**Target audience:** Clinician and researchers working with diffusion-weighted imaging (DWI).

**Purpose:** To propose a novel DWI data acquisition scheme to measure both $T_2$ and ADC simultaneously in attempt to correct for $T_2$ shine through or $T_2$ black out effect.

**Methods:** DWI is known to be affected by relaxation time$^1$. Practically only $T_2$ relaxation effect is of concern and can be represented as $S = S_0 \cdot \exp \left(-\frac{b \cdot T_2}{T_2} \right) \cdot \exp(-b \cdot ADC)$. The proposed schema here uses minimum echo time (TE) for each b value measurement to increase SNR and also to provide varying TE. In addition, a data point at low b value and long TE is added to provide stability to fit to the equation. Once ADC and $T_2$ have been fitted, it is possible to remove $T_2$ shine through effect by removing the $T_2$ dependent component. Abdominal DWI measurement with b=100, 100, 400, and 800 s/mm² and corresponding TE=34, 80, 42 and 49 ms on 1.5T Siemens Aera.

**Results:** Figure 1 shows the difference between Relax DWI and normal DWI, and that they also agree with each other as the data points falls on the same b value and TE plane. Relax DWI has the advantage of higher SNR due to shortened TE. Figure 2 shows a peritoneal metastasis ADC and $T_2$ images. It is clear that the metastasis is a longer $T_2$ and hence $T_2$ shine through effect on the high b value and long TE DWI images. This can be corrected by substituting TE 0 ms to the equation and surrounding tissue become more visible on the high b value DWI. Figure 3 shows $S_0$, ADC and $T_2$ map for abdominal organs, liver, kidney and spleen. Liver is demonstrated here to have a shorter $T_2$ than surrounding organs and hence liver DWI typically have $T_2$ blackout effect. This can be corrected with the above method.

**Discussion:** Relax DWI only require additional scan time equivalent of an additional b value for DWI and gain $T_2$ maps in addition to ADC maps. Relax DWI as proposed now only works for tissue with single ADC component. Therefore, b value was used from b 100 s/mm² onwards to avoid perfusion component. It is possible to consider tissue with multiple ADC components in further study.

**Conclusion:** Relax DWI is able to correct for $T_2$ related effects on DWI by provided $T_2$ map along with ADC map.

**References:**