Displaying anatomical and physiological information derived from preoperative medical images in the operating room is critical in image guided neurosurgery. Paul et al. presents a new approach referred to as augmented virtuality (AV) for displaying intraoperative views of the operative field over three-dimensional (3-D) multimodal preoperative images onto an external screen during surgery. A calibrated stereovision system was set up between the surgical microscope and the binocular tubes. Three-dimensional surface meshes of the operative field were then generated using stereopsis. These reconstructed 3-D surface meshes were directly displayed without any additional geometrical transform over preoperative images of the patient in the physical space. Performance evaluation was achieved using a physical skull phantom. Accuracy of the reconstruction method itself was shown to be within 1 mm (median: 0.76 mm +/- 0.27), whereas accuracy of the overall approach was shown to be within 3 mm (median: 2.29 mm +/- 0.59), including the image-to-physical space registration error. We report the results of six surgical cases where AV was used in conjunction with augmented reality. AV not only enabled vision beyond the cortical surface but also gave an overview of the surgical area. This approach facilitated understanding of the spatial relationship between the operative field and the preoperative multimodal 3-D images of the patient [1].

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Paul P, Fleig O, Jannin P. Augmented virtuality based on stereoscopic reconstruction in multimodal image-guided neurosurgery: methods and performance evaluation. IEEE Trans Med Imaging. 2005 Nov;24(11):1500-11. PubMed PMID: 16279086.