Patients computerized tomography and/or magnetic resonance volume data sets of the affected spinal segments were imported to Amira software, reconstructed to 3D images and fused with magnetic resonance data for soft-tissue visualization, resulting in a virtual patient model. Objects needed for surgical plans or surgical procedures such as trajectories, implants or surgical instruments were either digitally constructed or computerized tomography scanned and virtually positioned within the 3D model as required. As crucial step of this method these objects were fused with the patient's original diagnostic image data, resulting in a single DICOM sequence, containing all preplanned information necessary for the operation. By this step it was possible to import complex surgical plans into any navigation system. RESULTS: We applied this method not only to intraoperatively adjustable implants and objects under experimental settings, but also planned and successfully performed surgical procedures, such as the percutaneous lateral approach to the lumbar spine following preplanned trajectories and a thoracic tumor resection including intervertebral body replacement using an optical navigation system. To demonstrate the versatility and compatibility of the method with an entirely different navigation system, virtually preplanned lumbar transpedicular screw placement was performed with a robotic guidance system. CONCLUSIONS: The presented method not only allows virtual planning of complex surgical procedures, but to export objects and surgical plans to any navigation or guidance system able to read DICOM data sets, expanding the possibilities of embedded planning software [1].

1)
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