

## Letter to the Editor Concerning “Augmented Reality Device for Preoperative Marking of Spine Surgery Can Improve the Accuracy of Level Identification,” by Aoyama et al.

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To the Editor:

We were interested in the article of Aoyama et al.<sup>1)</sup>, who concluded that identification of the spinal level using augmented reality (AR) is effective in preventing wrong-site spine surgery. Although we entirely support the use of this novel technology for level confirmation, we have some concerns regarding the outcomes of AR-assisted marking and the validation of its usefulness.

First, given that there was no statement of statistical significance concerning the misidentification rate or misidentification range, the usefulness of this technique cannot be strongly asserted.

Second, the match between the three-dimensional data and reality was manually adjusted, which can lead to registration errors-hence the need for ingenuity in optimizing size and match accuracy. As the author pointed out, the difference between the posture in the preoperative image and the intraoperative posture can also cause errors. Therefore, the usefulness of this technique may also be proven by examining the inter-rater reliability based on the years of experience.

Third, AR-assisted studies also need to investigate workflow and cost-effectiveness<sup>2)</sup>. For this technique to be widely used in the future, it is necessary to evaluate the additional time and radiation exposure caused by this technique. To improve the error, intraoperative computed tomography using an O-Arm or other methods is necessary at present, and the issue of equipment cost needs to be addressed. In addition, the workload should also be evaluated, including head mount display suitability, visual discomfort, fatigue, motion

sickness, and other learning-related workloads applied to surgeons using a questionnaire (i.e., System Usability score and NASA-Task load index).

Finally, the present study included only one case involving the thoracic spine; however, in actual practice, misidentifications in the thoracic spine are frequent and embarrassing to surgeons. Therefore, we would like to request that the authors accumulate more data on the thoracic spine and provide further output.

We would appreciate your comments on these concerns so that we can further corroborate the results of this important study.

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### References

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