Anthropomorphic skull

An **anthropomorphic skull** typically refers to a depiction or representation of a skull with human-like or humanoid characteristics, blending anatomical accuracy with artistic interpretation or symbolic meaning. These representations are often used in art, design, literature, and various cultural contexts.

Sculpture and Anatomy Education:

1. Artists and anatomists sometimes create anthropomorphic skulls that blend human and other creature features (e.g., human-animal hybrids) for educational or imaginative purposes.

The use of anthropomorphic phantoms could be an excellent substitute. The study aimed to design and develop a patient-specific 3D skull and brain model with realistic CT attenuation suitable for conventional and augmented reality (AR)-navigated neurosurgical simulations.

Methods: The radiodensity of materials considered for the skull and brain phantoms was investigated using cone beam CT (CBCT) and compared to the radiodensities of the human skull and brain. The mechanical properties of the materials considered were tested in the laboratory and subsequently evaluated by clinically active neurosurgeons. Optimization of the phantom for the intended purposes was performed in a feedback cycle of tests and improvements.

Results: The skull, including a complete representation of the nasal cavity and skull base, was 3D printed using polylactic acid with calcium carbonate. The brain was cast using a mixture of water and coolant, with 4 wt% polyvinyl alcohol and 0.1 wt% barium sulfate, in a mold obtained from segmentation of CBCT and T1 weighted MR images from a cadaver. The experiments revealed that the radiodensities of the skull and brain phantoms were 547 and 38 Hounsfield units (HU), as compared to real skull bone and brain tissues with values of around 1300 and 30 HU, respectively. As for the mechanical properties testing, the brain phantom exhibited a similar elasticity to real brain tissue. The phantom was subsequently evaluated by neurosurgeons in simulations of endonasal skull-base surgery, brain biopsies, and external ventricular drain (EVD) placement and found to fulfill the requirements of a surgical phantom.

Conclusions: A realistic and CT-compatible anthropomorphic head phantom was designed and successfully used for simulated augmented reality-led neurosurgical procedures. The anatomic details of the skull base and brain were realistically reproduced. This phantom can easily be manufactured and used for surgical training at a low cost [1)].

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Lai M, Skyrman S, Kor F, Homan R, El-Hajj VG, Babic D, Edström E, Elmi-Terander A, Hendriks BHW, de With PHN. Development of a CT-compatible, Anthropomorphic Skull and Brain Phantom for Neurosurgical Planning, Training, and Simulation. Bioengineering (Basel). 2022 Oct 9;9(10):537. doi: 10.3390/bioengineering9100537. PMID: 36290503; PMCID: PMC9598361.