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Brain Dissection Wizard An interactive, three-dimensional, photogrammetric fiber tract model

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Awake surgeries enable the intraoperative testing of neuronal functions with the aim to preserve them and to achieve the best possible oncological and functional result. The knowledge of cerebral fiber tracts is essential for these kind of surgeries. The study of these tracts can be tedious and time-consuming. Because the fiber tracts cannot be seen intraoperatively it is necessary to build a mental image that can be adapted at any time. The aim of this work is facilitate the development of a mental map with the help of an interactive, three-dimensional, photogrammetric model. 15 brain specimens were prepared and dissected using a modified Klingler technique. Every dissection step was recorded photographically. The images were transformed into a photogrammetric model. Three low grade gliomas that were localized in predefined regions (premotor region, insula, temporo-parieto-occipital junction) were segmented and transformed into the photogrammetric model. Relevant fiber tracts were tracked using fiber tractography and transformed into the photogrammetric model. These photogrammetric models display the dissection steps in a realistic and undistorted way. The localization of the tumors in the photogrammetric model correlates very well with the localization in the original MRI data set. The virtual fiber tracts match very well with the anatomically dissected tracts. All photogrammetric models display the dissection steps in a realistic and undistorted way. For the first time segmented tumors and virtually tracked fibers could be overlaid onto the photogrammetric brain dissection model. This interactive, three-dimensional model offers the possibility to study subcortical anatomy in the presence of a tumor. This facilitates the development of a mental image of the fiber tracts, improves the intraoperative orientation and should optimize the onocological as well as functional result of awake surgeries in patients harboring intrinsic brain tumors.