A THERMAL STUDY OF TUMOR TREATING FIELDS (TTFIELDS) FOR GLIOBLASTOMA TREATMENT

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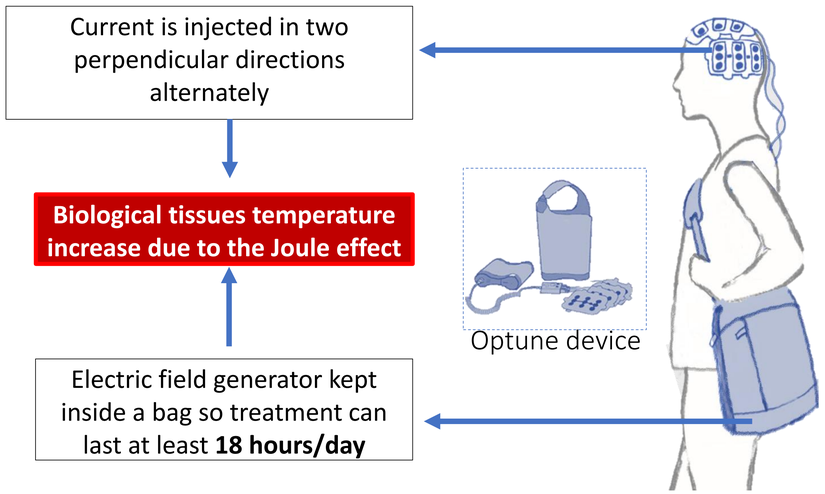
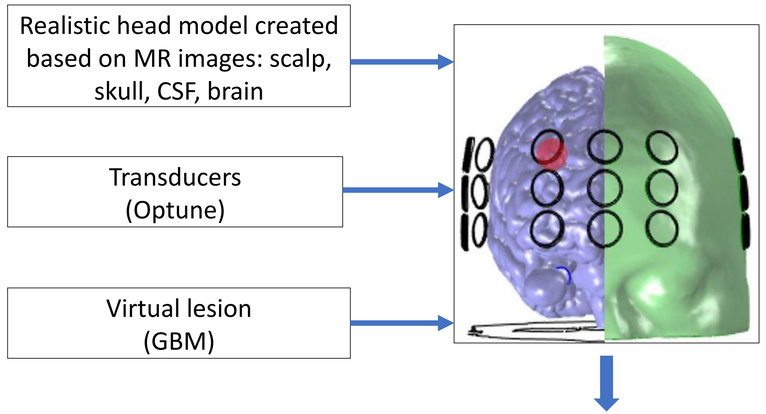
Introduction

Glioblastoma Multiforme (GBM) is one of the deadliest brain tumors. Its current standard of care includes surgery, radiation therapy, chemotherapy and, since 2011, Tumor Treating Fields (TTFields). The latter is a non-invasive technique that consists in applying an intermediate-frequency (100 – 300 kHz) alternating electric field (1 – 3 V/cm in the tumor) to affect the mitotic process of tumoral cells during metaphase and cytokinesis. This FDA-approved technique is applied in patients using a device named Optune, developed by Novocure.



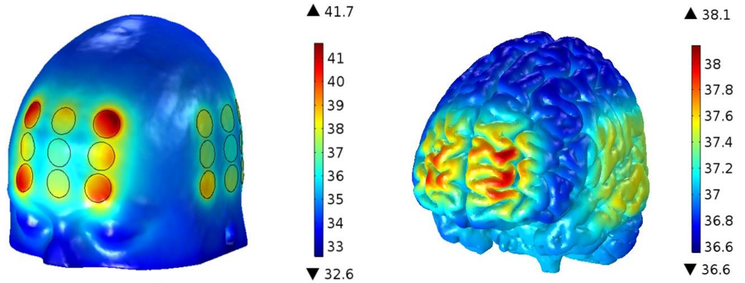
The goals of this work are to quantify the temperature increases during TTFields therapy and predict its thermal impact using a computational head model.

Methods



Results

Temperature distributions for scalp (left) and brain (right) surfaces are presented below. Increases occur mainly underneath the regions where the transducers are placed. All scales are in ºC.



Discussion

For this range of temperature increases significant thermal impact might be occuring in the brain, according to the literature. Changes such as variation in neocortical network activity, alterations in cell properties, metabolic rate and affinity of haemoglobin for oxygen are predicted.

Conclusions

None of the effects here predicted were reported during clinical trials. In the future, it is necessary to validate experimentally our model. Additionally, acquiring data that are sensitive to possible brain changes might help to corroborate or disprove our findings.

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