

Application of 3D modeling and printing in posterior stabilization of the cervical spine using screw constructs

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Objective. To prove the effectiveness of 3D computer modeling and printing of patient-specific templates for cervical spine screw fixation.

Materials and Methods. Based on the MSCT data of three patients, 3D models of cervical vertebrae and guiding templates were produced. The screws were inserted transpedicularly into 3D-printed models of C2-C7 vertebrae and C1 lateral masses using standard cervical instrumentation. This technology was then clinically tested in a patient with C2 tumor, in whom posterior stabilization of C1-C3 vertebrae was performed using guiding templates. In the postoperative period, MSCT was performed to monitor the position of screws.

Results. When implanting screws into 3D-models, technical difficulties were not revealed. After insertion of screws, a visual assessment of the 3D vertebra model was made. Malpositions in models were not detected. Based on the proven technique, a clinical approbation was performed in a patient with normal cervical spine pattern. MSCT study revealed the deviation of screws relative to the planned trajectory by no more than 2 mm, with no malpositions.

Conclusion. The first domestic description of the technique of navigation using guiding templates is presented. Of all the existing methods, this is the most reliable way of screw positioning in the cervical spine. The possible insertion error does not affect the quality of positioning

Figure 1. Screws trajectory and templates modeling. 1 – adjacent vertebra, 2 – ideal screw trajectory, 3 – drill guide, 4- template

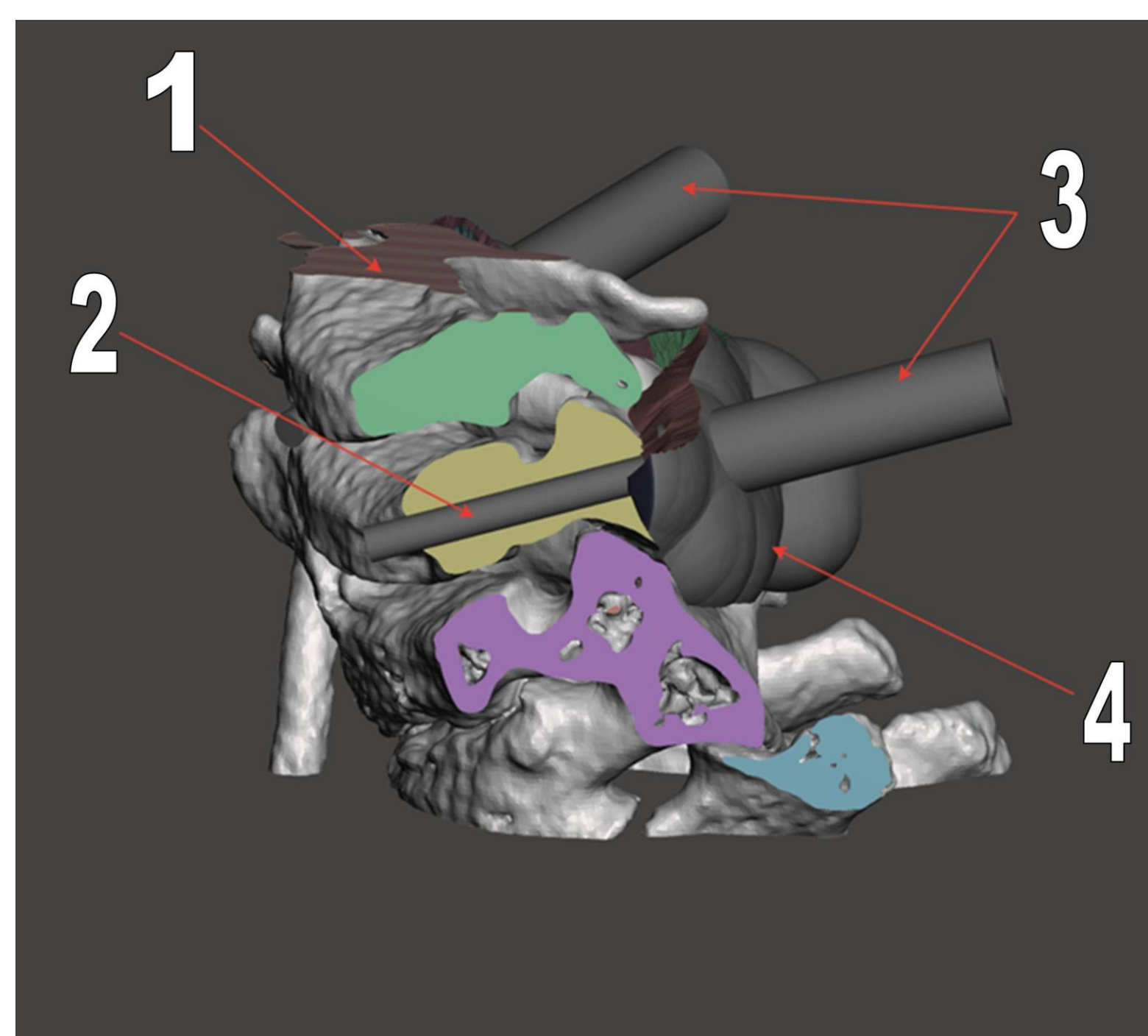


Figure 2. Cervical spine models and templates for screw navigation

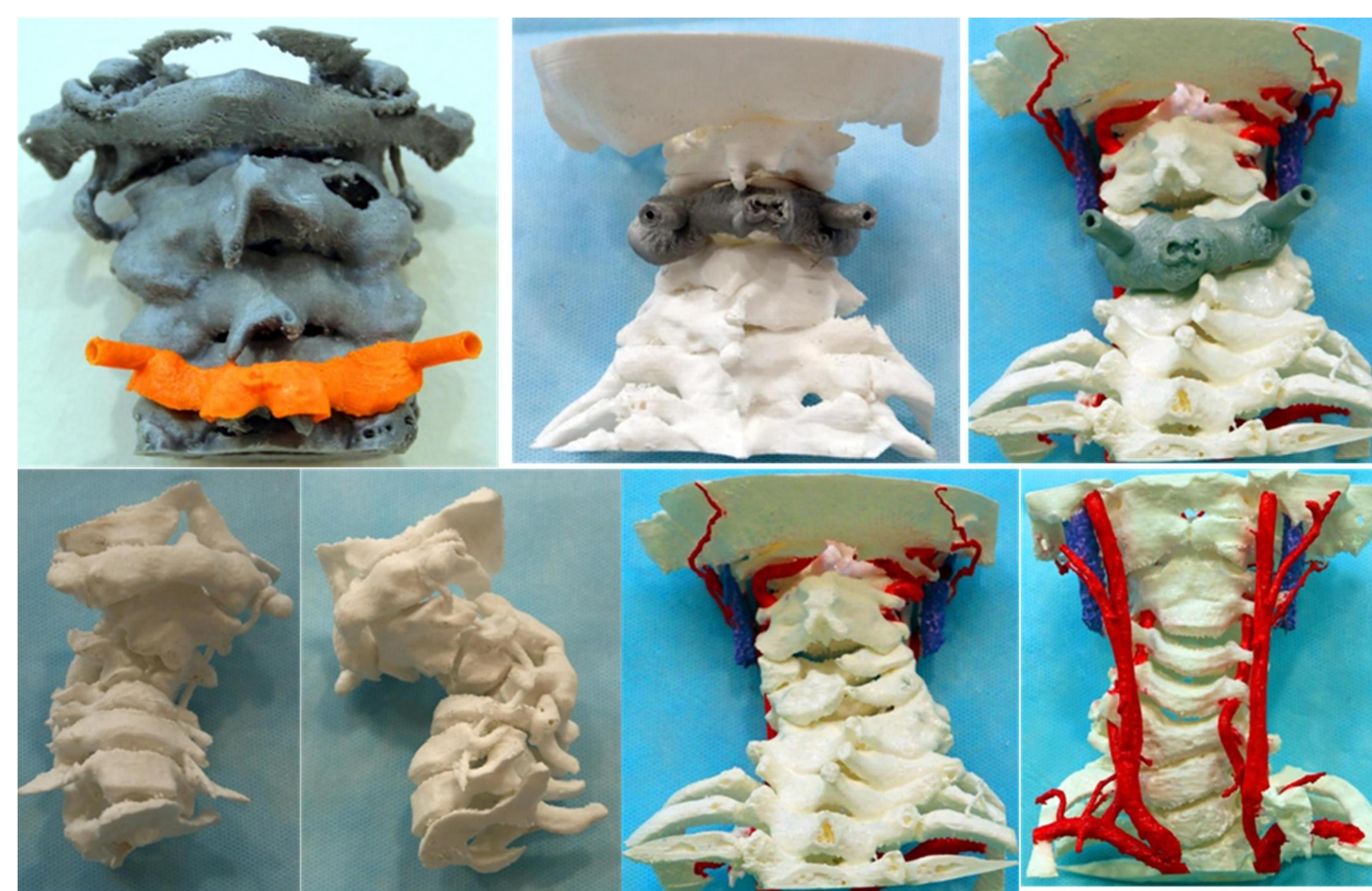


Figure 3. Screw insertion into cervical vertebra with the template

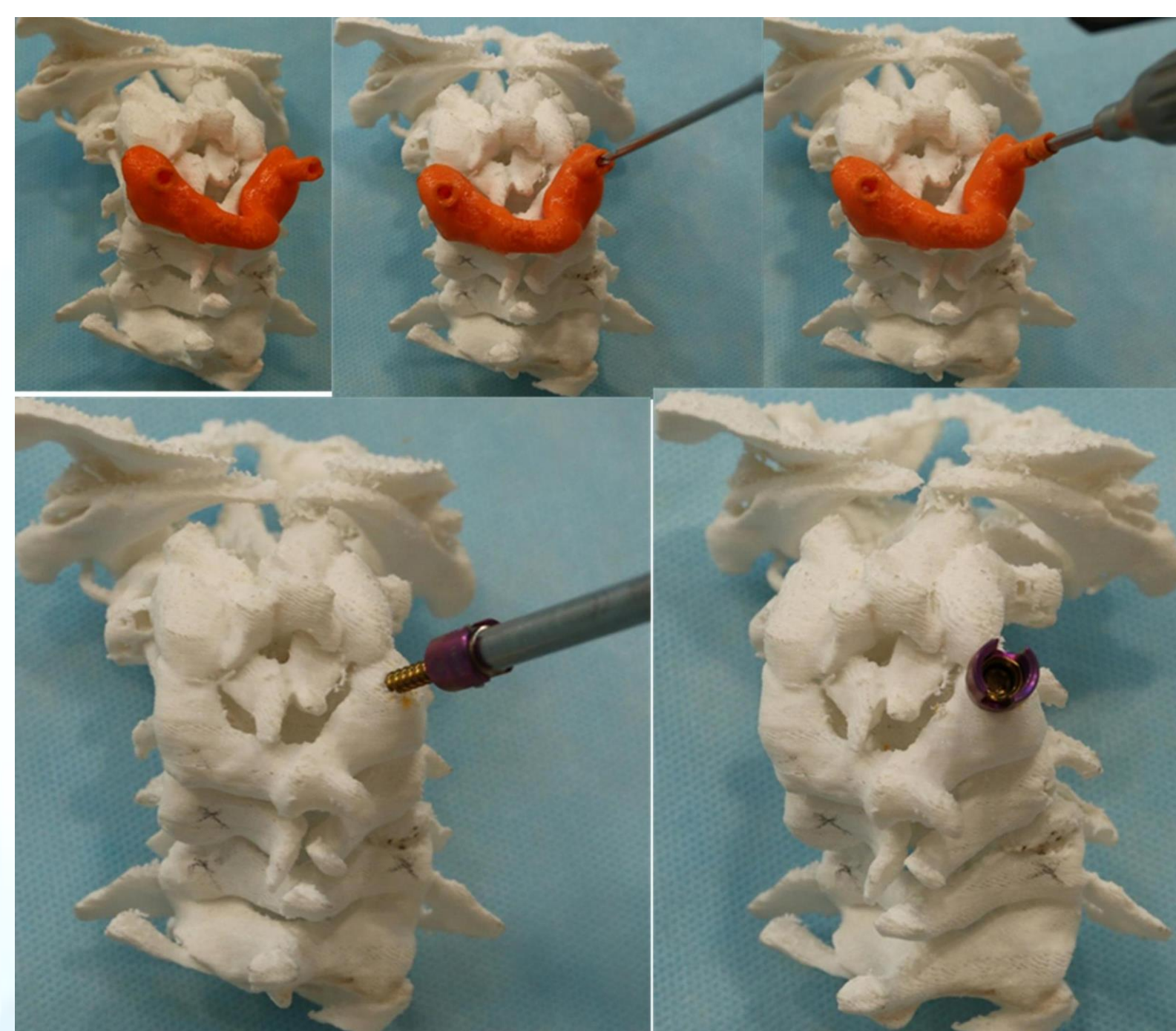


Figure 4. Screw position in the cervical spine model after template-assistant insertion

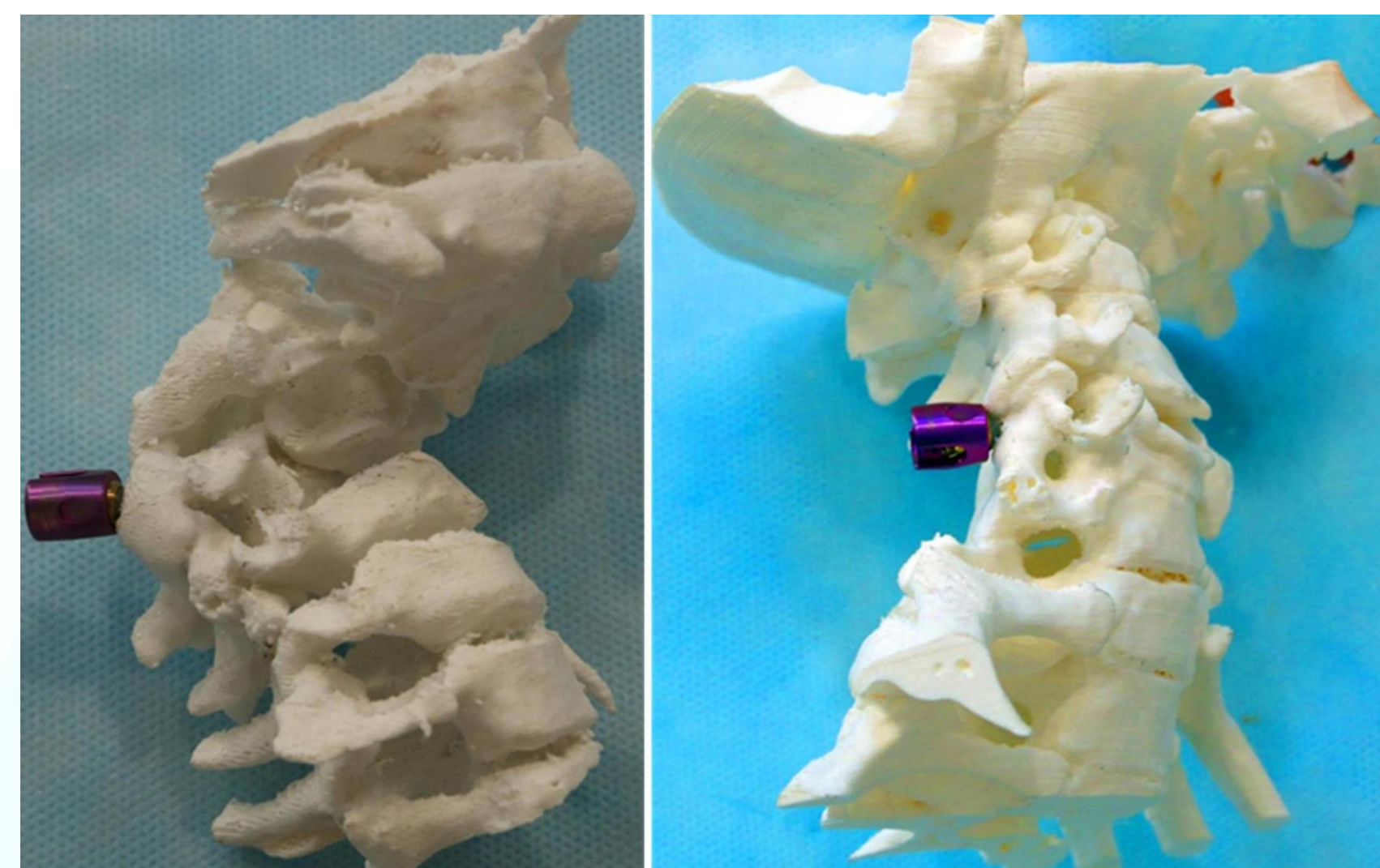


Figure 5. Intraoperative view

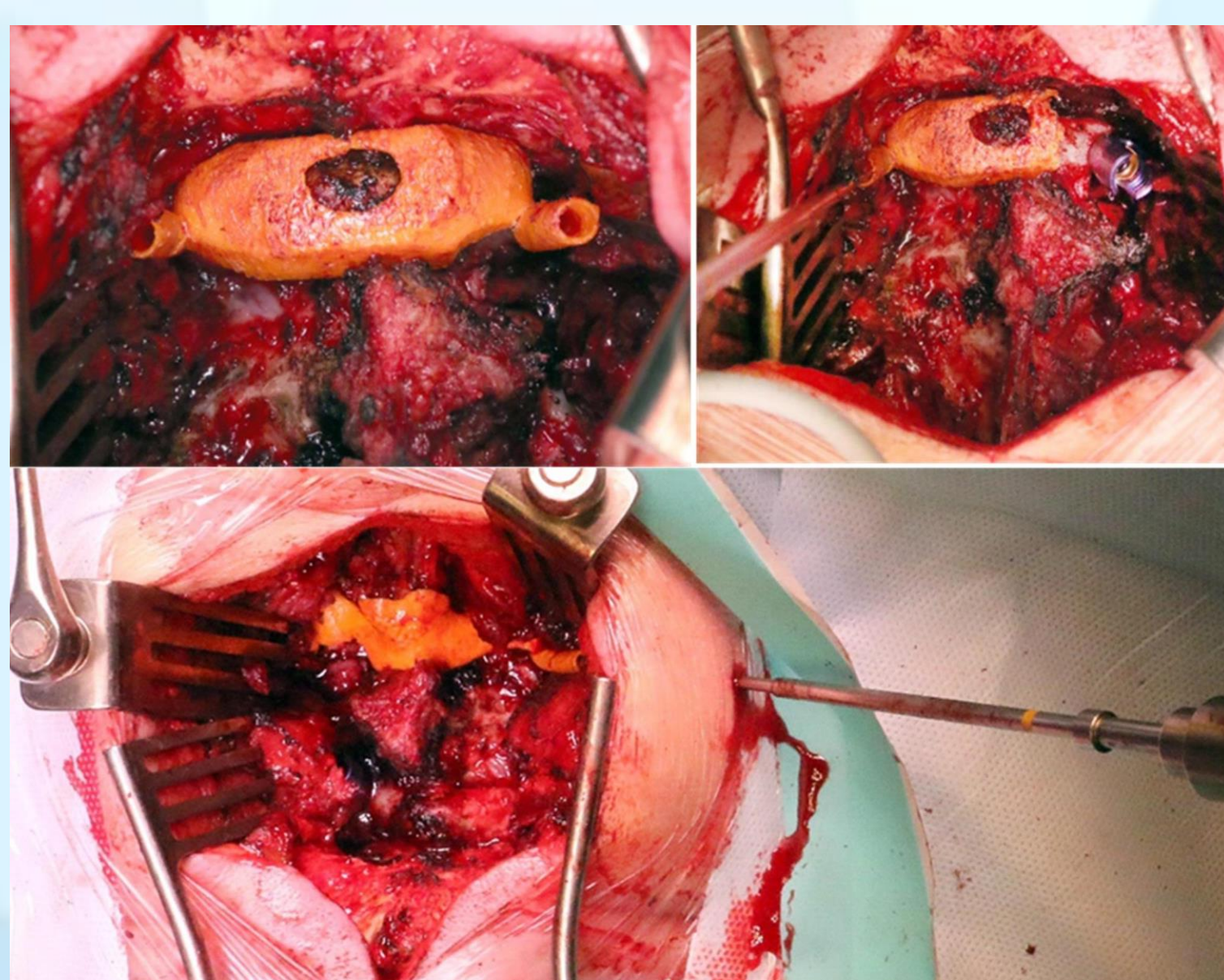


Figure 6. X-ray and computed tomogram after template-assistant screw insertion

