Docket #: S16-003

Wedge Transducer for Transcranial Ultrasound

Stanford researchers at the Khuri-Yakub Lab have developed a novel technique for coupling focused ultrasound into the brain. This technique uses guided Lamb waves in the skull as an efficient way of transmitting the ultrasound beam into the brain without significant attenuation. The main constituents of the transducer array are wedge transducer elements arranged over a wedge ring to provide a focusing mechanism. The benefits of this approach are improved efficiency, reduced heating of the skull, and the ability to address regions in the brain that are close or far from the skull and freedom to operate at a wider range of frequencies. This focused ultrasound beam can be used for brain cancer therapy or neuromodulation.

Figure

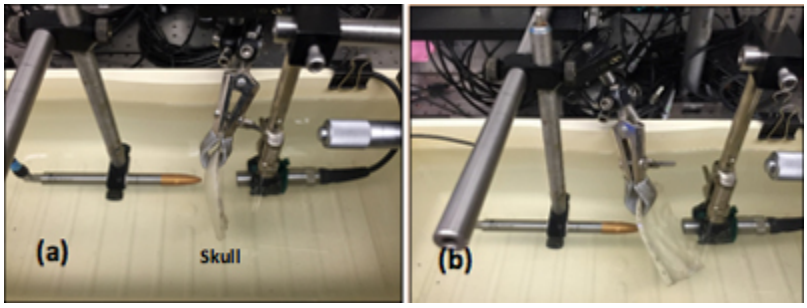


Figure description - Pressure field scan setup with the skull fragment placed between the transducer and hydrophone, at two different angles to emulate the normal-incident and wedge techniques (a) normal-incident transmission (b) wedge transmission.

Stage of Research

- **Proof-of-Concept** data using wedge prototypes
- Results showed that wedge transducer has negligible relative temperature elevation as compared to conventional normal-beam transducer

Applications

- **Transcranial ultrasound including:**
  - Therapeutics for brain cancer and bone cancer
  - Neuromodulation for the treatment of stroke, multiple sclerosis, neuropathic pain, migraine, depression

Advantages

- Non-invasive
- Improved efficiency
- Reduced heating of the skull – thus does not require cooling
- Ability to address regions in the brain that are close or far from the skull
- Freedom to operate at a wider range of frequencies – current technologies are limited to operate at frequencies below 1 MHz
- Robust to the range of thicknesses of the skull bone

Patents

- Published Application: 20180280735
- Issued: 11,305,133 (USA)

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