

Tissue-Mimicking Material for MRI, CT and Ultrasound Imaging Phantoms

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Technology description

In medical imaging, phantoms are nonliving objects that are scanned or imaged to test or calibrate an instrument and help in treatment planning. Ideal phantoms are composed of materials like gels and glycerol that exhibit the same properties relevant to a particular imaging method as actual human soft tissue. For ultrasound, such mimicking material should show the same ranges in speed and sound as tissue inside a real body, while computed tomography (CT) requires material that scans at the same CT number. More requirements need to be met for magnetic resonance imaging (MRI), such as simulating the hydrogen densities and relaxation times of several types of tissues.

Composing material that satisfies different imaging technologies and that is stable long term and easy to store has been challenging. For operations like ultrasound-guided transperineal prostate implantation, which combines images from ultrasound, CT and MRI, a better phantom would assist treatment. UW–Madison researchers have developed a tissue-mimicking material that may be adjusted to depict particular human tissues such as organs, skeletal muscle and fat, and is applicable to several imaging methods, including ultrasound, CT and MRI. The phantom is especially useful for simulating prostate tissue.

The material comprises an aqueous mixture of large organic water soluble molecules, a copper salt, a chelating agent for binding copper ions in the salt and a gel-forming agent. Glass beads also may be intermixed and treated to have low effect on the MRI T1 and T2. The materials mimicking the various tissues can be in direct contact with one another and remain stable in their multiple imaging properties over time.

The Wisconsin Alumni Research Foundation (WARF) is seeking commercial partners interested in developing material that can mimic human tissues like organs, skeletal muscle and fat in multiple types of imaging methods, and is especially useful in prostate implant treatment.

Application area

Medical imaging phantoms

Combined ultrasound, CT and MRI applications
Prostate tissue simulation

Advantages

Good representation of the properties essential to multiple imaging methods
Material can be in contact and not change properties.
Stable over long periods
No need for diffusion barriers that degrade images

Institution

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