Cyprus University of Technology
Faculty of Engineering and Technology

Doctoral Dissertation

PHANTOM FOR BLOOD BRAIN BARRIER OPENING USING FOCUSED ULTRASOUND AND APPLICATION IN ALZHEIMER'S DISEASE

Tereza Alekou

Limassol, July 2021

CYPRUS UNIVERSITY OF TECHNOLOGY

FACULTY OF ENGINEERING AND TECHNOLOGY

DEPARTMENT OF ELECTRICAL ENGINEERING, COMPUTER ENGINEERING AND INFORMATICS

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Approval Form

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ABSTRACT

This doctoral dissertation is examining various challenges presented in the use of High Intensity Focused Ultrasound in brain applications. The study is separated into five different sub-studies in the area of agar phantoms and brain applications. The first study is concentrated on the design and creation of a suitable agar-based phantom to be used in HIFU application on the blood brain barrier opening. A model that currently is not available to researchers, whereas all experiments are performed on animal models. The second objective of this dissertation is the evaluation of the attenuation of agar-based phantoms with various concentrations. The next study includes the evaluation of the mechanical properties of agar-based phantoms such as the structure and the stiffness since these data will help in understanding the structure of the phantom according to its composition. The fourth study includes the evaluation of an alteration in the composition of an agar phantom with the use of a preservative and its effect on the life of the phantom in combination with the storing conditions. Finally, the last study examines an application for the reduction of amyloid β plaques in a rabbit model with the use of antibodies crossing the blood brain barrier.

Keywords: ultrasound, phantom, blood brain barrier, agar