a well-known phenomenon in rectilinear sampling that causes fat signal to be displaced from the water signal in the direction of the readout by an amount that depends on the field strength and bandwidth. In most sequences the readout direction is fixed so the shift is always in one direction.

Center-out radial sampling is a fundamentally different sampling strategy that has the property of employing a unique direction for each readout. Off-resonance artifacts (of which chemical shift is an example) are typically described as blurring for this type of sampling, however a more precise description is that the point-spread function becomes ring-shaped (1,2). Characterizing the effects that this produces in images is important in clinical diagnosis since certain types of pathology or anatomy may be mimicked by the chemical shift artifacts of fat.

Results

Data were acquired on a GE 3.0 T Excite scanner. Figs 1 & 2 show phantom experiments with oil/water mixtures, revealing a radially symmetric artifact of the off-resonance species (i.e. oil). At the lowest bandwidths there are gross displacements of the oil signal in all directions. There are slight asymmetries to the artifact which are most evident at the lowest bandwidth and may reflect susceptibility-induced off-resonance. Fig 3 shows an *in vivo* example of the chemical shift artifact; the arrows show the displacement of fat mimicking bilateral subdural hematomas.

Fig 1 Water phantom with central oil dot. Matrix 256^2, FOV 15cm, TE 2.3ms, bandwidth ±62, 31, 15, 8 & 4 kHz.

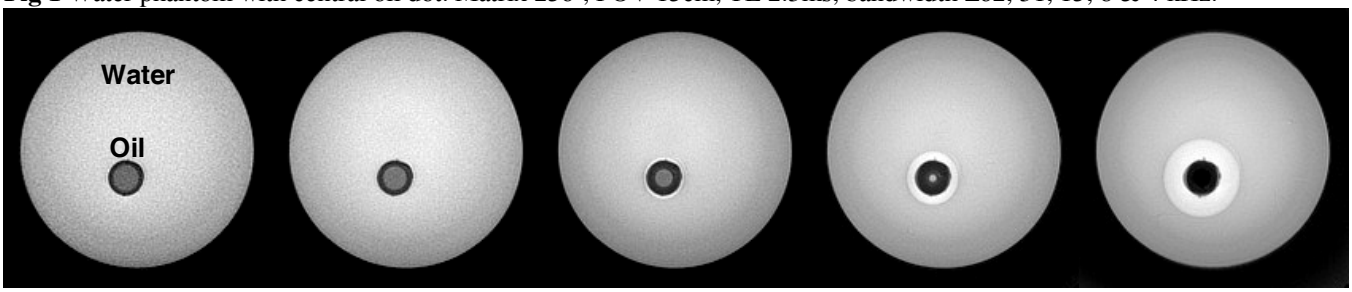
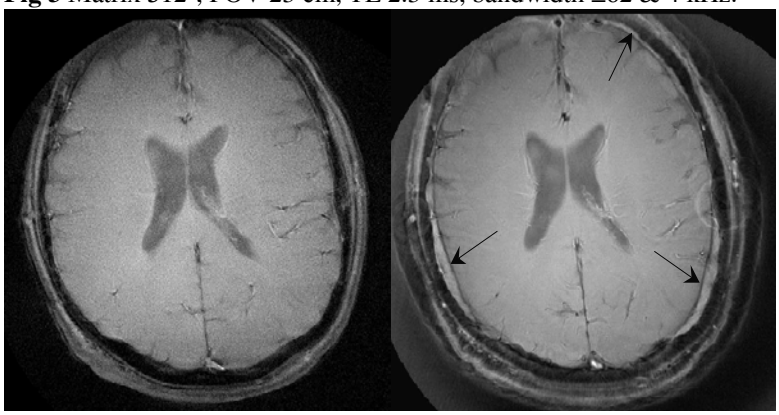


Fig 2 Water phantom with internal oil ring. Matrix 256^2, FOV 15cm, TE 2.3 ms, bandwidth ±62, 31, 15, 8 & 4 kHz.

Discussion

Off-resonance and T2 decay effects have been studied previously for radial sampling although they are typically described as blurring with center-out ½-projections (3,4) or as "horse-shoe" artifacts with full-projections (5). In fact, the off-resonance effect in center-out radial sampling creates a ring-shaped point spread function (1,2), which can result in distinct artifacts that mimic pathology (Fig 3) or anatomy such as periostium and articular cartilage. Artifacts due to susceptibility and flow may also produce unusual artifacts that need to be identified as potential pitfalls in clinical diagnosis.

Fig 3 Matrix 512^2, FOV 23 cm, TE 2.3 ms, bandwidth ±62 & 4 kHz.



References

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