**ABSTRACT SUBMISSION FORM**

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**PRESENTATION TITLE**

Longitudinal effects of radiation therapy on white matter structures, as measured by diffusion MRI.

**AUTHOR(S)**

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**ABSTRACT**

**Purpose:** To demonstrate the regional sensitivity of WM structures to radiation exposure

**Materials & Methods:** We selected a male subject, age 58 at diagnosis, who suffered from a LH fronto-parietal GBM, received IMRT with 60 Gy dosing in 30 fractions, underwent partial resection surgery and received Temodar-based chemotherapy. All the dMRI data were processed using ExploreDTI. To account for the spatial heterogeneity and complexity encountered in brain cancer, we aimed to have the CT/RT and dMRI data in the same space: first motion and distortion corrected was performed using the CT as registration target. Then, we performed an atlas-based ROI analysis. This step provides diffusion metrics based on volumetric ROIs in the native space for every data point. Fig. 1 showcases performance of the processing steps. Patient data was kindly provided by MD Anderson Cancer Center, Houston, Texas, USA.

**Results:** To analyse the longitudinal effects of high vs low dosing, we chose two ROIs around the tumour location: inferior-parietal (InfPar) and superior-parietal (SupPar) WM. Fig. 2 shows that both ROIs have decreased FA and increased MD in the same hemisphere (proximal – high dose), compared to the other hemisphere (distal – low dose). To further explore this effect, we analysed the AD, RD, and volume change. Both AD and RD were increased for the high dose, while no trend was observed for volume change. Both AD and RD were increased for the high dose, while no trend was observed for volume change.

**Conclusions:** The preliminary results seem to be in line with previous evidence on the effect of RT on DTI scalars. WM proximal to the tumor location received high radiation dose shows less anisotropy. The FA and MD point towards the same effect and the AD/RD ratio trend towards equilibrium further explain the effect. One direct implication could be that regional constraints on WM structures should be part of the standard clinical protocol (i.e., besides the current guideline on organs at risk). To conclude, we have showed that it is possible to study long-term RT-induced damage on WM regions with high spatial specificity using dMRI, and that the current pipeline is one feasible method to do so.
**Figure 1.** (a) Alignment of the DEC map on the b0 image. The tumor is located fronto-parietal in the LH. (b) Volume rendering of atlas-based ROI proximal to tumor location (InfPar WM) overlaid on the DWI.

**Figure 2.** Longitudinal trends in diffusion metrics for proximal (LH) and distal (RH) atlas-based WM ROIs following RT. (a) Decreased FA for proximal compared to distal WM, for both ROIs; (b) Increased MD proximal compared to distal WM for both ROIs; (c) Increased AD proximal compared to distal WM for both ROIs; (d) Increased RD proximal compared to distal WM for both ROIs.