## Intraoperative optical imaging

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Intraoperative optical imaging (IOI) is a marker-free, contactless, and noninvasive imaging technique that is able to visualize metabolic changes of the brain surface following neuronal activation. Although it has been used in the past mainly for the identification of functional brain areas under general anesthesia, Oelschlägel et al. investigated the potential of the method during awake surgery. Measurements were performed in 10 patients who underwent resection of lesions within or adjacent to cortical language or motor sites. IOI was applied in 3 different scenarios: identification of motor areas by using finger-tapping tasks, identification of language areas by using speech tasks (overt and silent speech), and a novel approach the application of IOI as a feedback tool during direct electrical stimulation (DES) mapping of language. The functional maps, which were calculated from the IOI data (activity maps), were qualitatively compared with the functional MRI (fMRI) and the electrophysiological testing results during the surgical procedure to assess their potential benefit for surgical decision-making. The results reveal that the intraoperative identification of motor sites with IOI in good agreement with the preoperatively acquired fMRI and the intraoperative electrophysiological measurements is possible. Because IOI provides spatially highly resolved maps with minimal additional hardware effort, the application of the technique for motor site identification seems to be beneficial in awake procedures. The identification of language processing sites with IOI was also possible, but in the majority of cases significant differences between fMRI, IOI, and DES were visible, and therefore according to the authors' findings the IOI results are too unspecific to be useful for intraoperative decision-making with respect to exact language localization. For this purpose, DES mapping will remain the method of choice. Nevertheless, the IOI technique can provide additional value during the language mapping procedure with DES. Using a simple difference imaging approach, the authors were able to visualize and calculate the spatial extent of activation for each stimulation. This might enable surgeons in the future to optimize the mapping process. Additionally, differences between tumor and nontumor stimulation sites were observed with respect to the spatial extent of the changes in cortical optical properties. These findings provide further evidence that the method allows the assessment of the functional state of neurovascular coupling and is therefore suited for the delineation of pathologically altered tissue <sup>1)</sup>.

## 1)

Oelschlägel M, Meyer T, Morgenstern U, Wahl H, Gerber J, Reiß G, Koch E, Steiner G, Kirsch M, Schackert G, Sobottka SB. Mapping of language and motor function during awake neurosurgery with intraoperative optical imaging. Neurosurg Focus. 2020 Feb 1;48(2):E3. doi: 10.3171/2019.11.FOCUS19759. PubMed PMID: 32006940.

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