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ABSTRACT BOOK

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OPTIMAL OVERLAPPING PROTOCOL AND ROBUSTNESS ASSESSMENT OF BLOOD-BRAIN BARRIER OPENING IN HUMANS USING A SINGLE-ELEMENT FOCUSED ULTRASOUND TRANSDUCER

Sergio Jiménez-Gambín[1], Noé Jiménez[1], Andrei Marin[1], Francisco Camarena[1]
[1] Instituto de Instrumentación para Imagen Molecular, Consejo Superior de Investigaciones Científicas, Universitat Politècnica de València, Valencia, Spain
e-mail: serjigam@upv.es; nojigon@upv.es; ancrism2@alumni.uv.es; fracafe@fis.upv.es

OBJECTIVES

The blood-brain barrier (BBB) restricts the diffusion of therapeutic drugs to the brain. BBB disruption is safely achieved by using focused ultrasound and microbubbles. Single-element transducers can be used to cover a complex and big structure such as the left hippocampus (LH). This numerical study addresses the optimal transcranial targeting of the LH of an adult human with specific transducer positons and its robustness as a potential clinical technique is assessed.

METHODS

k-space method was used to simulate a 500 kHz single-element focused transducer. The skull acoustic properties were obtained from CT-scans and the LH location from a 3D brain atlas. The LH was divided into 2 and 4 parts to optimize the overlapped volume with the number of sonications. Positioning errors of ±1 mm and ±1 deg were considered to evaluate the robustness of the technique.

RESULTS

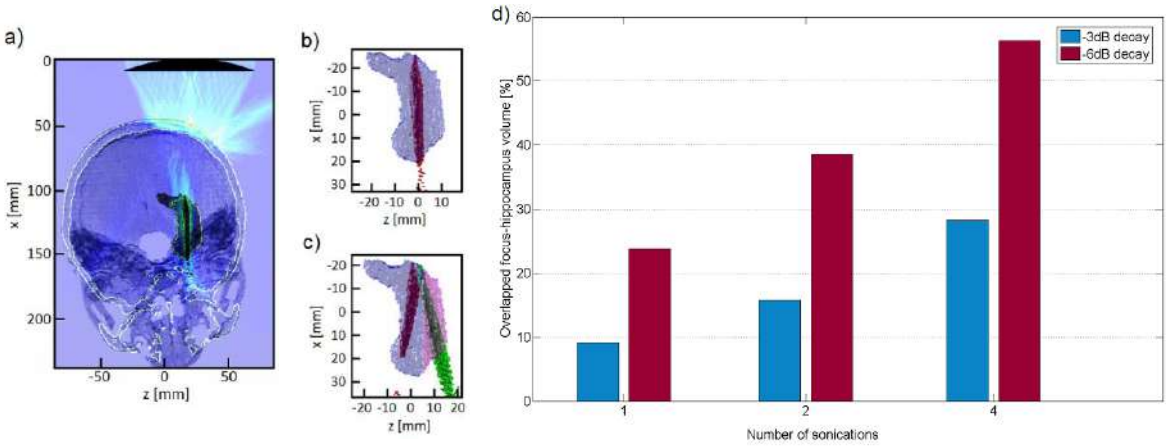
The LH overlapped volume increases with the number of sonications, from 23% (1 sonication) to 57% (4 sonications). The robustness of the system is submillimetric against a positioning error of the transducer of ±1 mm, and about ±1 mm when introducing an incidence angle error of ±1 deg.

CONCLUSIONS

Single-element proposed system has demonstrated the ability to cover high percentage of the LH and targeting errors are submillimetric.

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CAPTION: a) *k*-space simulation including skull and brain; b) one sonication of the LH; c) two sonications of the LH; c) overlapped volume of the LH as a function of the number of sonications.