

# TE average as a tool for functional MRS of glutamate at 3 Tesla

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## Introduction

Functional MRS (fMRS) of glutamate (Glu) is of high interest since it is the main excitatory neurotransmitter. There is a problem of separating Glu and glutamine signals in MRS, especially at 3 Tesla. One of the ways to obtain Glu signal uncontaminated by glutamine is TE averaging (TEavg) [1]. We used TEavg to measure local Glu change in response to continuous visual stimulation at 3 T.

## Methods

Twenty healthy subjects (aged 20-34) participated in the study. Philips Achieva dStream 3T and Head-Neck SENSE coil were used. The *InVivo Sensavue* monitor, the mirror and home-made 8 Hz flashing checkerboard video were used for visual stimulation. 3D T1w images were obtained for voxel positioning. The spectroscopy voxel sized 20x40x30 mm was positioned in visual cortex (fig.1). TEavg was performed for TE=35, 45, ... 185 ms, NSA for each TE=16, resulting in 256 total averages, TR = 2000 ms (time ~8.5 mins). At first, spectrum in rest was obtained, after that – spectrum during continuous visual stimulation with the same WS and shimming parameters. Spectral processing was performed in LCMoDel, home-made program based on the FID-A package was written to simulate TEavg brain *in vivo* spectra; basis set for LCMoDel was created, Glu/Cr and NAA/Cr values were obtained in each spectrum. For each participant the relative effect of stimulation (stimulation/rest) on Glu/Cr and NAA/Cr were found. All relative values were compared with the value = 1 both with Mann-Whitney (MW) criteria and Student t-test.

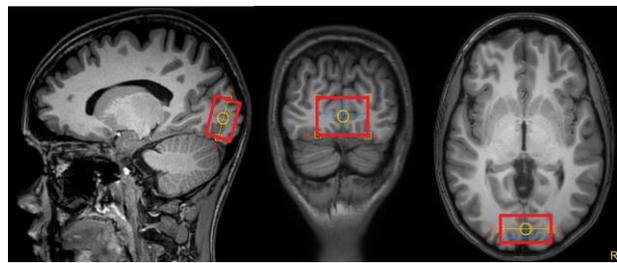


Figure 1. Voxel location in visual cortex

## Results

Typical TEavg spectrum and its processing in LCMoDel is demonstrated on fig.2. The single Glu peak at 2.35 ppm was perfectly fitted by the simulated basis set. The statistically significant increase of Glu/Cr was revealed, NAA/Cr remained unchanged.

Table 1. Relative changes (stimulation/rest) of all analysed metabolites (Mean ± Standard Error).

Metabolite	Mean	Standard Error
Glu/Cr	1.05*	0.02
NAA/Cr	1.0	0.01

\* -  $p < 0.01$

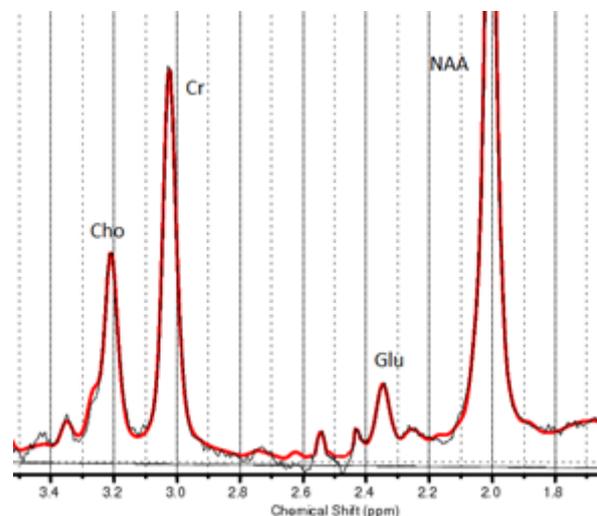


Figure 2. Typical TEavg spectrum and its fitting in LCMoDel

## Discussion

For the first time TEavg was used for functional MRS of glutamate. It allowed to confidently observe the growth of Glu at 3 Tesla during continuous visual stimulation, which is in good agreement with published data obtained at 7 Tesla [2, 3]. The neuronal adaptation effect did not affect Glu change after ~8.5 mins of stimulation. However, the stability of NAA in this study (that is often reported to be decreased in neuroactivation, for e.g. [4]) might be the manifestation of neuronal adaptation.

## References

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