

Transcranial Magnetic Resonance Imaging-Guided Focused Ultrasound Treatment (tcMRgFUS) at 1.5 T: A Retrospective Study on Treatment- and Patient-Related Parameters Obtained From 52 Procedures

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tcMRgFUS treatments and objective



Essential Tremor



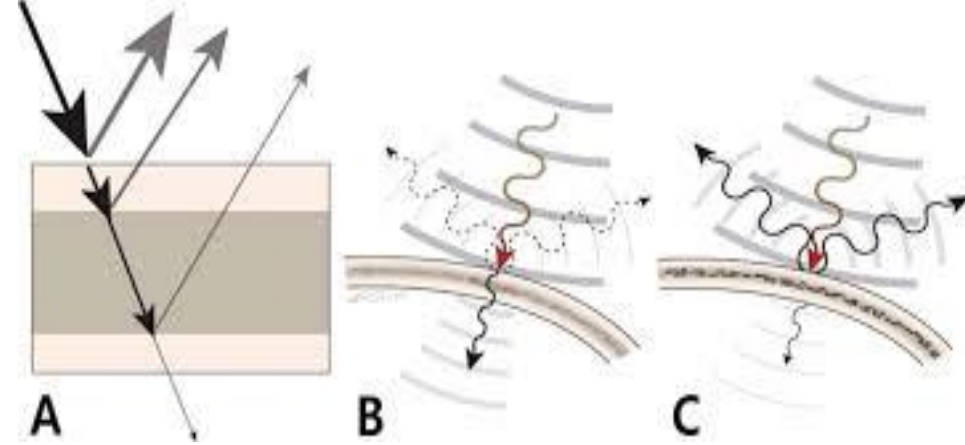
tcMRgFUS is a non-invasive therapy that combines imaging, to visualise diseased tissue, with the use of ultrasonic waves. This powerful combination can be used to treat various neurological disorders (e.g. essential tremors, Parkinson's disease).

Objective: to conduct a retrospective analysis of patient- and sonication-related parameters of a group of **52 patients** by investigating the effect of cranial morphology on the execution of **tcMRgFUS** treatment using a **1.5 T MRI** unit scanner.

Parameter affecting tcMRgFUS: Skull Density Ratio (SDR)

The **Skull Density Ratio (SDR)** is **average of the ratio between the trabecular and the cortex bone CT values (in Hounsfield units)**. It represents an estimate of how effectively a wave can pass through the skull.

It was found that a **higher energy is required** in case of patients with **low SDR values** to achieve the desired temperature rise because the skull hampers the HIFU energy transmission by reflecting and attenuating energy at interfaces differently compared with the case of patients with high SDR values.



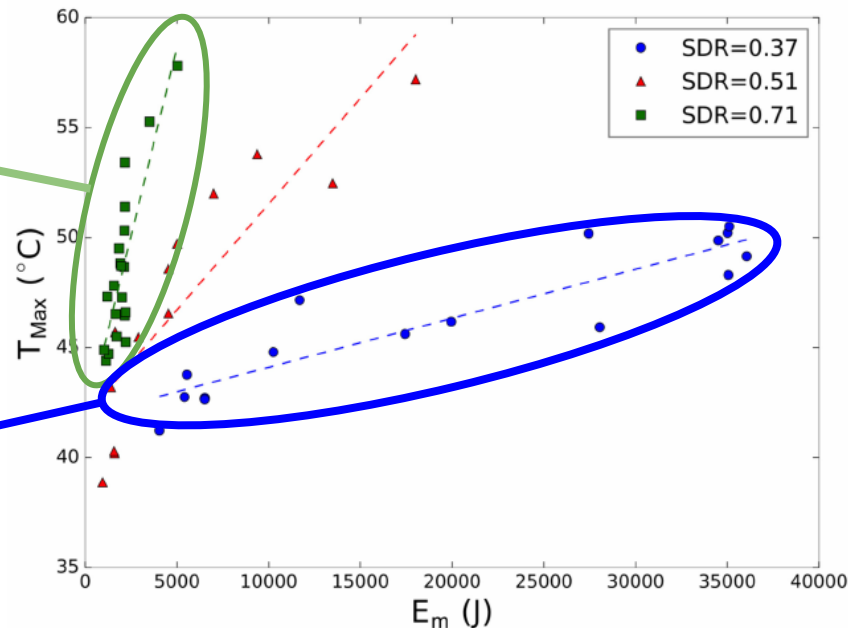
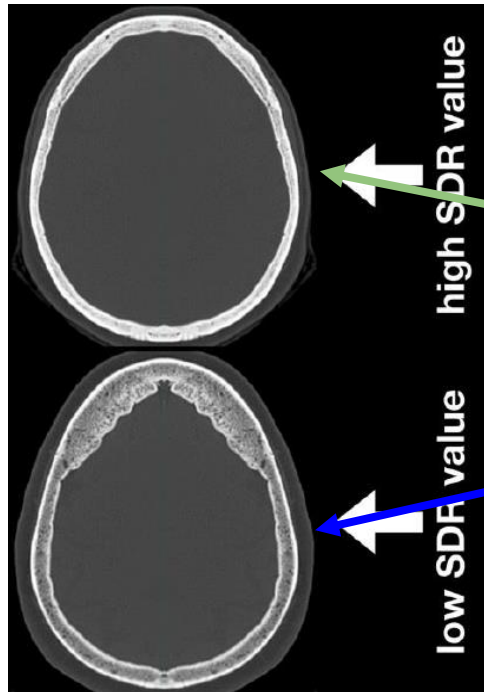
A: Attenuation and reflection of ultrasonic energy at the cortical level.

B: Higher energy transmission through higher SDR skulls.

C: Low energy transmission through skulls with lower SDR.

Results

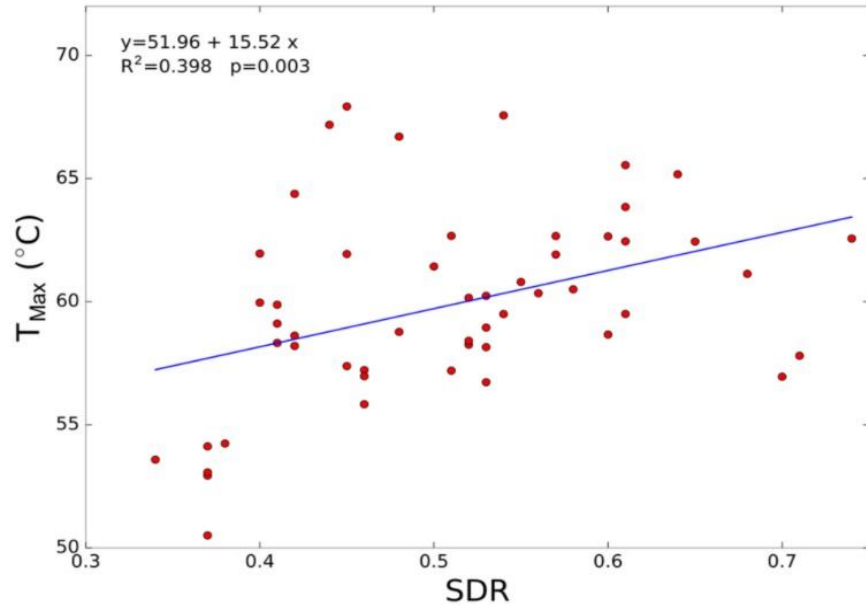
In this study, we analyzed the characteristic data of the treatment to verify the effect of SDR on the treatments of 52 patients



The amount of energy required to reach a temperature of 50°C at the target in the case patients with an SDR of 0.37 and 0.51 was more than five and two times, respectively, higher than that required for a patient with an SDR = 0.71. In certain cases (such as when SDR is 0.37) it was not possible to reach the preset temperature.

Results

For SDR values < 0.4 the maximum temperature has not reached 55 °C



As the SDR increases, the slope of temperature increase on the target increases.

