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Fast susceptibility weighted imaging with premium image quality

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Fast susceptibility weighted imaging with premium image quality

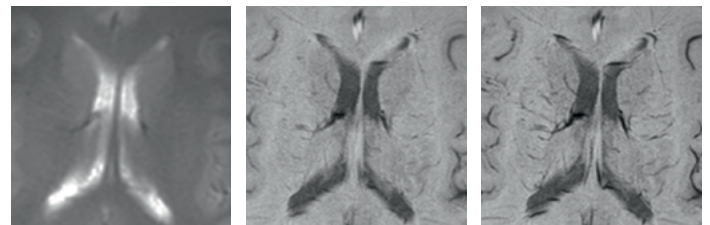
The new SWIp method for susceptibility weighted imaging provides exquisite contrast and resolution in short scan times

Susceptibility weighted imaging (SWI) enhances the contrast between tissues with susceptibility differences; for instance, the contrast between deoxygenated blood or some mineral deposits (e.g. calcium deposits) and surrounding tissue. Due to this contrast enhancement, SWIp images are sensitive for structures containing venous blood. When used in combination with other clinical information, SWIp may help radiologists in the diagnosis of various neurological pathologies.

Typical SWI methods

Image contrast in susceptibility weighted imaging is based on differences in tissue susceptibility. The susceptibility of a tissue is the degree of magnetization it gets in a magnetic field, which influences $T2^*$ and the phase.

The long available $T2^*$ FFE technique is fast with well established contrast. A high resolution 3D $T2^*$ FFE method with long TE already shows some contrast in veins. Conventional SWI uses phase information, which enhances the contrast in veins, but this typically takes a long scan time.

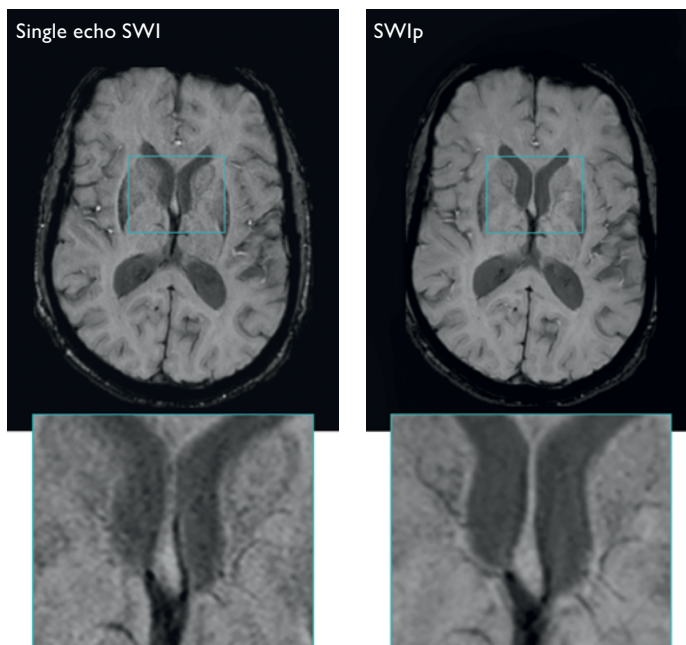


T2 FFE, 2-3 min.

3D T2 FFE, long TE

Typical SWI, 5 min.

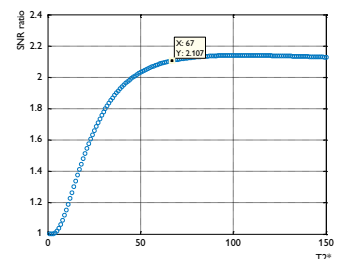
SWIp combines premium image quality with fast and robust scanning

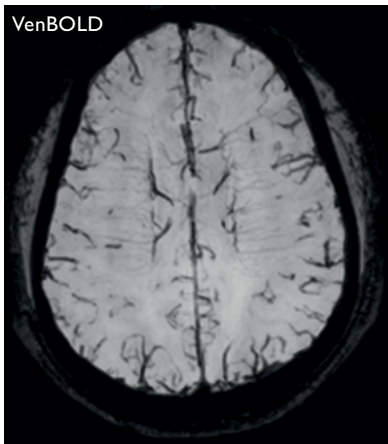


Typical susceptibility weighted imaging has relatively long scan times, which limits feasibility for routine use. Philips therefore developed the SWIp technique. It is based on a high resolution 3D whole brain acquisition. It uses phase information to get enhanced susceptibility contrast, in combination with a 4-echo FFE acquisition to increase SNR compared to single echo techniques. A short scan time, while maintaining high SNR, may then be obtained leveraging dS SENSE.

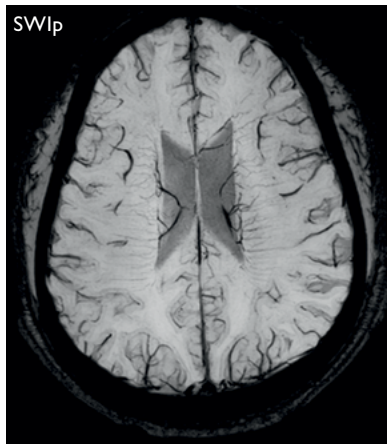
Comparing multi-echo SWIp to single-echo SWI shows the gain in SNR.

The gain in SNR is demonstrated to be 55% to 110%, depending on the $T2^*$ of the tissue.



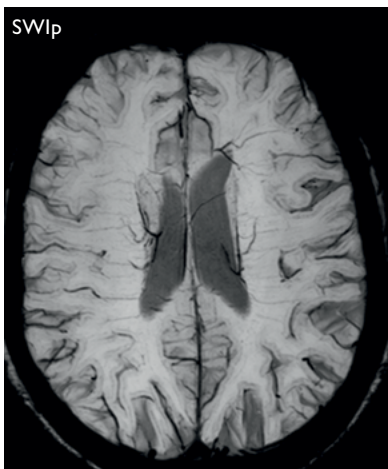


1.0 x 1.0 x 1.0 mm 6:17 min.

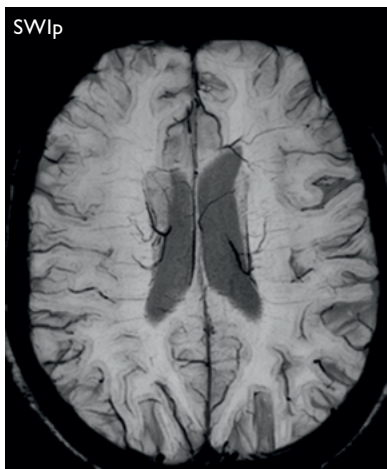


0.6 x 0.6 x 1.0 mm 4:32 min.

The SWIp technique provides exquisite images with high sensitivity to venous blood products. SWIp can be acquired with high resolution and quite short scan time.

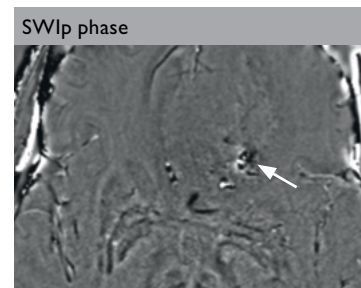
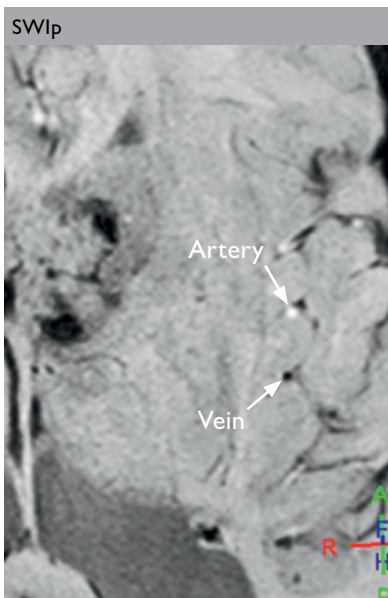


0.6 x 0.6 x 1.0 mm 4:30 min.

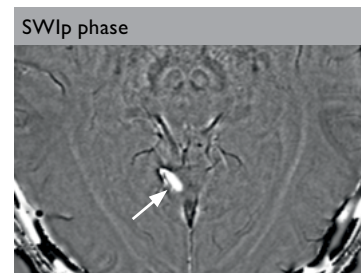


0.6 x 0.6 x 1.0 mm dS SENSE 4.5, 2:30 min.

Adding dS SENSE factor 4.5 to SWIp with high resolution (voxels 0.6 x 0.6 x 1.0 mm) reduces scan time from 4:30 min. to only 2:30 min. while maintaining excellent image quality. Ingenuia 3.0T with 32-channel dS Head coil.



Venous blood



Calcification

SWIp may help provide arterial and venous information based on signal intensity differences.

Phase maps may be used for advanced diagnosis. On phase images venous blood typically shows as hypointense signal whereas as calcification typically shows as bright signal.

Courtesy of University of Michigan, USA.