evolution

MRI: **Good to Know**

SPED

Spin Echo Dixon (SPED) for Dedicated MRI

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Introduction

Fat-water separation using the Dixon method can be achieved by applying a Spin Echo or Gradient Echo sequence. Both sequences have their own peculiarities: while the Gradient Echo potentially is the faster between these sequences, the Spin Echo is more robust and less prone to artefacts.

The new Esaote Spin Echo Dixon or SPED is, like the name says, a Spin Echo variation of the existing Esaote Gradient Echo Dixon technique XBone, taking advantage of the same chemical shift effect.

How it works

The SPED sequence is a Spin Echo type sequence with two echoes, in which the echo times are determined automatically by the software according to the resonance frequency and the chemical shift between water and fat to generate two images in which the water and fat signals are respectively in phase and in counter phase.

The subsequent data processing creates the two images containing respectively only the fat signal and only the water signal, obtaining the desired water/fat separation.

Figure 1: Acquired Images

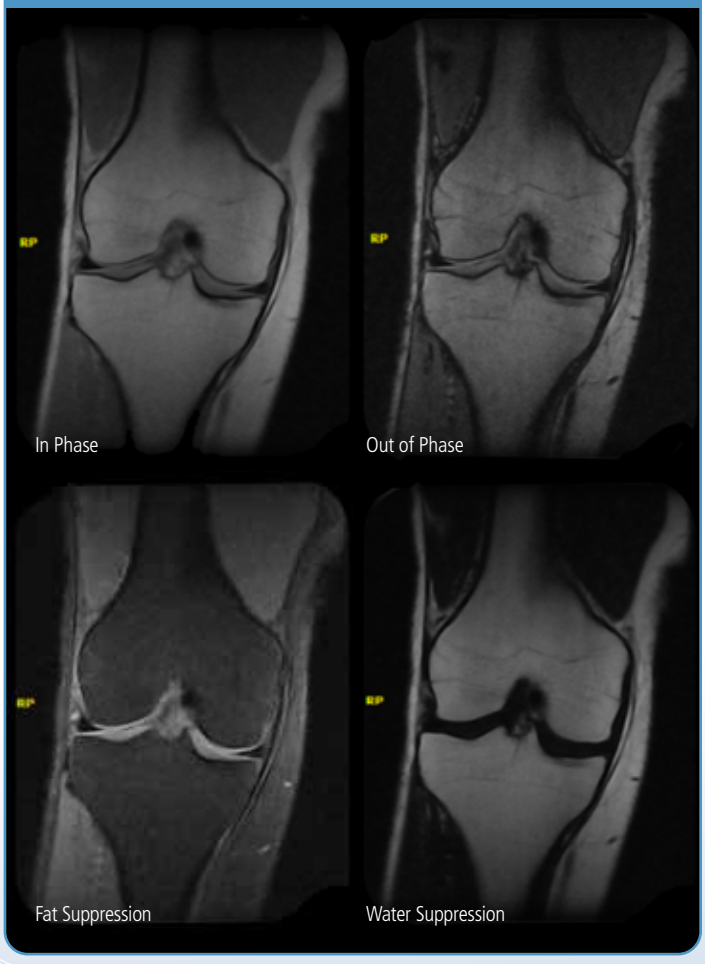


Figure 2: Representative behaviour of Water and Fat signals. a) before slice excitation, b) when the spin echo refocusing condition is reached (in-phase signals), c) in correspondence of the gradient echo refocusing (out-of-phase signals).

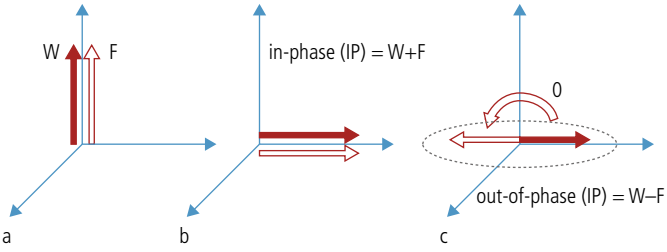


Figure. 3 - RF and gradients time evolution for SPED sequences. "G slice" is the slice selection gradient -"G phase" is the phase encoding gradient -"G readout" is the frequency encoding (or reading) gradient.

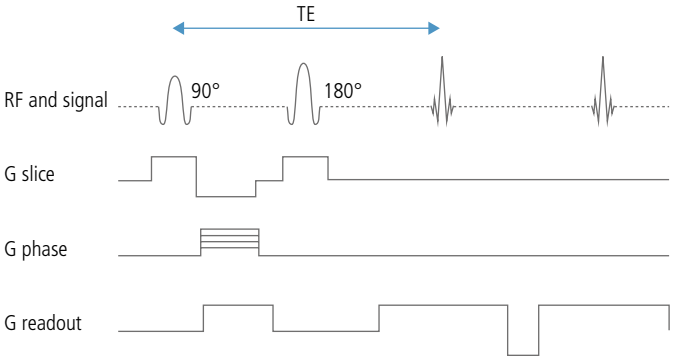
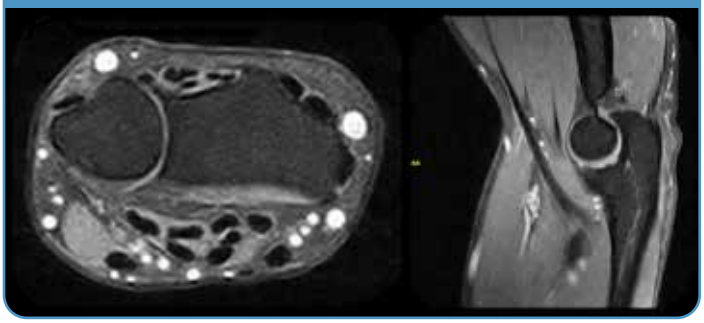


Figure 4: SPED PD, Fat Suppression



The SPED sequence offers the possibility to achieve a Fat/Water separation T1 contrast as well as a PD weighted image by changing the repetition time (TR).

A TR more than 1500 ms or more produces a PD-weighted images, whilst a lower value produces a more T1-weighted image.

The principal advantages are listed below:

- SPED provides morphological information and Fat Suppression based on PD-weighted contrast.
- SPED provides higher resolution definition compared to STIR sequences
- SPED can be used for identifying MSK pathologies sensible to PD contrast (Fracture, Oedema, Tears)

Figure 5: SPED PD, Fat Suppression - Meniscal Tear, TR = 1600 ms

Figure 9: SPED PD, Fat Suppression - Posterior Tibial Edema, TR = 1500 ms

Figure 6: SPED PD, Fat Suppression - Radius Fracture, TR = 2000 ms

Figure 10: SPED T1, Fat Suppression, TR = 480 ms

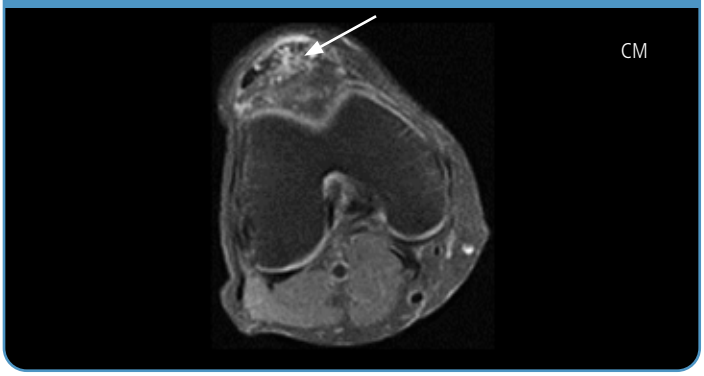


Figure 7: SPED PD, Fat Suppression - Bone Oedema, TR = 1800 ms

Figure 11: SPED PD, Fat Suppression - Metal Implant, TR = 1300 ms

Figure 8: SPED PD, Fat Suppression, TR =1800 ms

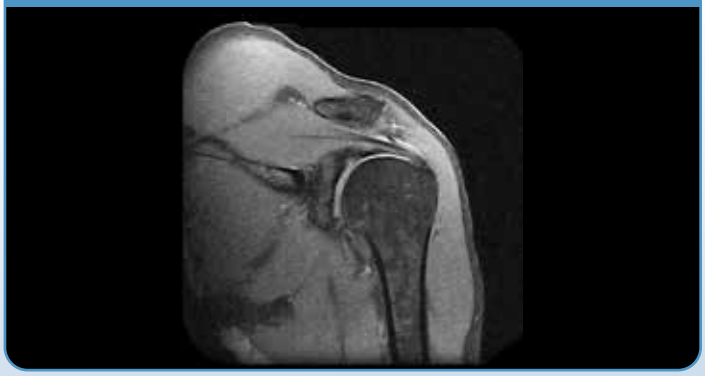
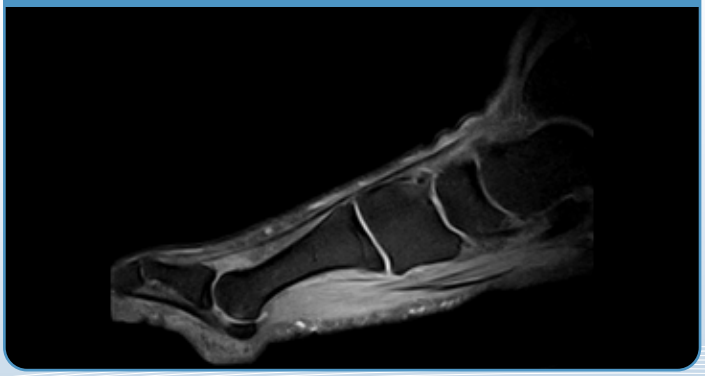


Figure 12: SPED PD, Fat Suppression - TR = 1500 ms



All images, courtesy of our customers

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