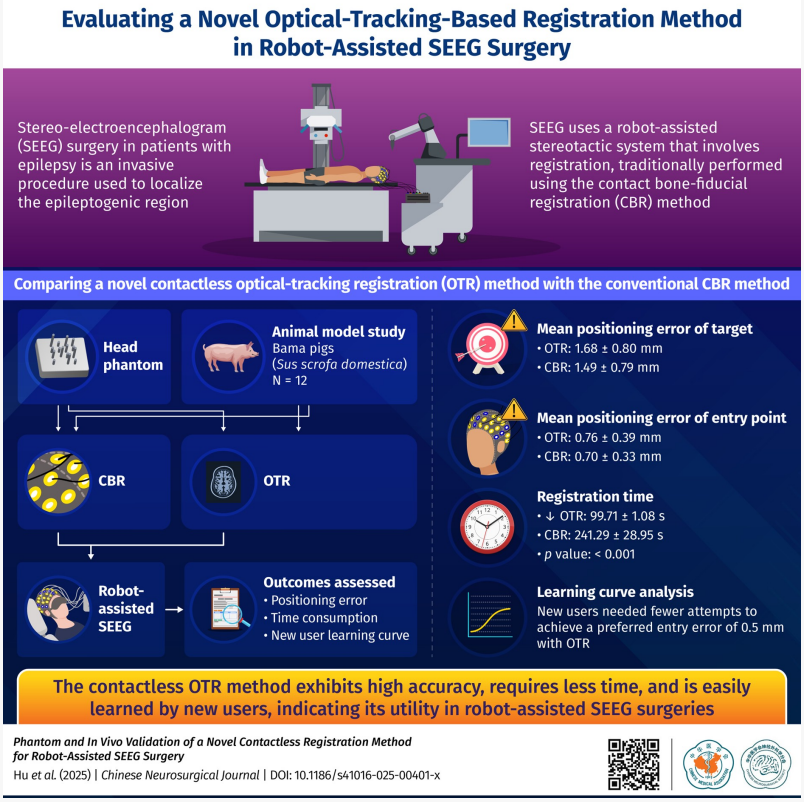
A Huazhong University of Science and Technology Study Reports a Novel Optical Mapping Technique for Neurosurgery

Researchers highlight the advantages of an optical tracking method for identifying target areas in robot-assisted neurosurgery in patients with epilepsy



This study compared the accuracy and convenience of a novel contactless optical tracking registration method with the traditional contact-based bone fiducial registration method used in robot-assisted neurosurgery for patients with epilepsy I

BEIJING, BEIJING, CHINA, November 6, 2025 /EINPresswire.com/ -- Robot-guided neurosurgery in patients with epilepsy involves accurately mapping the skull to identify the entry points and target areas. A recent study compared the clinical utility of a contactless optical method with the conventional method, which requires repeated contacts. The study demonstrates that optical tracking is accurate, less time-consuming, and easily learned by new users. These findings pave the way for faster and more error-free surgical interventions for epilepsy.

Patients with epilepsy are affected by a brain disorder where nerve cells fail to signal properly, resulting in uncontrolled bursts of electrical activity or seizures. For the most part, epilepsy can be controlled with medications. However, approximately 30% of patients fail to respond to medications and require invasive intervention or surgery.

The stereo-electroencephalography (SEEG) presurgical evaluation helps identify whether the patient will benefit from precisely targeted treatment, such as the targeted destruction or surgical removal of brain cells involved in seizure activity. SEEG locates the specific areas in the brain where difficult-to-treat epileptic seizures originate and involves accurate presurgical

mapping or registration to determine if destruction or removal of the brain region involved in seizures would result in post-surgery neurological problems.

In recent times, robot-assisted mapping and neurosurgery have improved accuracy and efficiency of the procedure. Conventionally, mapping is done using the contact bone-fiducial registration (CBR) method, which places metal implants in the skull as reference points and maps the entry point and target areas using appropriate software.

Now, a research team led by Professor Kai Shu at the Department of Neurosurgery, Tongji Medical College, Huazhong University of Science and Technology, Wuhan, China, in collaboration with Dr. Xinwei Li at the Wuhan United Imaging Surgical Co., Ltd., has demonstrated the clinical utility of a novel contactless technique. Explaining their motivation for this study, Prof. Shu says "If a registration method can simplify the procedure, take less time, and shorten the learning curve of the operator while maintaining accuracy, it will be of great practical importance for the clinical treatment process." This study was published in Volume 11, article number 20 of the Chinese Neurosurgical Journal on September 16, 2025.

In their experimental study, Prof. Shu and his research team tested the clinical utility of a novel contactless optical-tracking registration (OTR) method and compared it with the CBR method. They tested the mapping performance on either a dummy or phantom head built with reference points or on Bama pigs as their animal model. While performing robot-guided SEEG surgery, they assessed outcomes including positioning errors, procedure time, and the ease or difficulty of training new users.

The study findings demonstrate accurate mapping achieved by the OTR method, as the mean positioning error at both the target and entry points was comparable between the two techniques. Besides consistent accuracy, the findings also confirmed the time efficiency of the OTR method, as the time spent on mapping was considerably shorter compared with the CBR approach.

The traditional CBR method is limited by the need for repeated contact and a complex operational procedure that necessitates specific operator skills. The OTR system overcomes the need for contact by tracking the reference markers through the formation of light intersects. Another notable advantage of the OTR method is that the operator skills required are easily acquired. The research team used learning curve analysis to demonstrate that a new operator needed 50% fewer attempts with the OTR method to achieve preferable accuracy.

In conclusion, the contactless optical tracking method exhibits accuracy, requires less time, and is easily learned by new users, indicating its promising applicability in robot-assisted neurosurgery. These technological innovations improve patient comfort, reduce operational time, and lower the margin of error. Sharing his vision of this project, Prof. Shu explains, "We are initiating a multicenter clinical trial involving 50 patients with refractory epilepsy, with the aim of validating OTR in human SEEG procedures."

Let us hope that the enhanced accuracy, safety, and effectiveness of this procedure will simplify the intricate procedure, save medical resources, and extend its benefit to more patients with epilepsy.

Reference
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