

# T1 and T2 relaxation times of human median nerve at 3 Tesla

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## Introduction

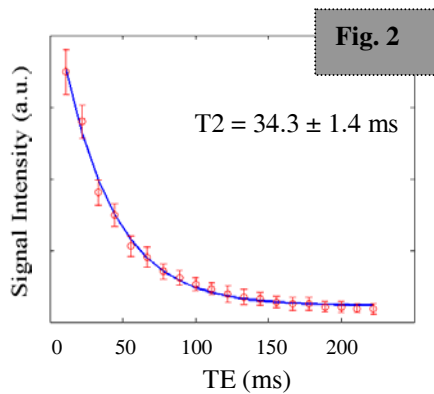
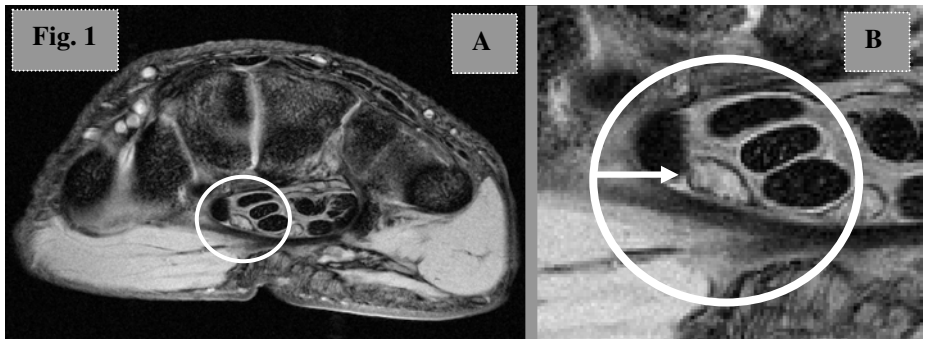
For optimized clinical MRI protocols, it is of particular importance to know the  $T_1$  and  $T_2$  relaxation times of the tissue under investigation. For most clinical relevant tissues and common field strengths  $T_1$  and  $T_2$  relaxation times of water protons are well known [1]. The  $T_1$  relaxation time of human peripheral nerves, however, has not been reported and the respective  $T_2$  relaxation time has been published only for 1.5 Tesla (in the median nerve, [2]), even though MRI of the peripheral nerves is of great clinical interest [3-5]. The purpose of this study was to investigate the water proton  $T_1$  and  $T_2$  relaxation time in human median nerve at 3 T to develop optimized clinical protocols for the investigation of the peripheral nerves [6].

## Methods

All MRI experiments were performed on a clinical 3 T Tim Trio Siemens scanner using a dedicated TX/RX CP wrist coil. Gradient echo images (TR/TE=800/9 ms, flip angle = 45°) were acquired for anatomical localization of the median nerve.  $T_1$  and  $T_2$  relaxation times were measured with an inversion recovery turbo spin echo (TR/TE=6000/15 ms, six inversion times TI = 36, 200, 1000, 2000, 4800, 5800 ms) and a multiecho CPMG (20 echoes, TR/TE=3000/11 ms) imaging sequence, respectively. Fat saturation was applied in both sequences.  $T_1$  and  $T_2$  were calculated within a manually segmented ROI of the median nerve by fitting the signal intensities to a monoexponential recovery and decay function, respectively.

## Results

Excellent anatomical delineation of the median nerve, at the level of the wrist, was obtained in the gradient echo images (Figure 1.A; zoomed in Figure 1.B, where the median nerve is indicated by the arrow). The average relaxation times of the median nerve were  $T_1 = 1410 \pm 70$  ms (n=3) and  $T_2 = 35.5 \pm 2.8$  ms (n=3). Typical relaxation decay and recovery curves are shown in Figure 2 and 3, respectively.



## Discussion

Despite the great clinical potential of MRI to investigate the peripheral nervous system (PNS), only little work has been published so far [2-6]. In general, development and optimization of such a clinical MRI application requires accurate knowledge of the  $T_1$  and  $T_2$  relaxation times of the PNS. The herein measured relaxation behaviour of water protons in the median nerve (long  $T_1=1410$  ms and short  $T_2=35$  ms at 3T) is consistent with the highly-oriented and densely-packed structure of the peripheral nerves, which consist of fascicles of individual fibers enclosed by connective tissue sheaths. The  $T_2$  measured in the current study is shorter than the value measured at 1.5 T ( $T_2 \sim 50$  ms [2]). This is in line with the expected decrease in  $T_2$  at higher magnetic fields for such a highly-oriented structure.

To date, the MRI assessment of peripheral nerve pathology has relied exclusively on qualitative imaging, mostly on observing abnormal signal intensities in  $T_2$ -weighted imaging. On the other hand, quantitative relaxation measurements as presented here have the potential to allow longitudinal studies, providing additional information about the course of the neuropathy over time, and make comparisons between individual patients possible.

## References and Acknowledgements

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