Styrene-ethylene/butylene-styrene (SEBS) gels are biologically inert and present tunable properties, including mechanical properties that resemble the soft tissue. Therefore, SEBS is an alternative to develop a patient-specific phantom, that provides real visual and morphological experience during simulation-based neurosurgical training.

A 3D model was reconstructed and printed based on patient-specific magnetic resonance images. The fused deposition of polyactic acid (PLA) filament and selective laser sintering of polyamid were used for 3D printing. Silicone and SEBS materials were employed to mimic soft tissues. A neuronavigation protocol was performed on the 3D-printed models scaled to three different sizes, 100%, 50%, and 25% of the original dimensions. A neurosurgery team (17 individuals) evaluated the phantom realism as “very good” and “perfect” in 49% and 31% of the cases, respectively, and rated phantom utility as “very good” and “perfect” in 61% and 32% of the cases, respectively. Models in original size (100%) and scaled to 50% provided a quantitative and realistic visual analysis of the patient's cortical anatomy without distortion. However, reduction to one quarter of the original size (25%) hindered visualization of surface details and identification of anatomical landmarks.

A patient-specific phantom was developed with anatomically and spatially accurate shapes, that can be used as an alternative for surgical planning. Printed models scaled to sizes that avoided quality loss might save time and reduce medical training costs [1)].

1)
Grillo FW, Souza VH, Matsuda RH, Rondinoni C, Pavan TZ, Baffa O, Machado HR, Carneiro AAO. Patient-specific neurosurgical phantom: assessment of visual quality, accuracy, and scaling effects. 3D Print Med. 2018;4(1):3. doi: 10.1186/s41205-018-0025-8. Epub 2018 Mar 13. PubMed PMID: 29782617; PubMed Central PMCID: PMC5954795.