

Application for Round 3 QIBA Project Funding

Title of Proposal: Phase 2 Phantom Study with Inelastic, SWS-dispersive Media		
QIBA Committee/Subgroup: US SWS Phantoms Subcommittee		
NIBIB Task Number(s) which this project addresses:		
Project Coordinator or Lead Investigator Information:		
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Institution/Company: University of Wisconsin - Madison		
Amount Requested:		

Project Description

An extension of the current Phase 1 Phantom Study that was performed in homogeneous, isotropic, and (nearly) mechanically lossless gel materials. Comparison was performed of shear wave speed (SWS) estimates among 15 sites representing systems from three commercial vendors for shear wave imaging systems, one non-imaging system and several research systems at universities. The results of that study demonstrate that there is little difference in SWS estimates on repeat estimates by a participant, among participants and among systems from the same vendor. A small bias was found between SWS estimates from different vendors' imaging systems. This bias would have almost certainly been zero if the materials were completely elastic. Although each system creates shear waves with different frequency content, those differences don't matter in truly lossless media. The Phase 1 study also established methods for independently verifying material properties, exchanging data and for robust data analysis among sites. The Phase 2 study will involve media that are mechanically lossy, providing a better approximation to the viscoelastic properties of liver [1]. We expect larger differences in SWS estimates from different system vendors, and that data will form a basis to begin investigation of the system-related causes for bias in SWS estimates (such as frequency content of the shear wave, details of the shear wave tracking strategy, etc.). Several approaches to accounting for these sources of bias have been proposed, but the differences have to be measured in order to make corrections. Inter-laboratory tests in known media, such as this, are essential for achieving that goal. Test samples will be created at the time these phantoms are manufactured so that independent dynamic mechanical testing can be performed on equivalent materials over time. The phantoms will be shipped serially to the sites involved (a subset of those involved in the Phase 1 study) for SWS estimation with various systems and participants. Data analysis will follow that established in the Phase 1 study.

Primary goals and objectives

Our ultimate goal is to develop methods by which SWS estimates made with systems from different vendors can be directly equated. Completion of this task from this and subsequent data will be accomplished in the following year.

The immediate goals are to:

1. Produce the first reliable viscoelastic phantoms with well characterized viscoelastic properties
2. Obtain SWS measurements on essentially all commercial US systems with SWS measurement and several respected research and prototype systems, as a function of shear wave frequency where possible. Phantoms large enough for MR elastography probably will not be possible with these funds and at this time.