Supplementary Materials

Fast Track Protocol for optimization of presurgical planning in acute surgical treatment of acetabular quadrilateral plate fractures using 3D printing technology and pre-contoured reconstruction plates.

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Table S1. Fast Track protocol.

Fast-Track-Protocol

1. Patient injury classification;
2. CT (Computed Tomography) scan in accordance with the following protocol:

Computed Tomography Scanning Protocol	
NECT	Non-contrast Enhanced Computed Tomography
Region	Pelvis
Image reconstruction	Reconstruction algorithms (Kernels): Used in the study • **GE**: Standard, Bone, Bone Plus; • **Siemens**: B30f, B30s, B60s, B70s; Recommended for other CT scanners • **Philips**: Standard, Sharp, Detail (B, C, D, E, L); • **Toshiba**: FC08, FC18, FC30, Fc35;
Slice Thickness	≤ 1.0 mm (isometric voxel)
Resolution	512x512
Pitch	≤ 1.0
Gantry Tilt Angle	0°
Data Format	Uncompressed DICOM files

3. Segmentation of bone structures, virtual surgical planning and preparation of 3D models of the pelvic bones in 3D Slicer software:
    a. CROP VOLUME module;
    b. SEGMENT EDITOR module;
        i. SURFACE CUT function;
        ii. TRESHOLD function;
        iii. ISLANDS function;
        iv. SCISSORS function;
        v. ERASE function;
        vi. PAINT function;
        vii. WRAP SOLIDFY function;
    c. MARKUP module;
        i. CREATE PLANE MARKUP function;
    d. DYNAMIC MODELE module;
        i. MIRROR function;

e. SURFACE TOOLBOX module;
    i. SMOOTHING function
f. Save the virtual 3D models of the pelvis as stl or .obj files;

4. Build anatomical models of the pelvis using a dual extruder FDM (Fused Deposition Modeling) 3D printer, material - for example: Ultimaker U3 3D printer (Ultimaker B.V, Utrecht, The Netherlands) according to the following parameters:

3D printing parameters	
Printing temperature	205°C
Build plate temperature	60°C
Layer high	0.2 mm
Infill	60%
Support material	Polyvinyl alcohol (PVA) (for example: Ultimaker B.V, Netherlands)

5. Removal of support material
    a. If possible, manually remove any of the support material that can be manipulated without damaging the printed model.
    b. Prepare an appropriately sized container and fill it with lukewarm tap water
    c. Immerse the model in the water and make sure that it is completely covered
    d. Leave model immersed in water until all of the support material dissolves
6. Select appropriate reconstruction plates and carry out shaping / pre-contouring according to the manufacturer's instructions, in clean (sterile) conditions
7. Sterilize the pre-contoured plates according to local procedures

Fast-Track-Protocol - detailed workflow for preparing 3D anatomical models of the pelvic bones

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Figure S1. Select the 'CROP VOLUME' module. Select the area / volume for segmentation (pelvic bones).

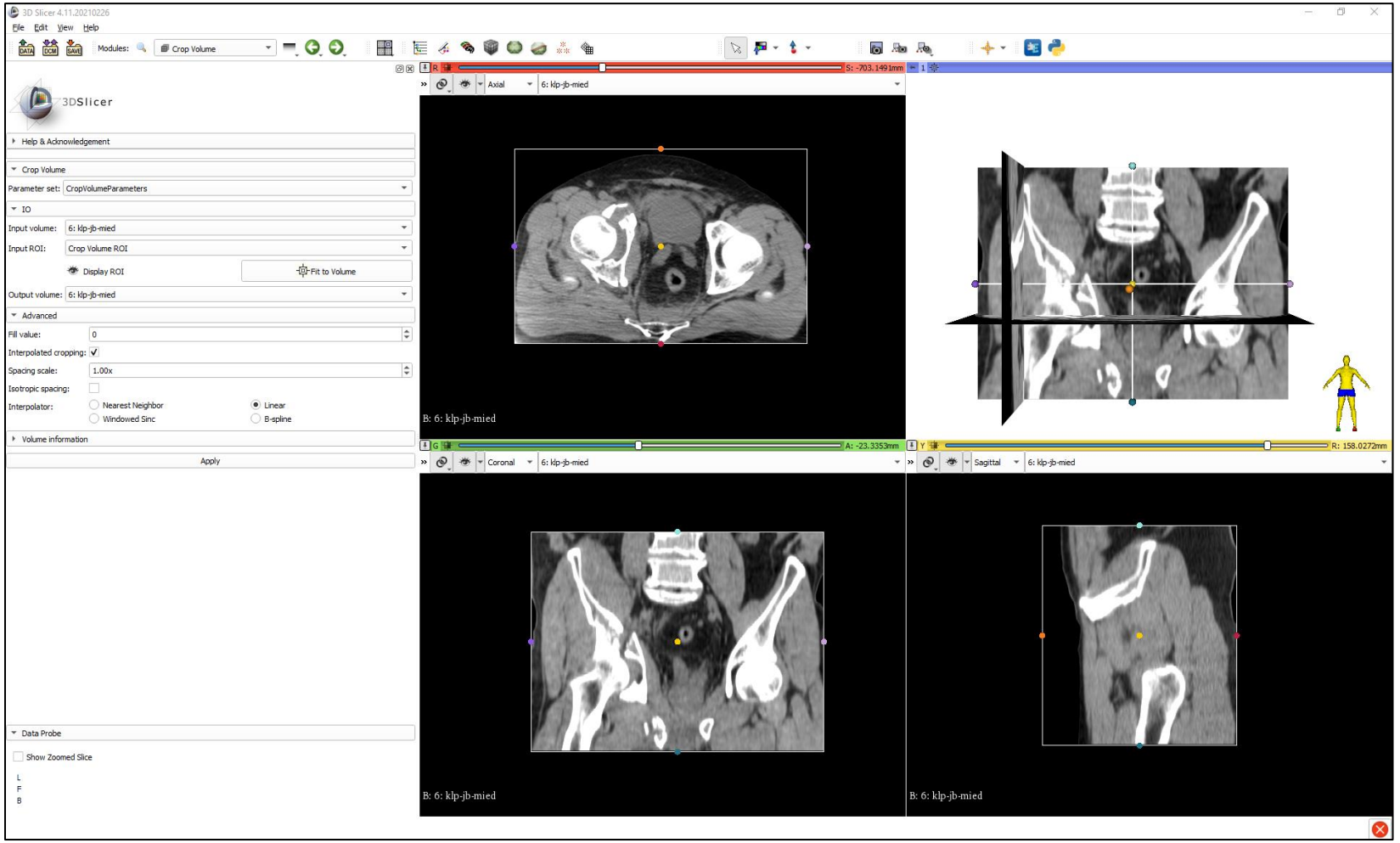

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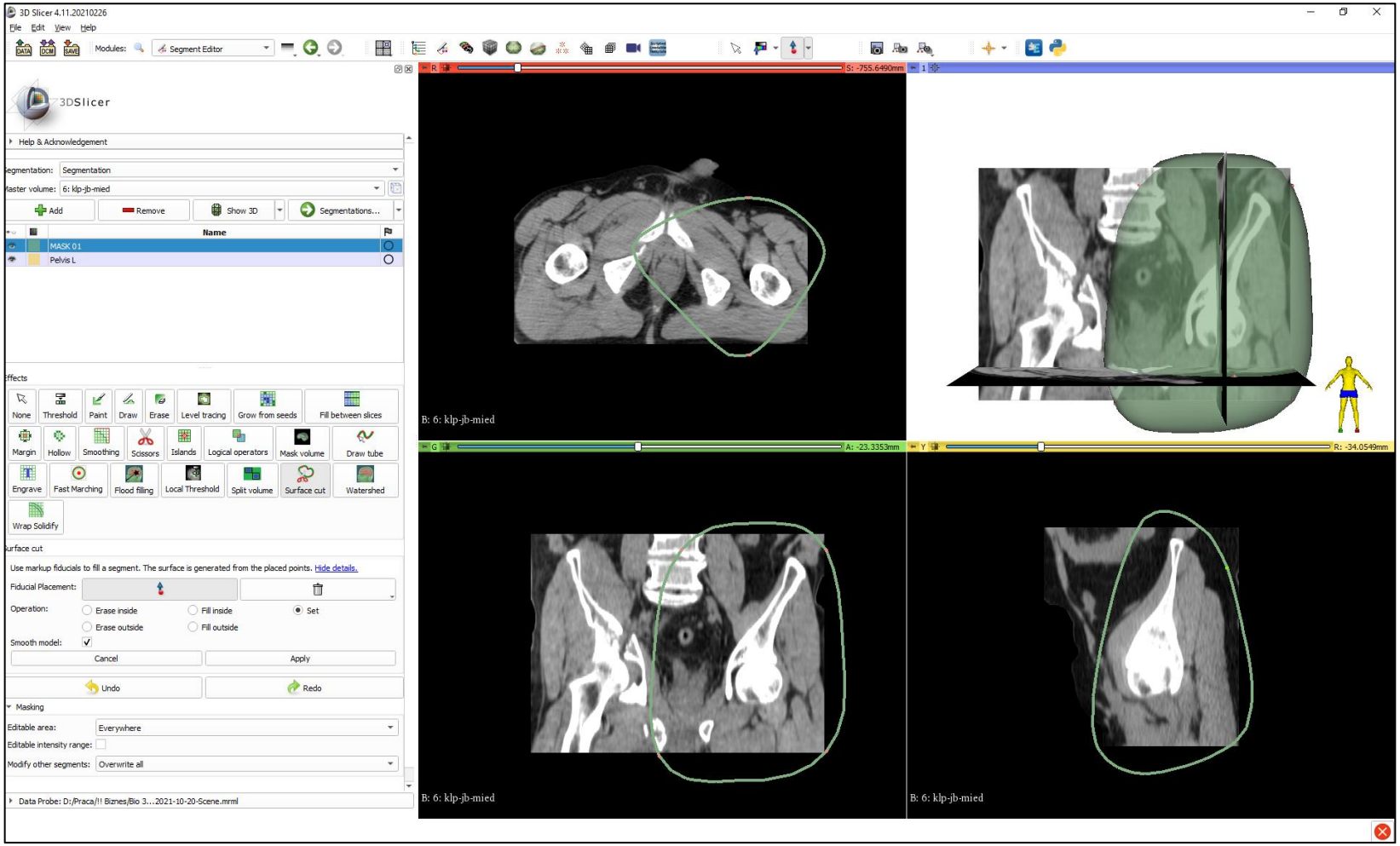
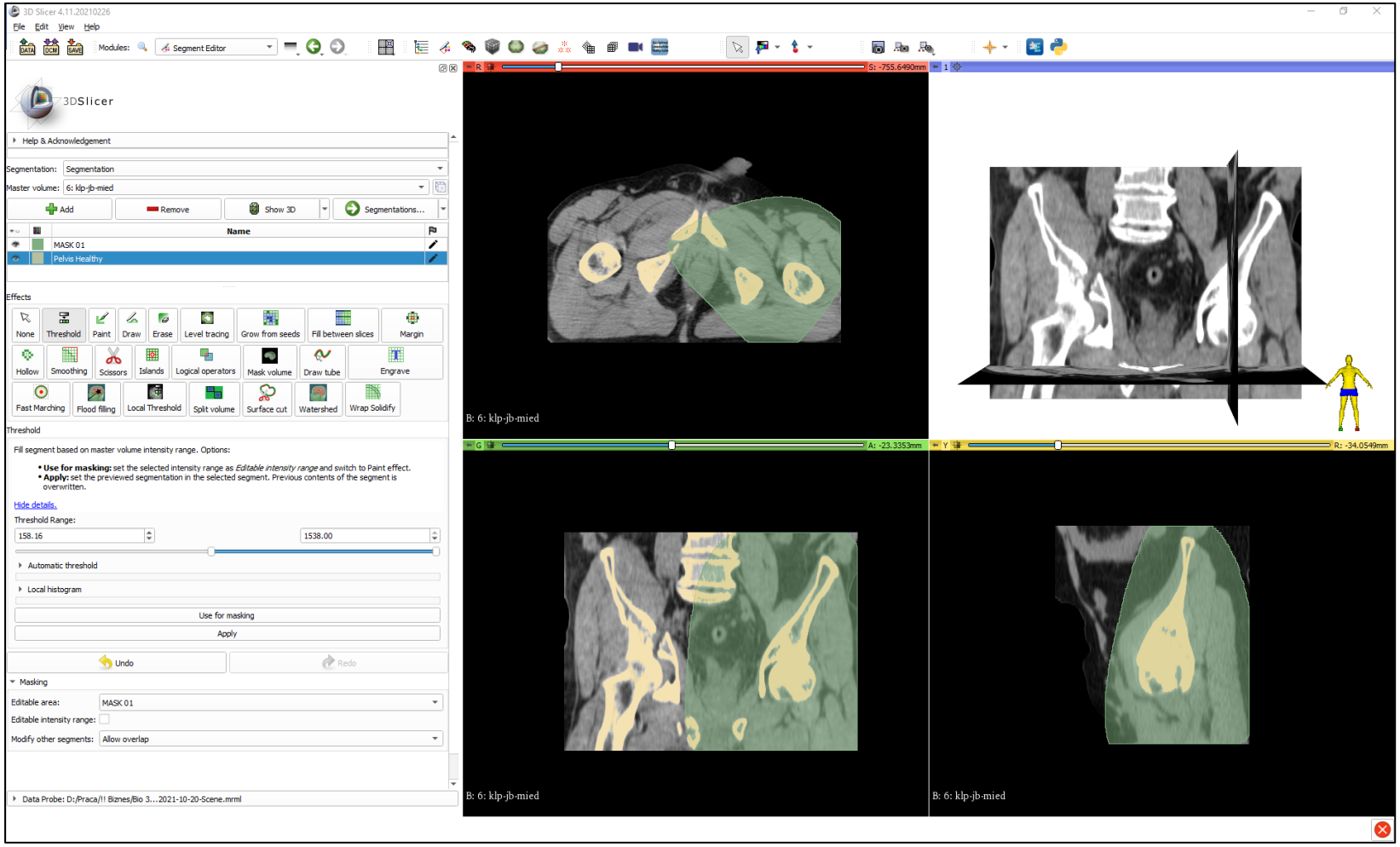
Figure S2. Select the 'SEGMENT EDITOR' module. Create two segments; that is, the first segment can be named, for example, MASK 01 and the second segment, for example, Pelvis L / R or uninjured.

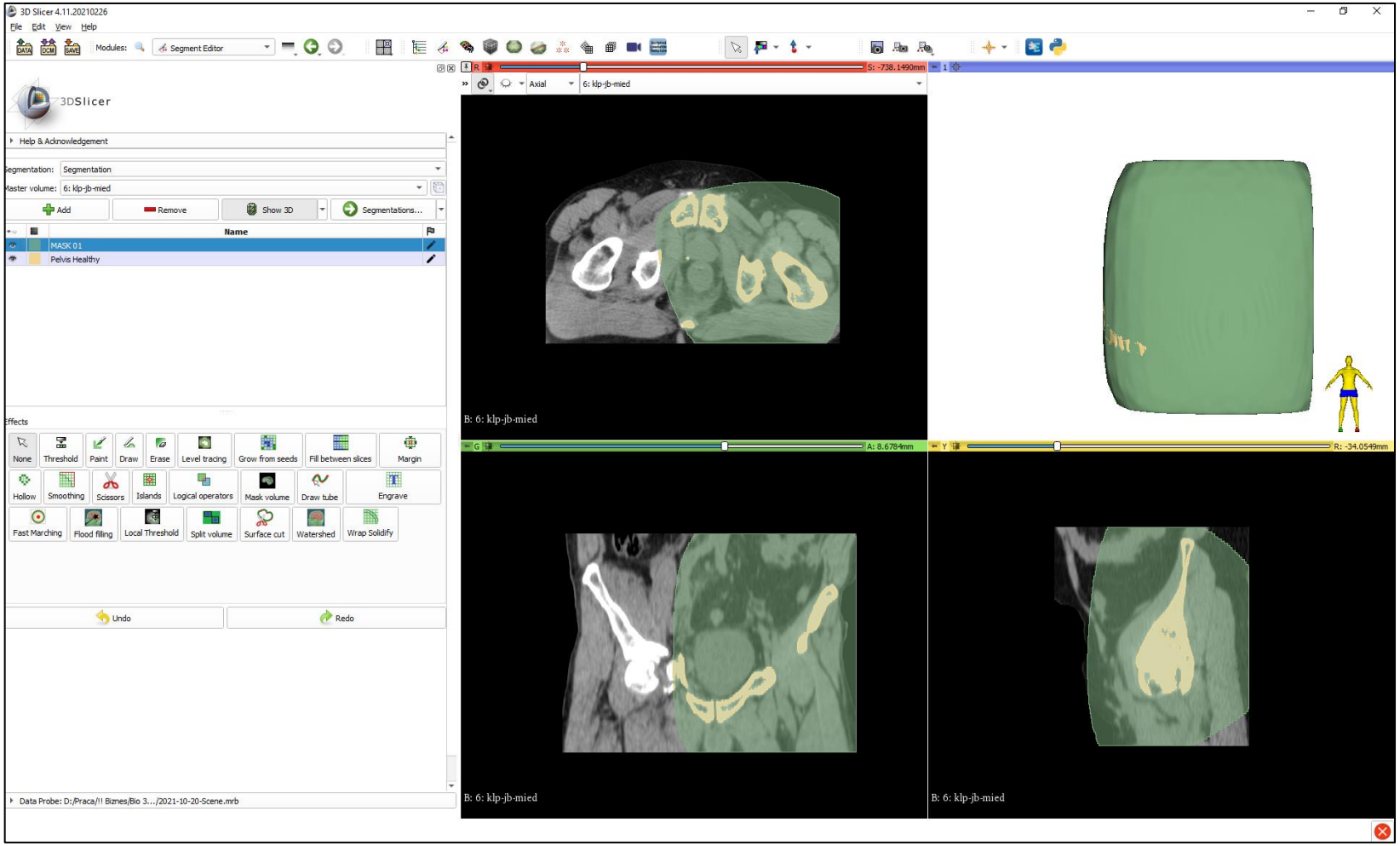
- Select the 'Surface Cut' function and then select the 'Fiducial Placement' function. Mark the area covered by segmentation on the CT images so that it covers the uninjured pelvic bones. Confirm 'Apply'.



- Select the 'Threshold' function. Adjust the Threshold Range so that the pelvic bones are clearly marked without any artifacts. The typical range is 150 to 1500. In the 'Masking' tab, in the 'Editable Area' select 'Inside MASK 01' and in the 'Modify Other Segments' select 'Allow Overlap'. Confirm 'Apply'.



- Activate the ‘SHOW 3D’ function and then hide the ‘MASK 01’ segment.



- Select the 'PELVIS Injured' segment and perform segmentation correction process (remove artifacts) using the 'SCISSORS' function.

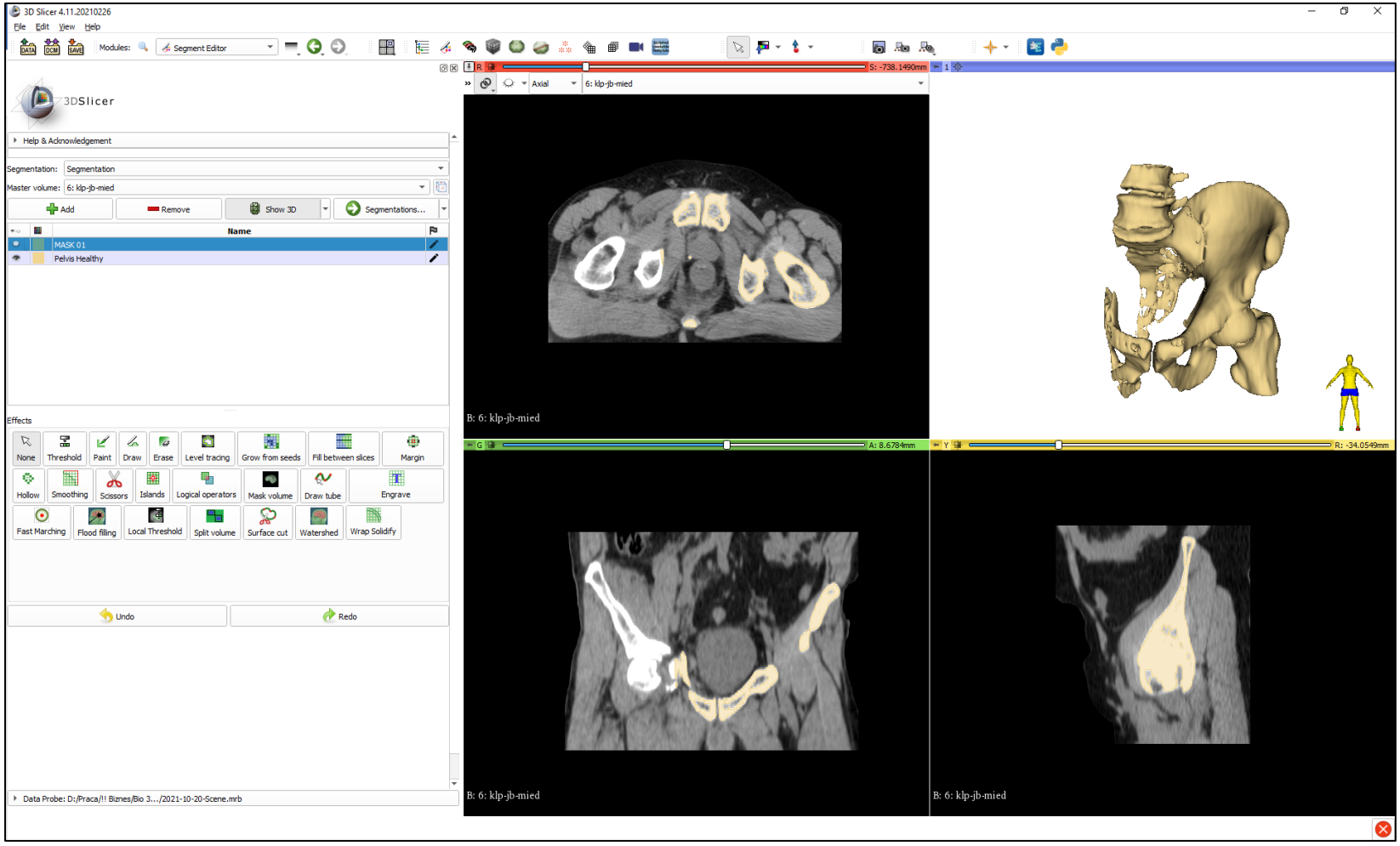


Figure S3. Segmentation correction process (removal of artifacts) using the ‘SCISSORS’ function.

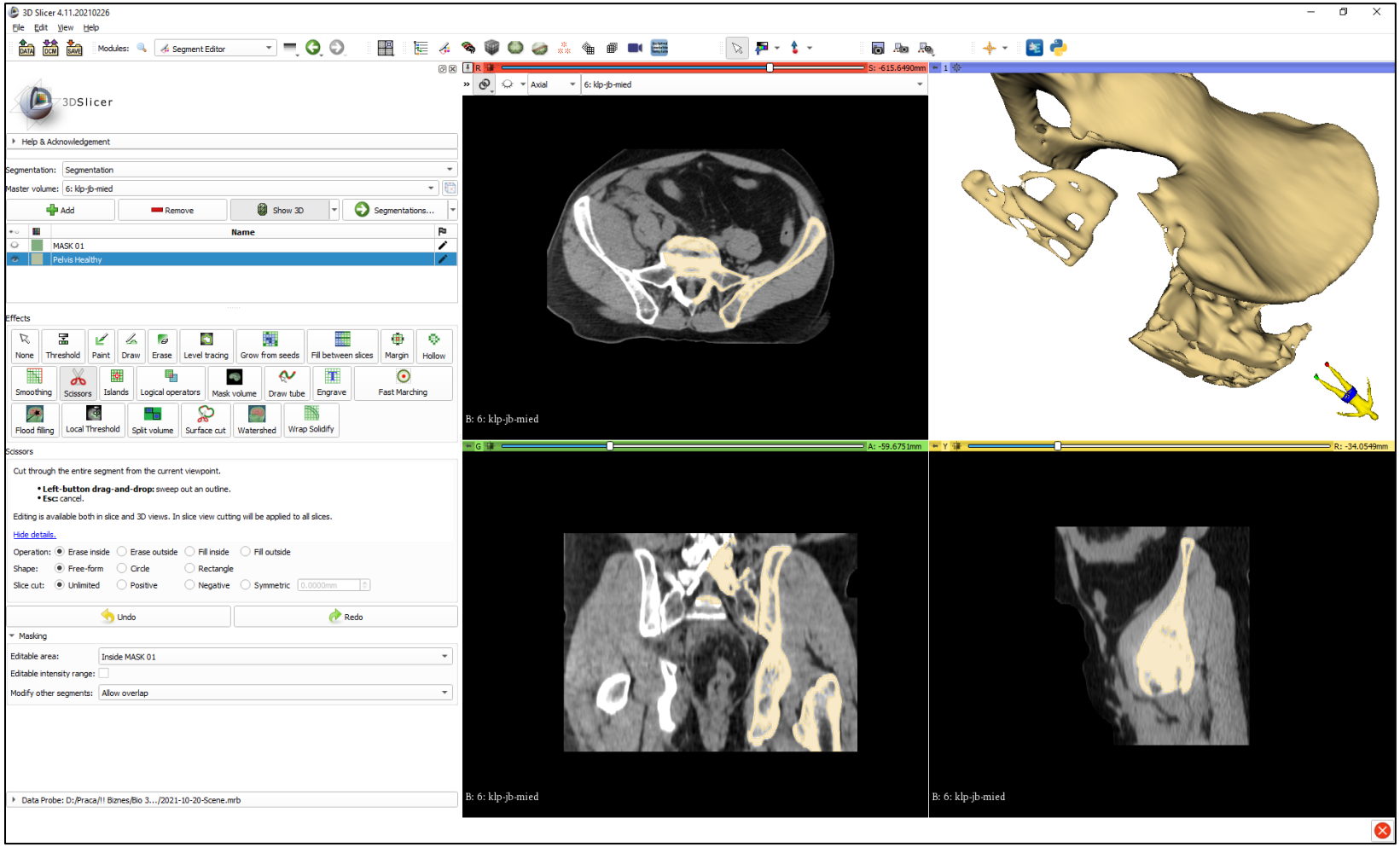


Figure S4. Segmentation correction process (removal of artifacts) using the ‘ERASE’ function.

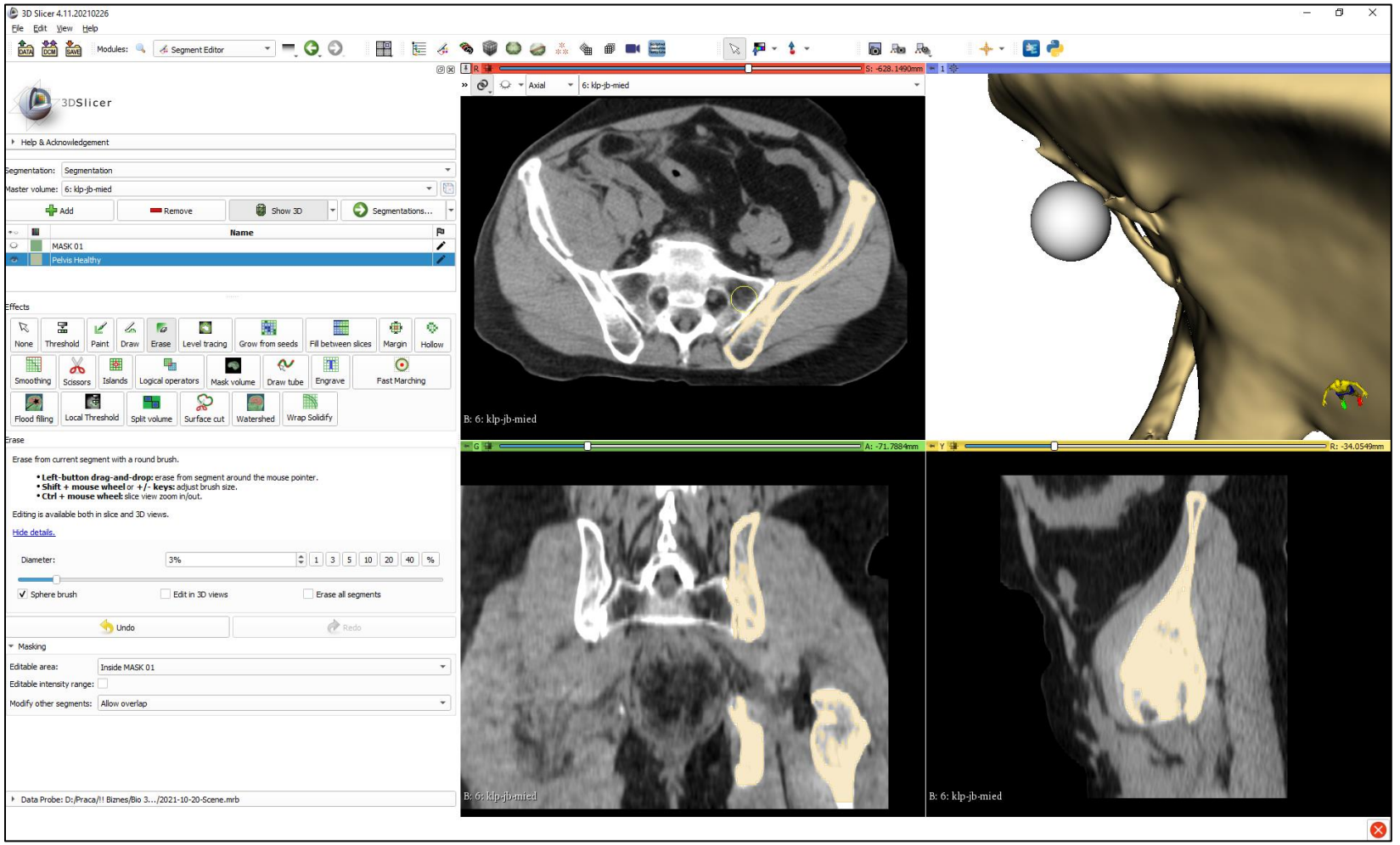


Figure S5. Segmentation correction process (removal of artifacts) using the ‘PAINT’ function.

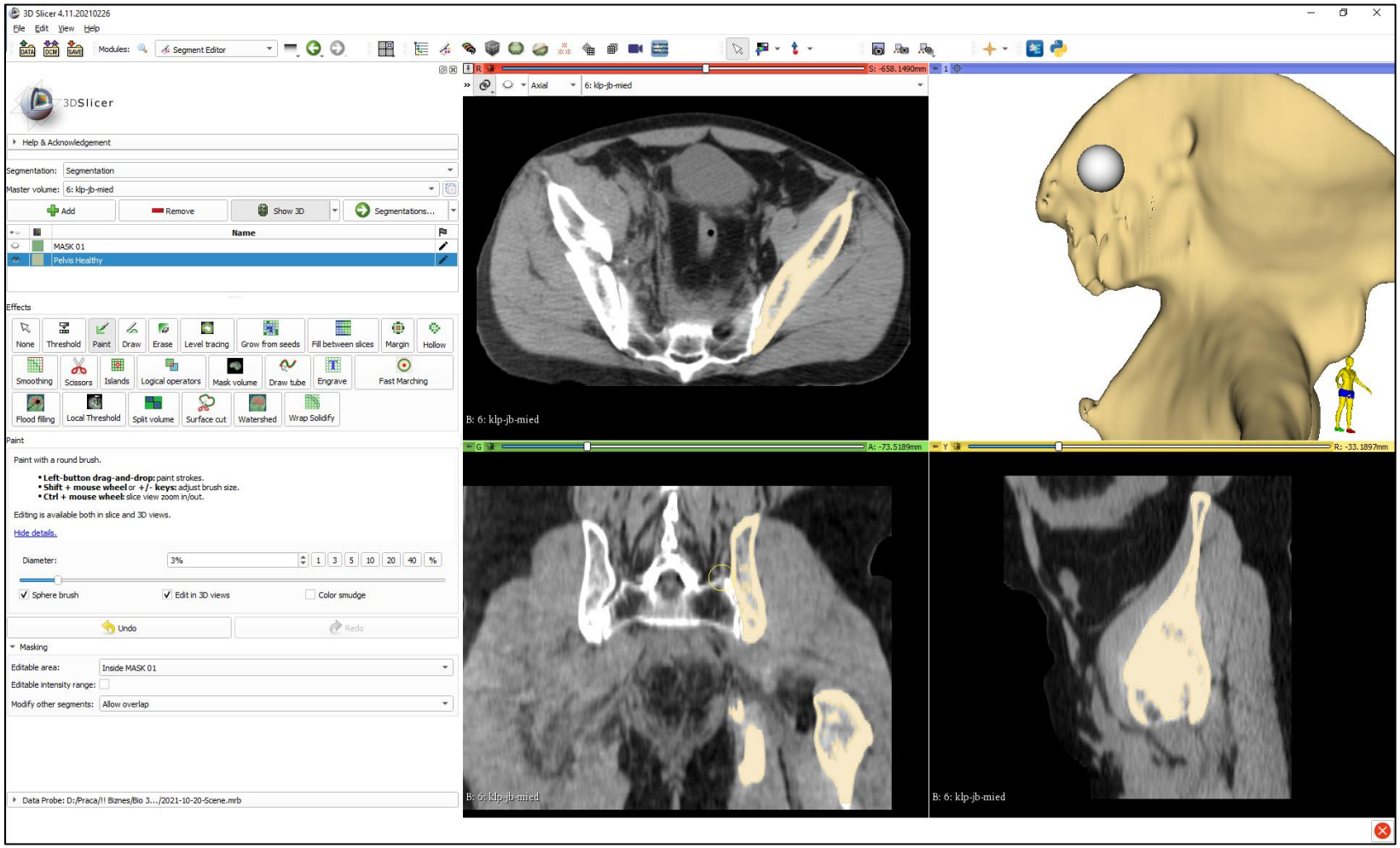
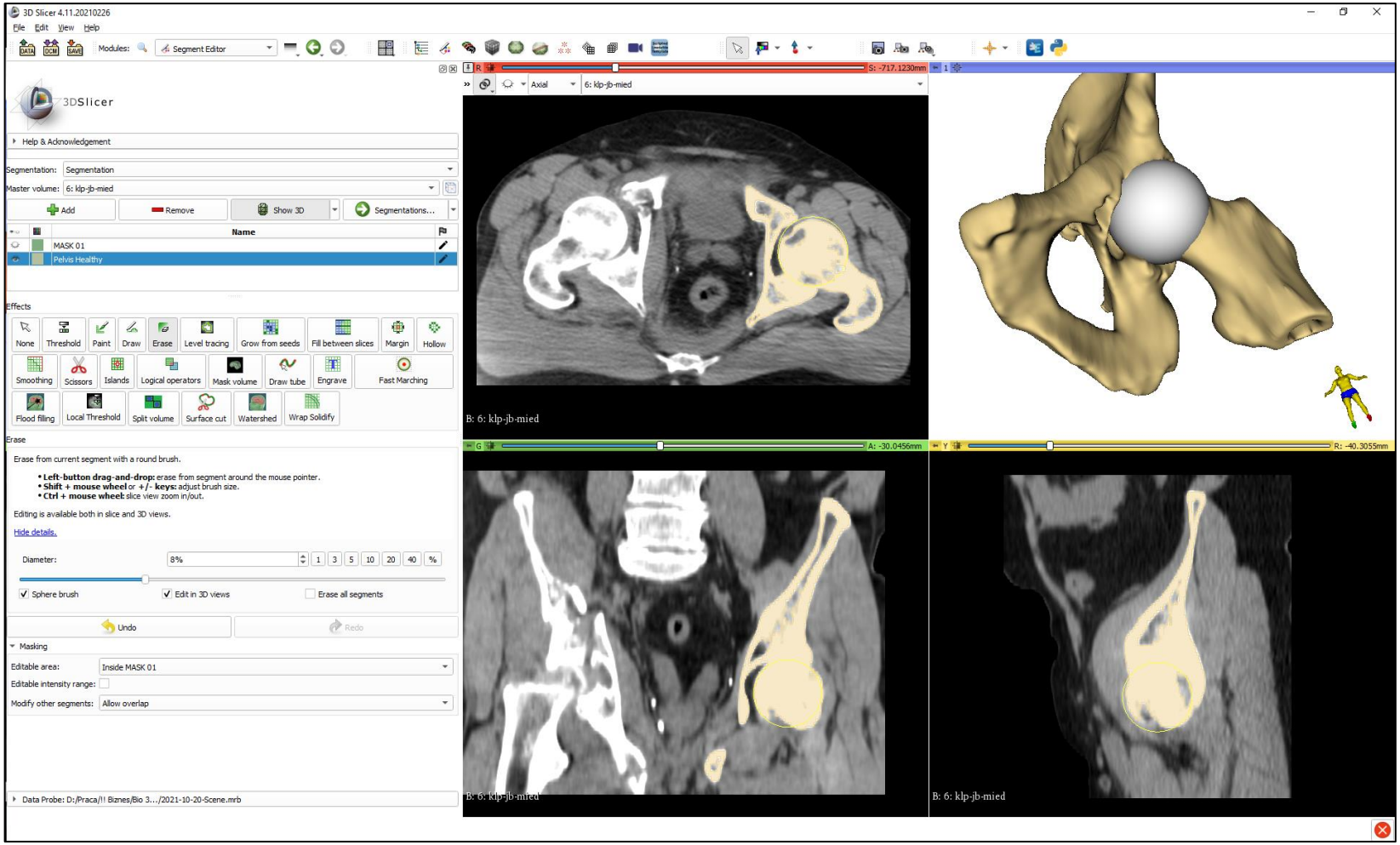
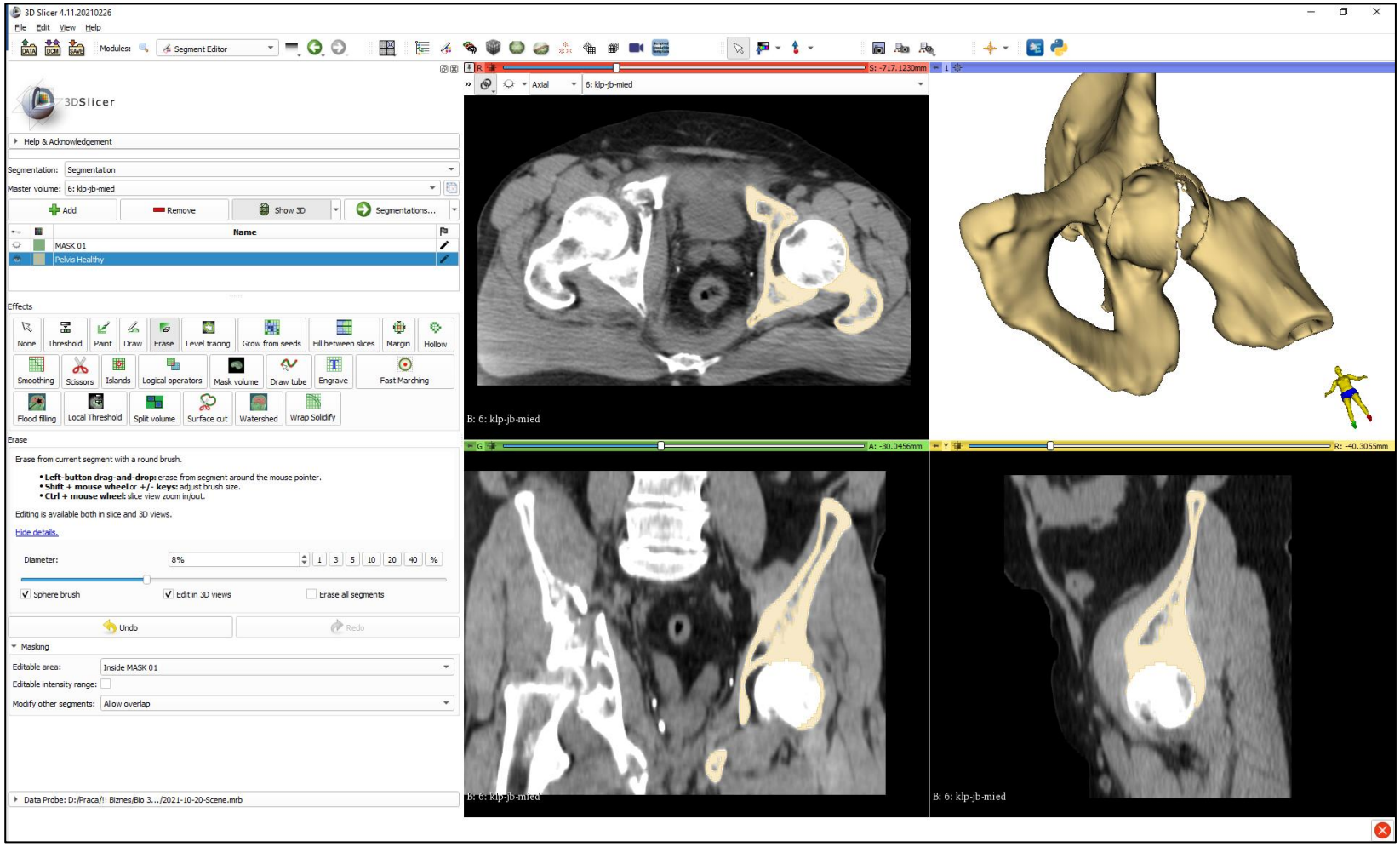


Figure S6 A, B and C. Removal of the femur using the ‘ERASE’ function and the ‘ISLAND’ function.

A



B



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C

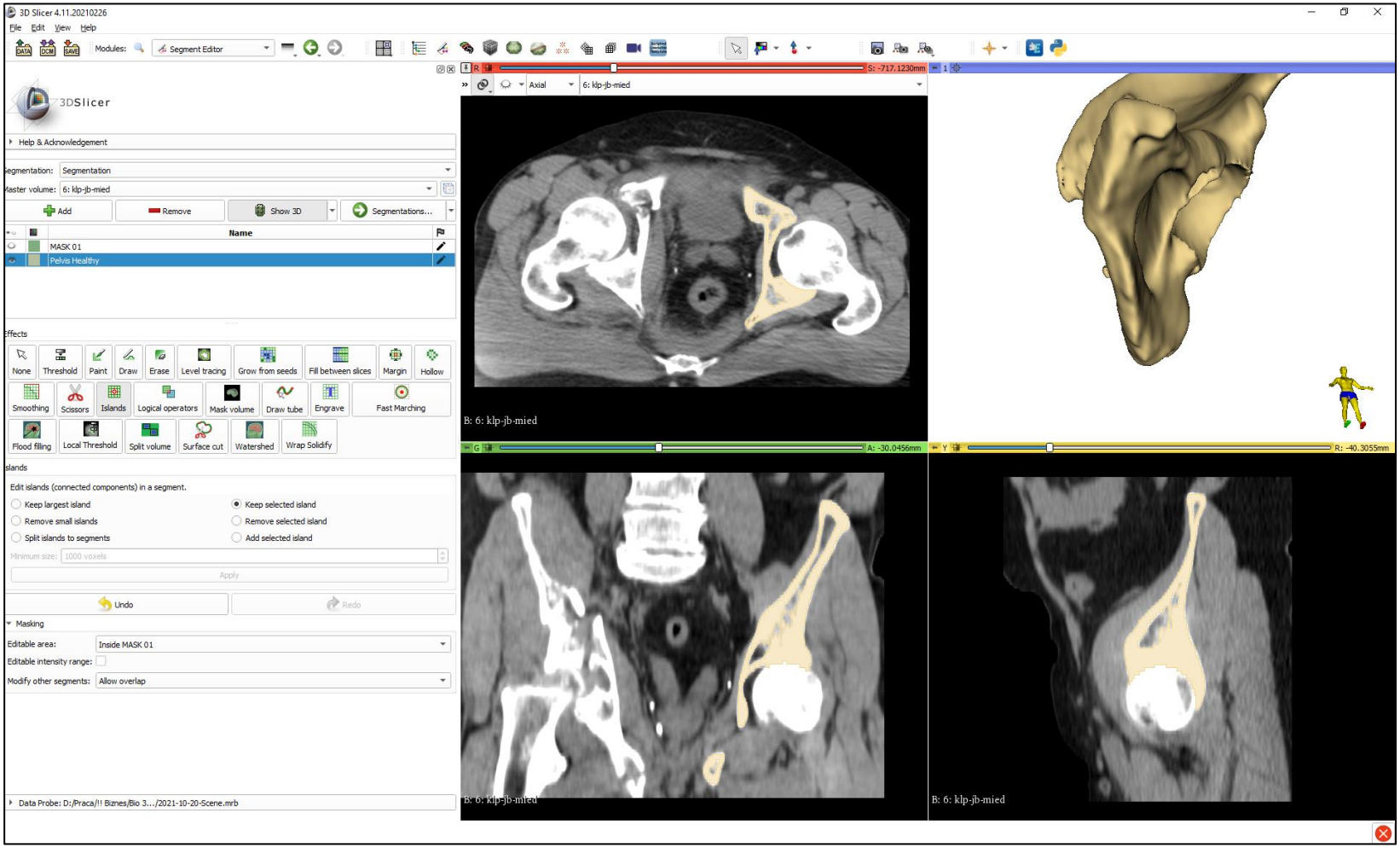

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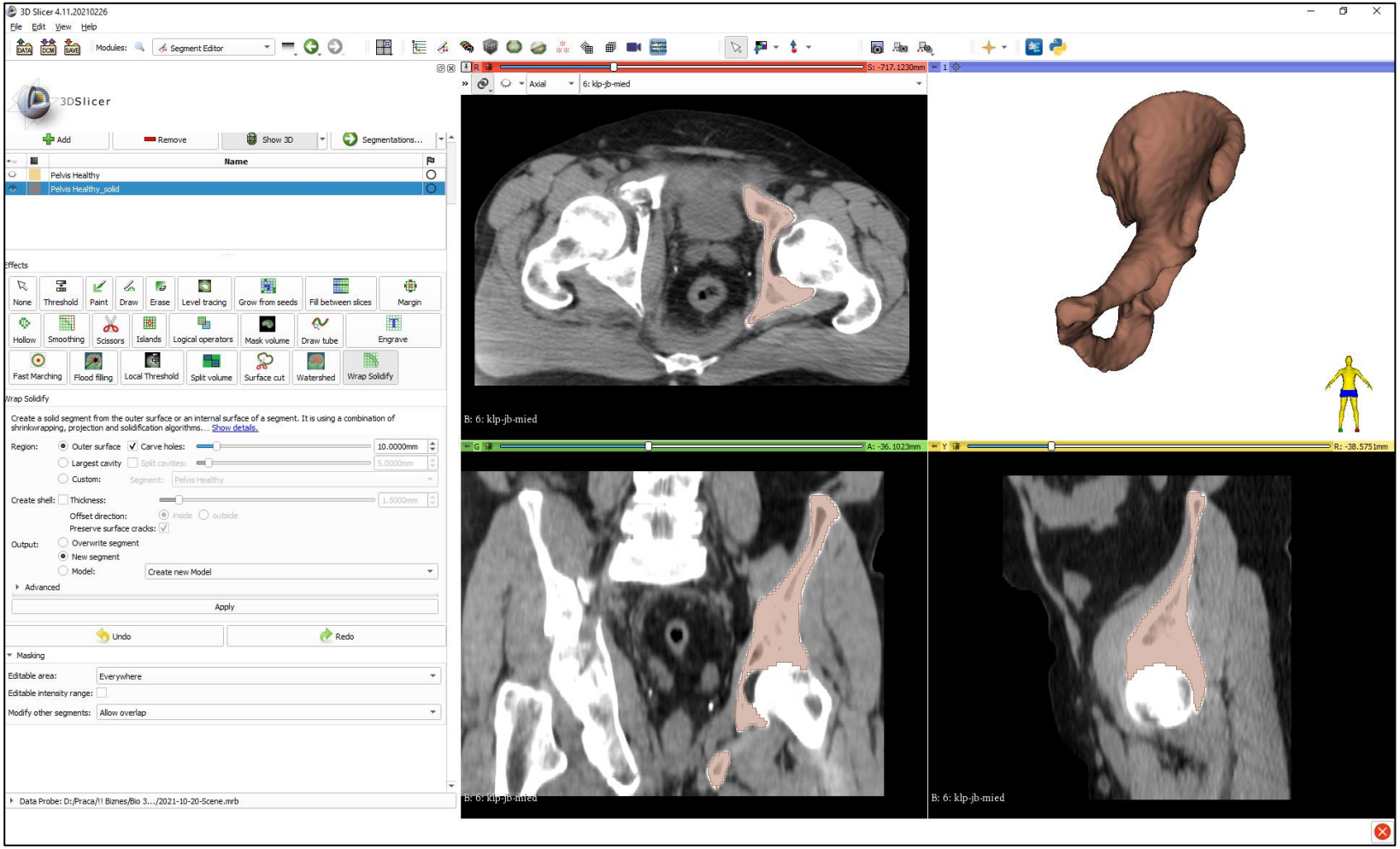
Figure S7 A and B. Creating a 3D model for printing. Select the ‘WRAP SOLIDFY’ function. Select the ‘Other Surface’ option and the ‘Carve Holes’ option in ‘Region’ function and mark its value on level 10. Select ‘New segment’ in the ‘Output’ function. Confirm using ‘Apply’. A new segment will be created with the same name as the original segment but with the note ‘solid’.

A



B

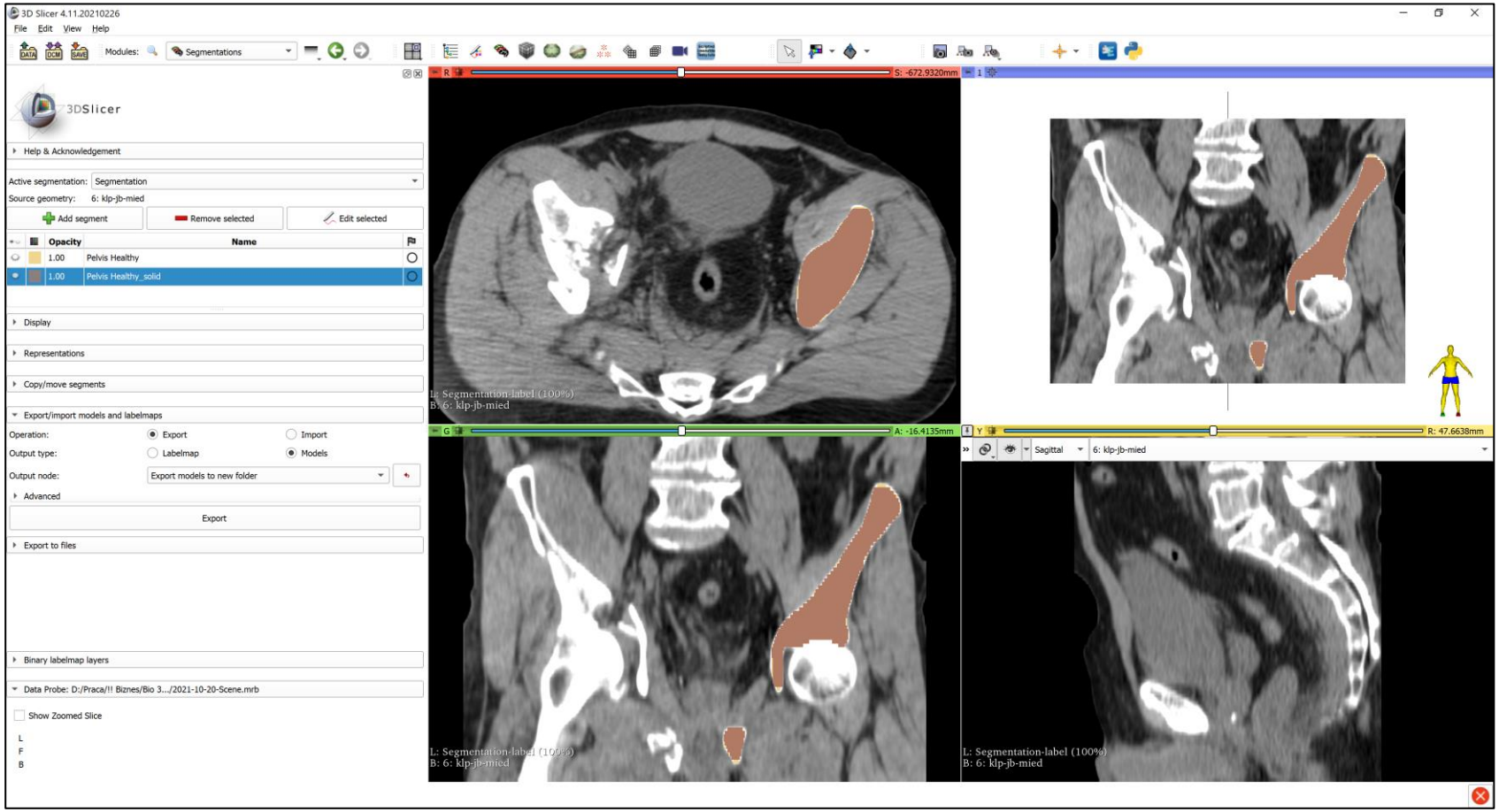


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Figure S8. Select the 'MARKUP' module. Create a mirror plane (sagittal view) with the function 'Create plane markup'.

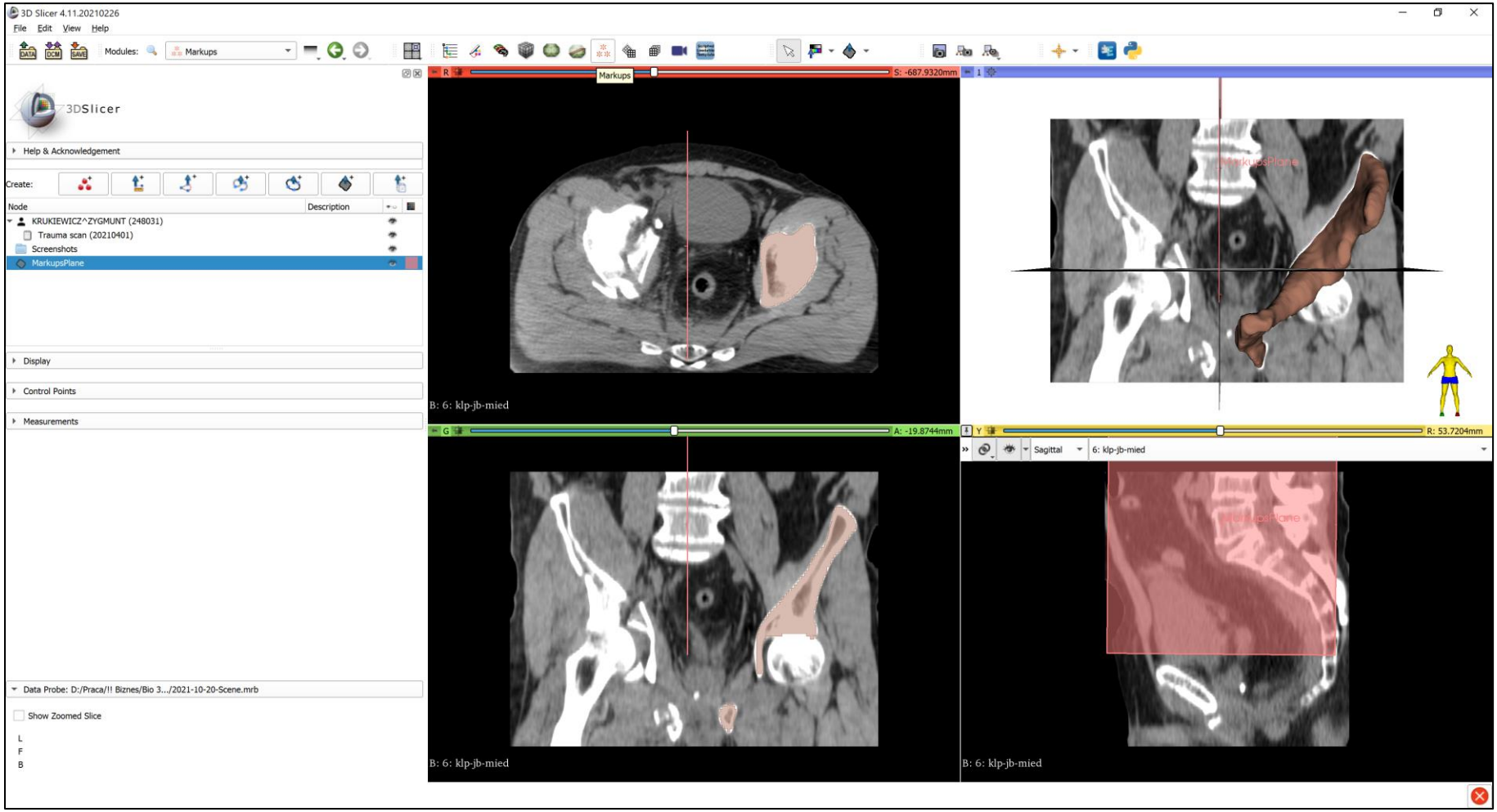

Figure S9. Select the 'DYNAMIC MODEL' module. In the 'Input nodes' tab, select the segment with the annotation 'solid' and select the previously created mirror plane. In the 'Output nodes' tab, select the 'Create new model' option. Confirm using 'Apply'.

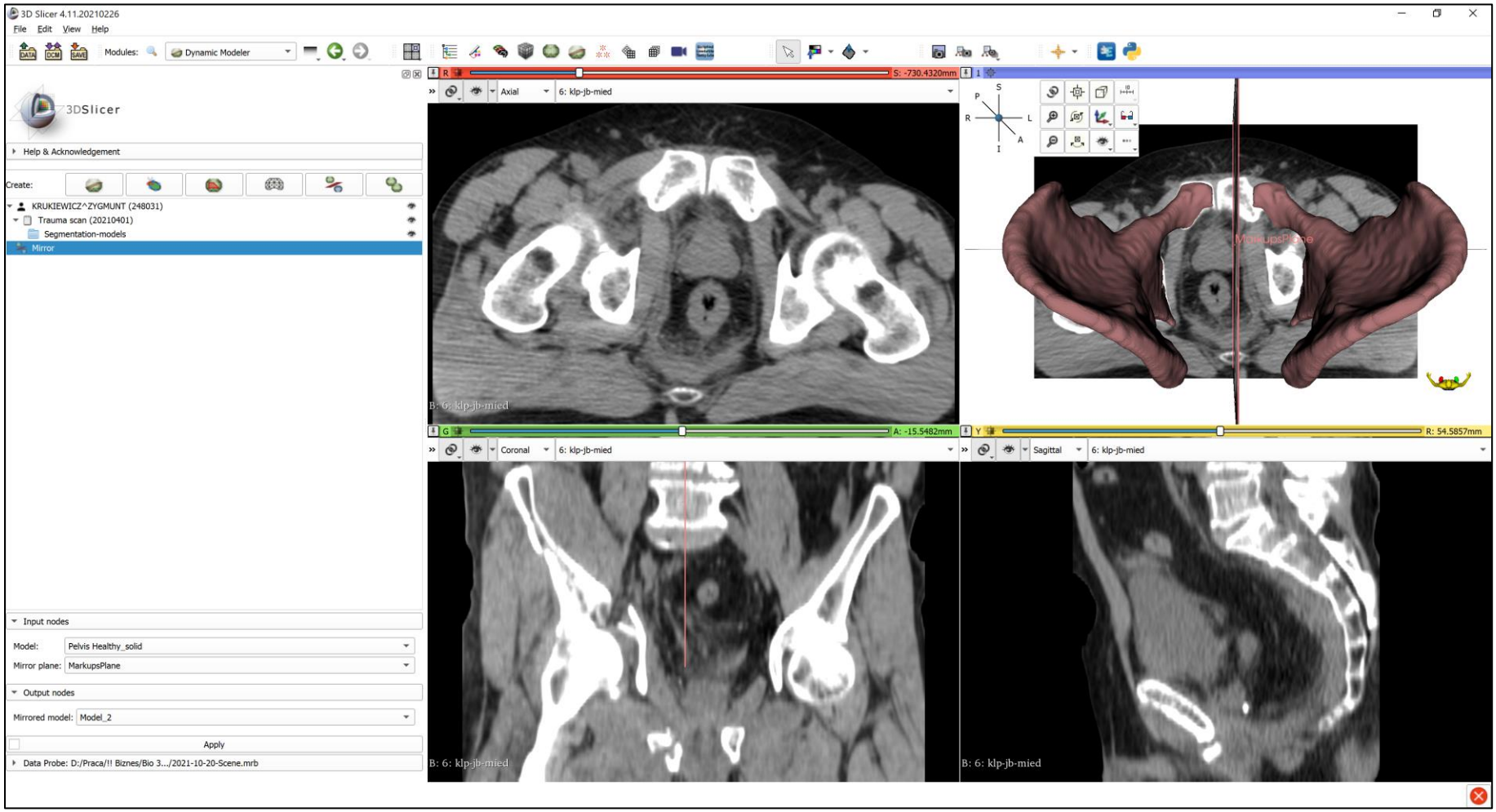

Figure S10. Select the 'SURFACE TOOLBOX' module. Select the 'SMOOTHING' function and set the following parameters Method: Leplace, iterations: 100 and relaxation: 0.1. Confirm with 'Apply'.

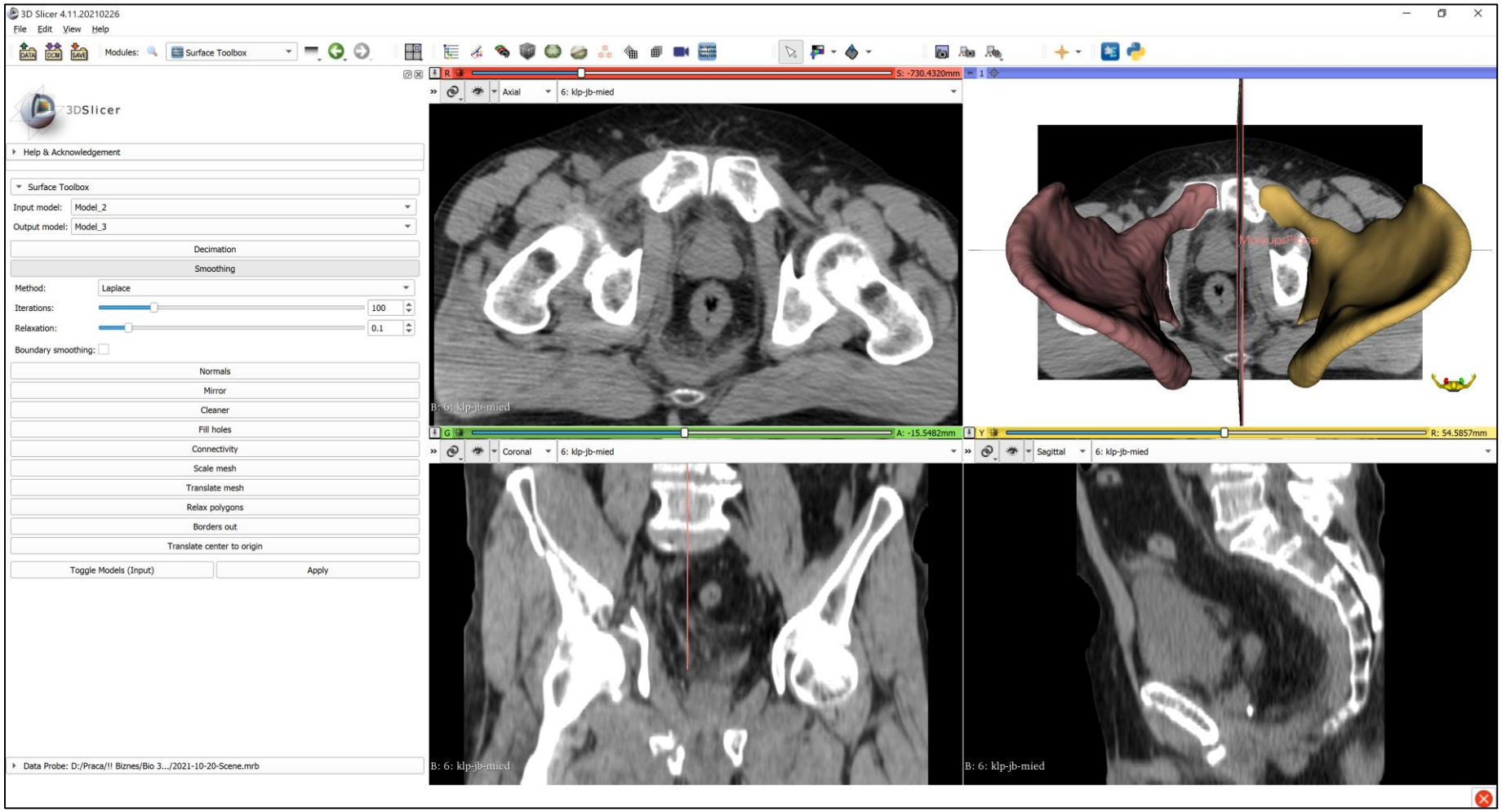

Figure S11. Export the model. Select the 'SAVE' function, choose the prepared model and select the file format (i.e., stl or .obj) and indicate the save path. Confirm 'Save'.