

1 3D Preoperative Virtual Planning in Derotational Proximal Femoral Osteotomy

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3 **Supplementary File 1**

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5 **1. 3D Slicer software**

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7 **1.1. How to obtain the biomodel, step by step (Supplementary Figure S1)**

The screenshot displays the 3D Slicer 4.11.20210226 software interface. The main window shows a 'Welcome' screen with several buttons: 'Load DICOM Data', 'Load Data', 'Install Slicer Extensions', 'Download Sample Data', 'Customize Slicer', and 'Explore Loaded Data'. A 'Help & Acknowledgement' section is also visible. A file import dialog box is open, showing a directory view of 'C:\Users\KATERINA\Desktop\Alba perez D' containing various DICOM files. Below the dialog, the 'DICOM database' is displayed with three tables: Patients, Studies, and Series.

Patient name	Patient ID	Birth date	Sex	Studies	Last study date	Date added
DummyPatName1	DummyPatID1	1960-01-01	M	1	Fri Nov 23 2018	2022-11-...8:44.976

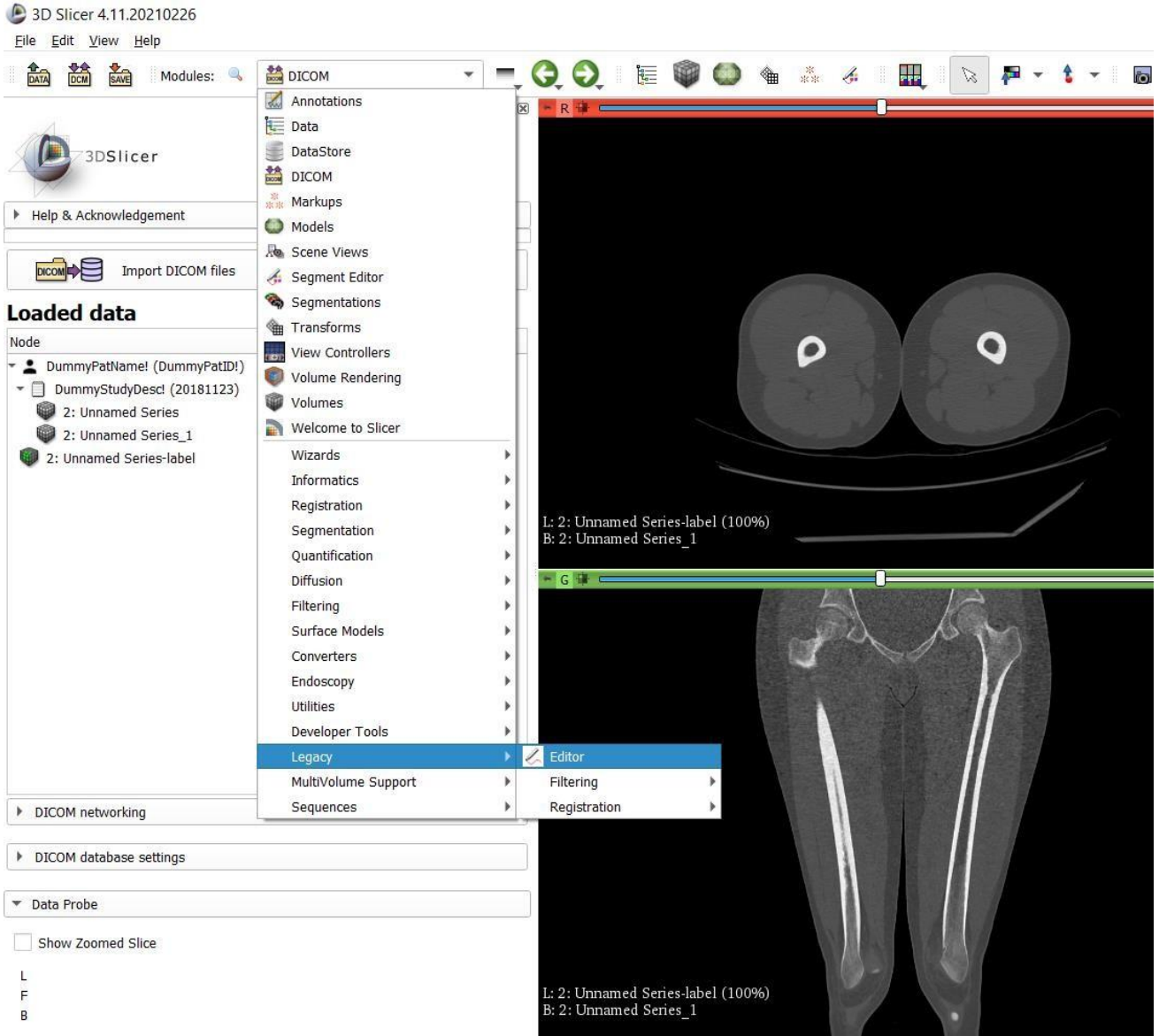
Study date	Study ID	Study description	Series	Date added
20181123	23169	DummyStudyDesc	4	2022-11-...8:44.977

Series #	Series description	Modality	Size	Count	Date added
1		CT	888x1289	2	2022-11-...8:44.977
2		CT	512x512	837	2022-11-...8:44.980
3	DummySeriesDesc	CT	512x512	419	2022-11-...8:45.608
999	DummySeriesDesc	CT	512x512	1	2022-11-...8:45.936

8 **1.2. How to create the biomodel**

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10 **1.2.1. As described in protocol step 2.3.2, in the dropdown menu, choose the Legacy |**
11 **Editor option (Supplementary Figure S2).**



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- 13 **1.2.2.** Select the **Threshold Effect** icon (**Supplementary Figure S3**). Move the bar in the
- 14 lower box until only the bone is painted in the images on the right (as shown in the image).
- 15 Click on **Apply**.

3DSlicer Try the new [Segment Editor](#) module for more advanced editing! Please help us improve the module by giving [feedback](#).

▼ Create and Select Label Maps

Master Volume: 2: Unnamed Series

Merge Volume: 2: Unnamed Series-label

▶ Per-Structure Volumes

▼ Edit Selected Label Map

ThresholdEffect

Undo/Redo: [Undo] [Redo]

Active Tool: ThresholdEffect

Label: tissue 1

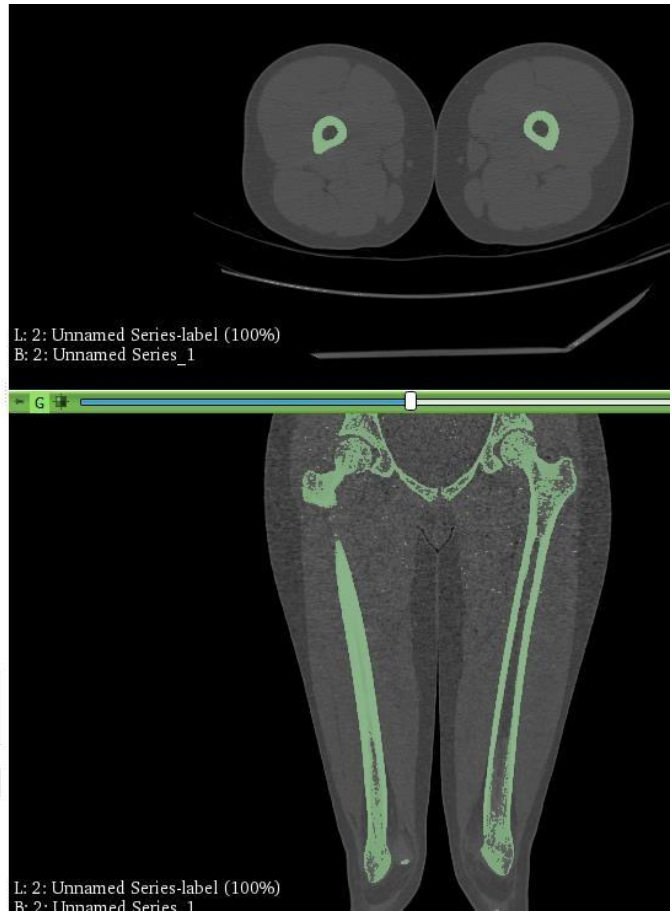
Threshold Range: 260.54 3415.00

Use For Paint

▼ Data Probe

Show Zoomed Slice

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- 16
- 17 **1.2.3.** Select **Make Model Effect** | **Apply** (**Supplementary Figure S4**)

3DSlicer Please help us improve the module by giving [feedback](#).

▼ Create and Select Label Maps

Master Volume: 2: Unnamed Series

Merge Volume: 2: Unnamed Series-label

▶ Per-Structure Volumes

▼ Edit Selected Label Map

MakeModelEffect

Undo/Redo: [Undo] [Redo]

Active Tool: MakeModelEffect

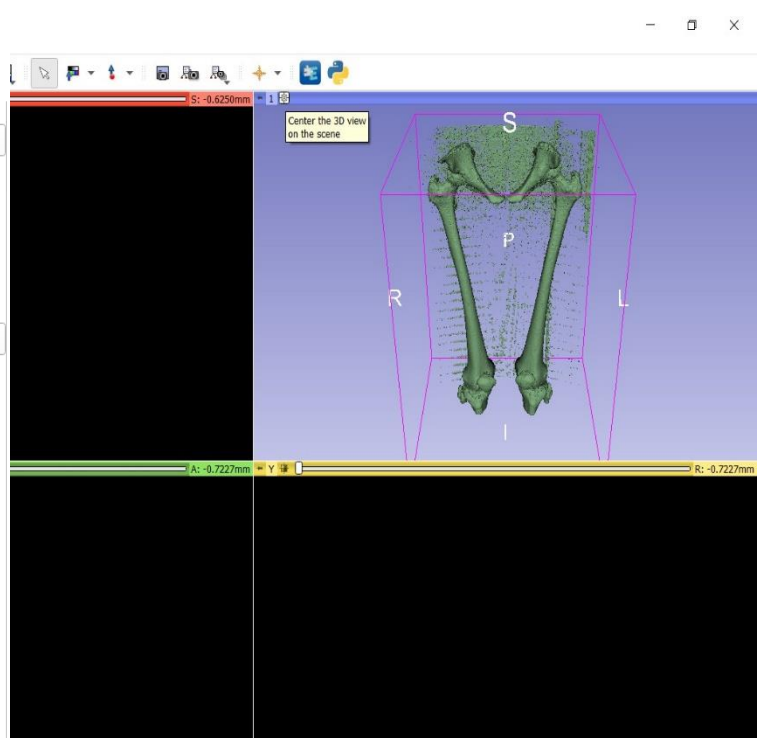
Label: tissue 1

Go To Model Maker

Smooth Model

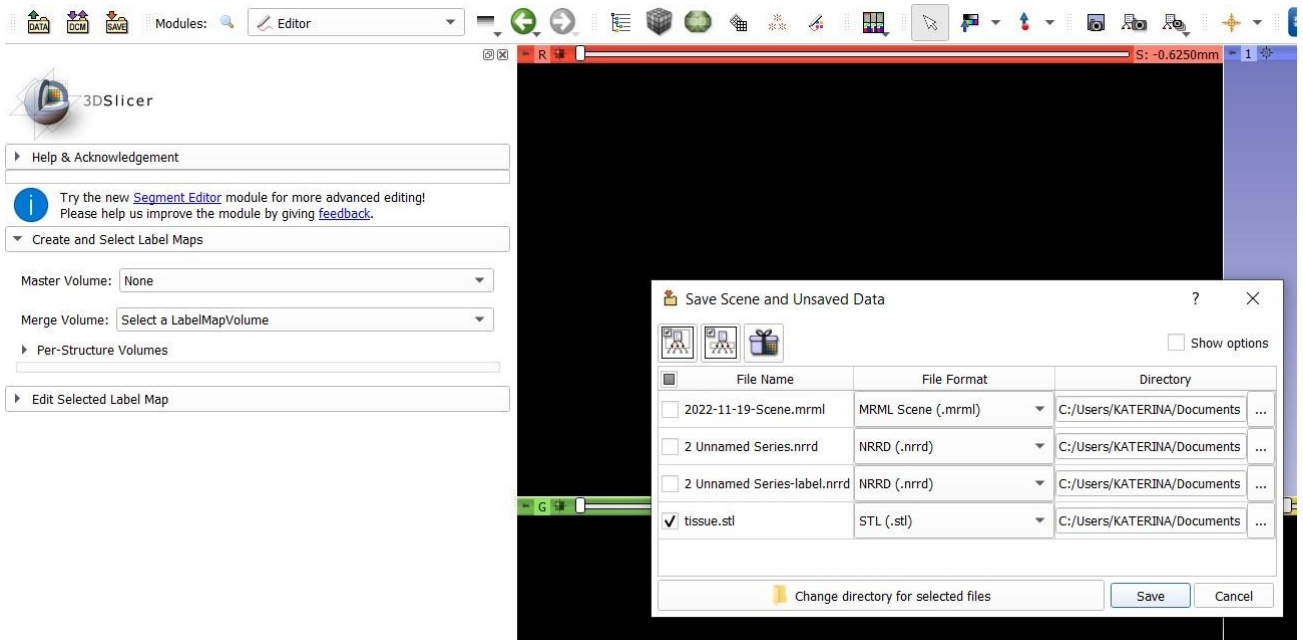
Model Name: tissue

Apply



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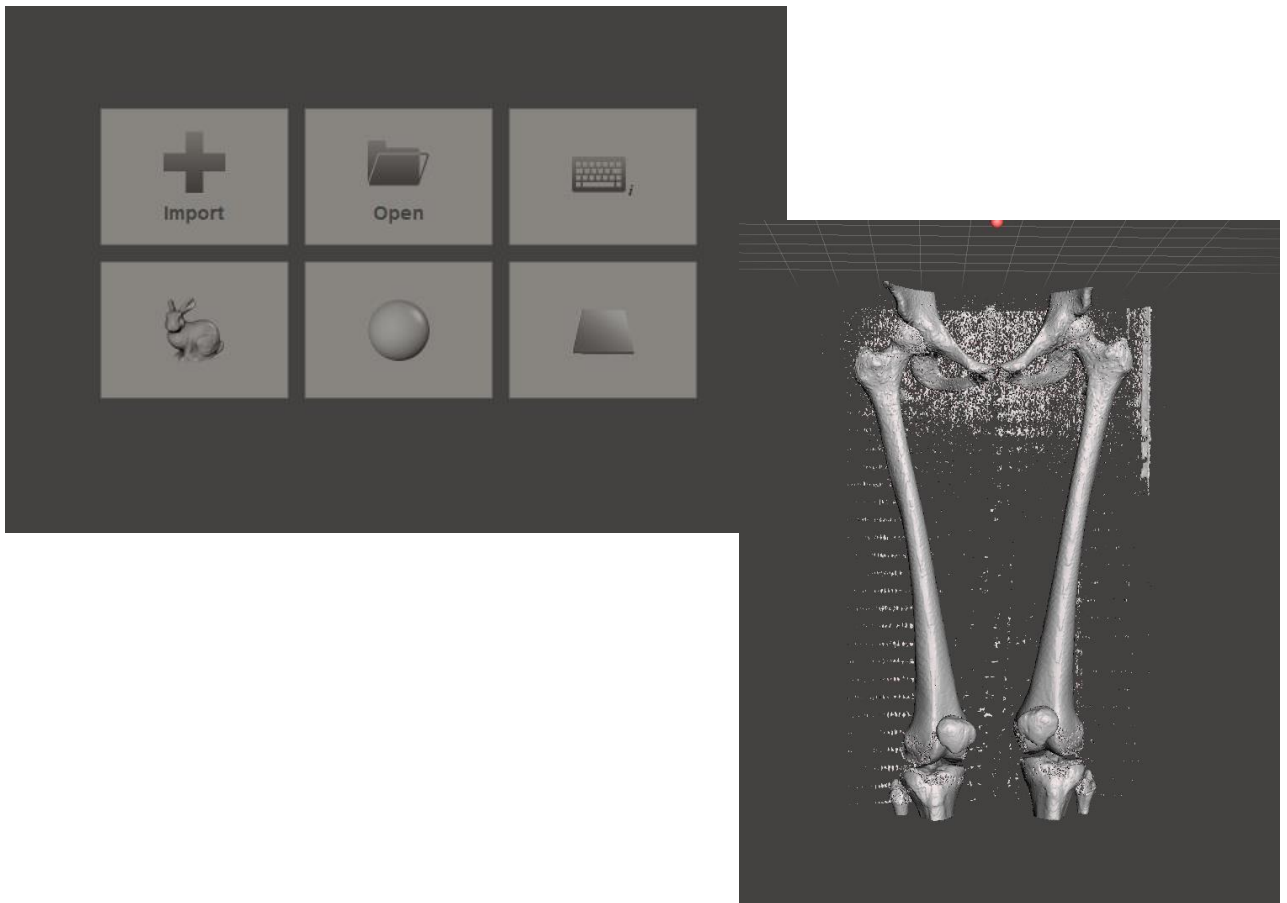
1.3. Select only the file "tissue" (Supplementary Figure S5). Save in STL format.



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2. MeshMixer software

2.1. Import the STL image by selecting **Import** (Supplementary Figure S6)

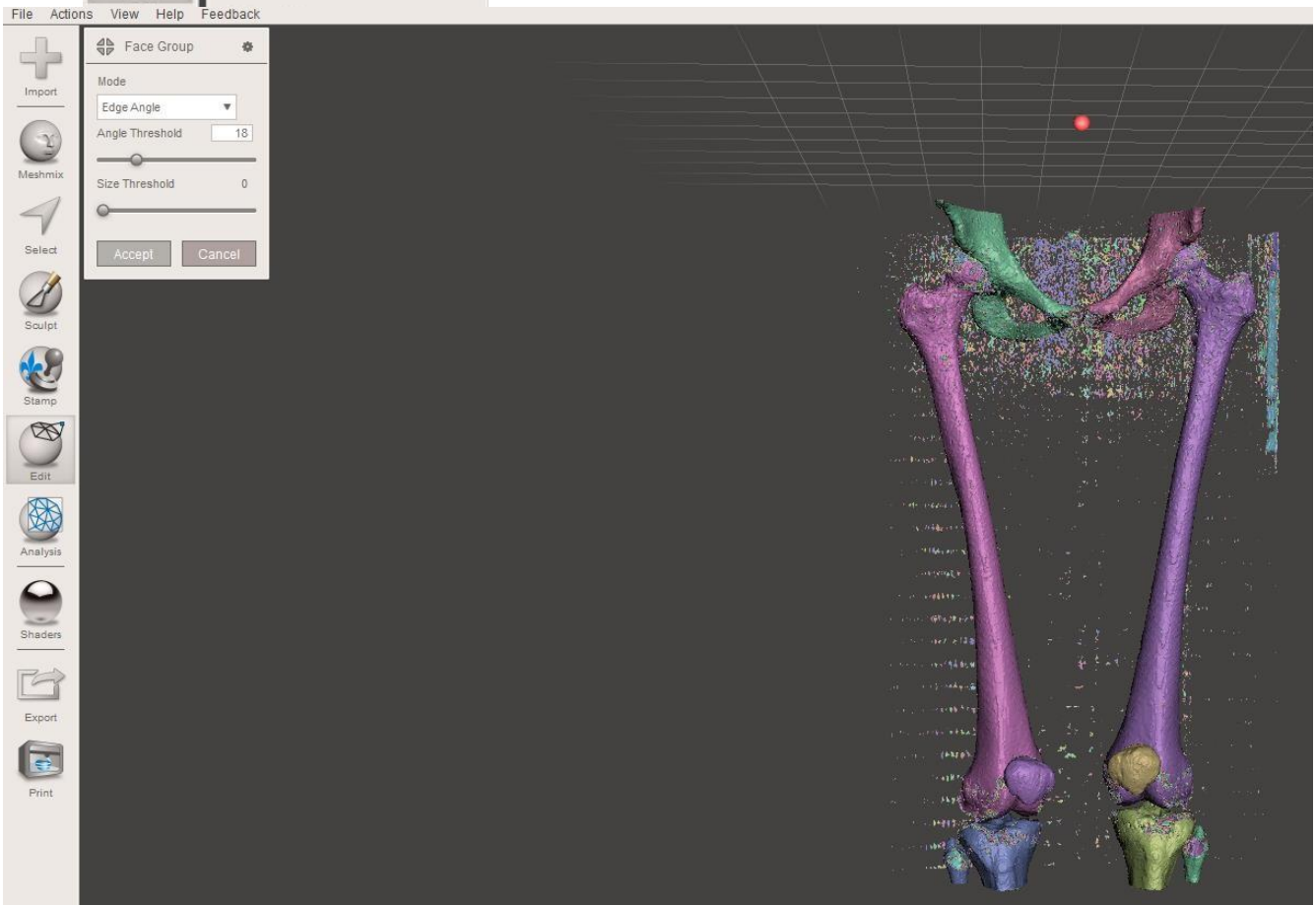
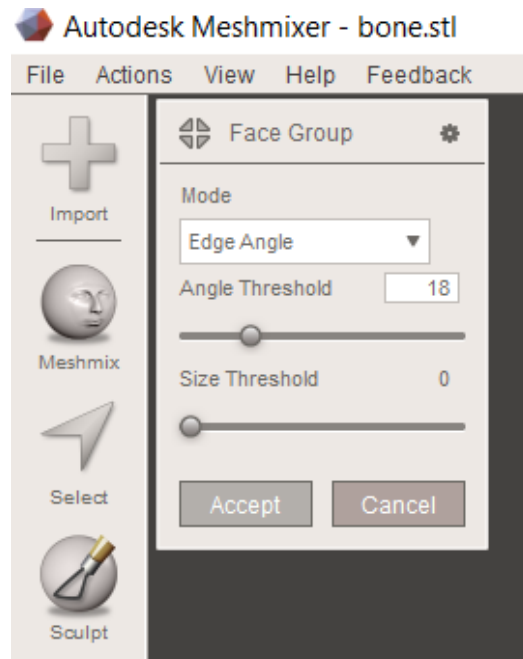
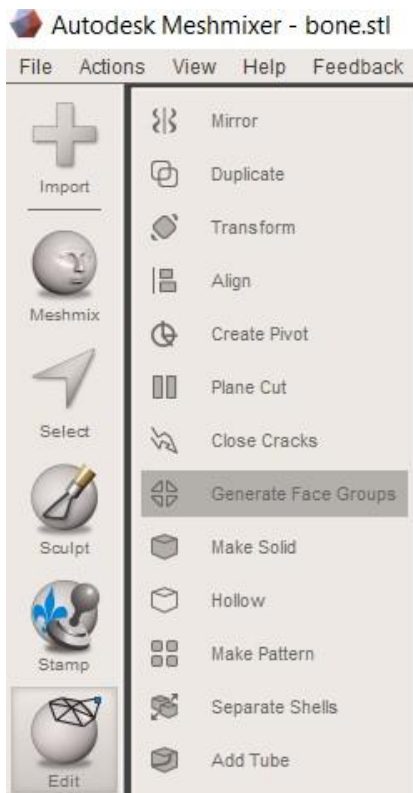


25 **2.2.** Click **Select**, select the thickness of the brush, and double-click on the femur
26 (**Supplementary Figure S7**). In this case, it is not possible to separate only the femur (the
27 femur is selected with the pelvis).
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39 **2.3.** Select the tool **Edit | Generate face Groups**. Use **Angle Threshold** to move the bar
40 until the different structures have a different color—the pieces have been recognized as
41 separate (**Supplementary Figure S8**).

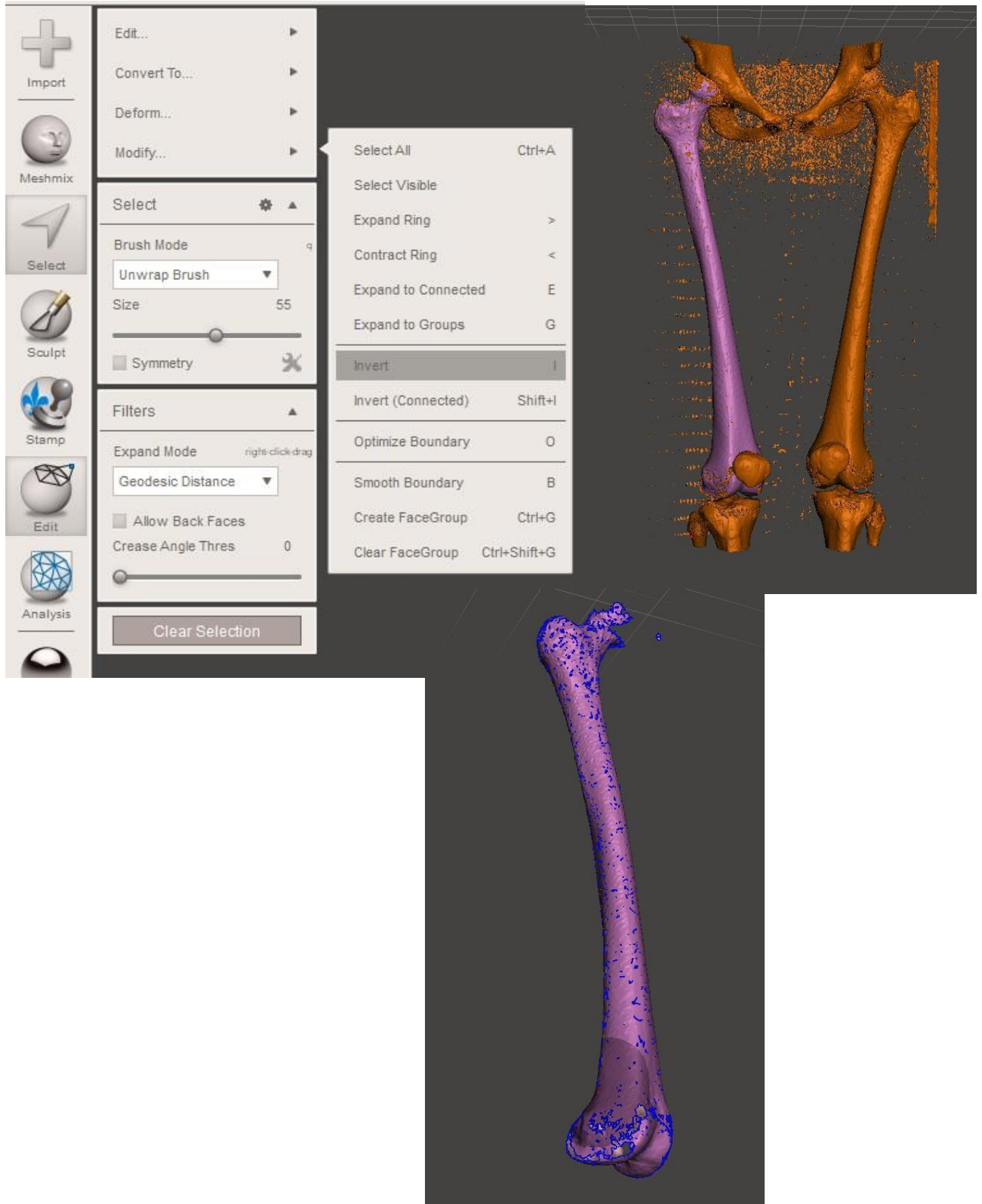


42 **2.3.1.** How to invert and delete (**Supplementary Figure S9**):

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44 **2.3.2.** Use the **Select** tool to select the part of interest. Look for the **option Select | Modify**
45 **| Invert** in the side menu and press **Delete** (**Supplementary Figure S9**) to delete the
46 unselected parts (Step 3.3.2). At this juncture, the biomodel of the clean femur is obtained.

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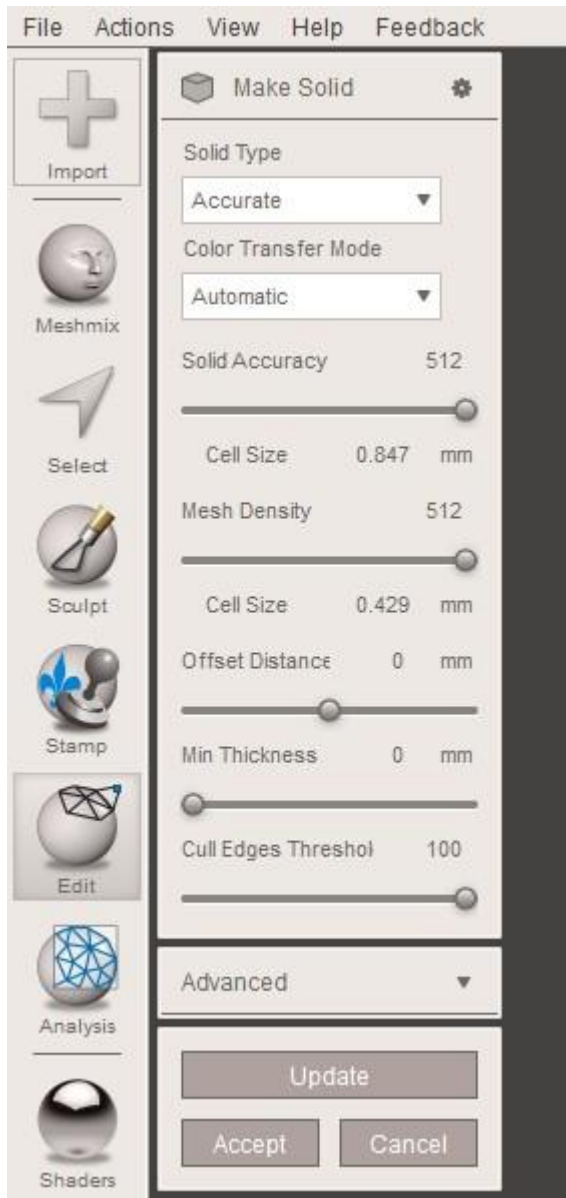


48 **2.4.** How to make a solid model (**Supplementary Figure S10**):

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50 **2.4.1.** Navigate to Edit | Make Solid | Solid Type| Accurate (Step 3.4.1). Maximize Solid
51 Accuracy and Mesh Density values (Step 3.4.2).

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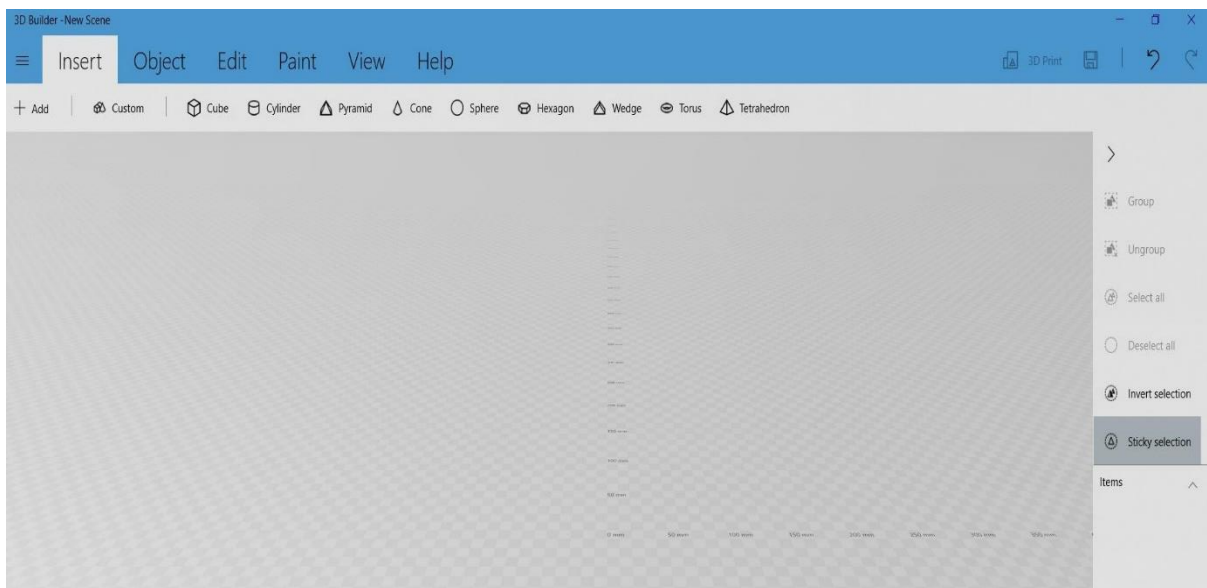
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64 **3. 3D Builder software**

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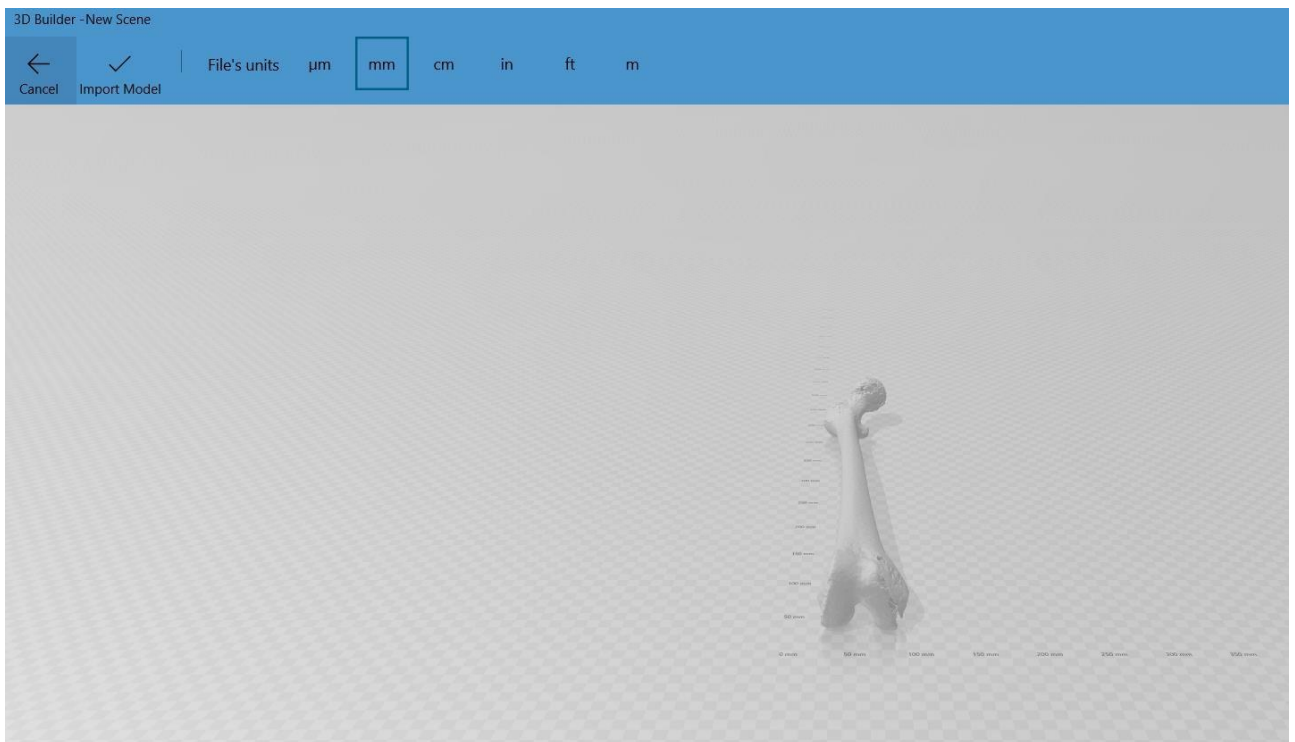
66 **3.1. Insert the biomodel (Supplementary Figure S11).**



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68 **3.2. Import the biomodel (Supplementary Figure S12).**

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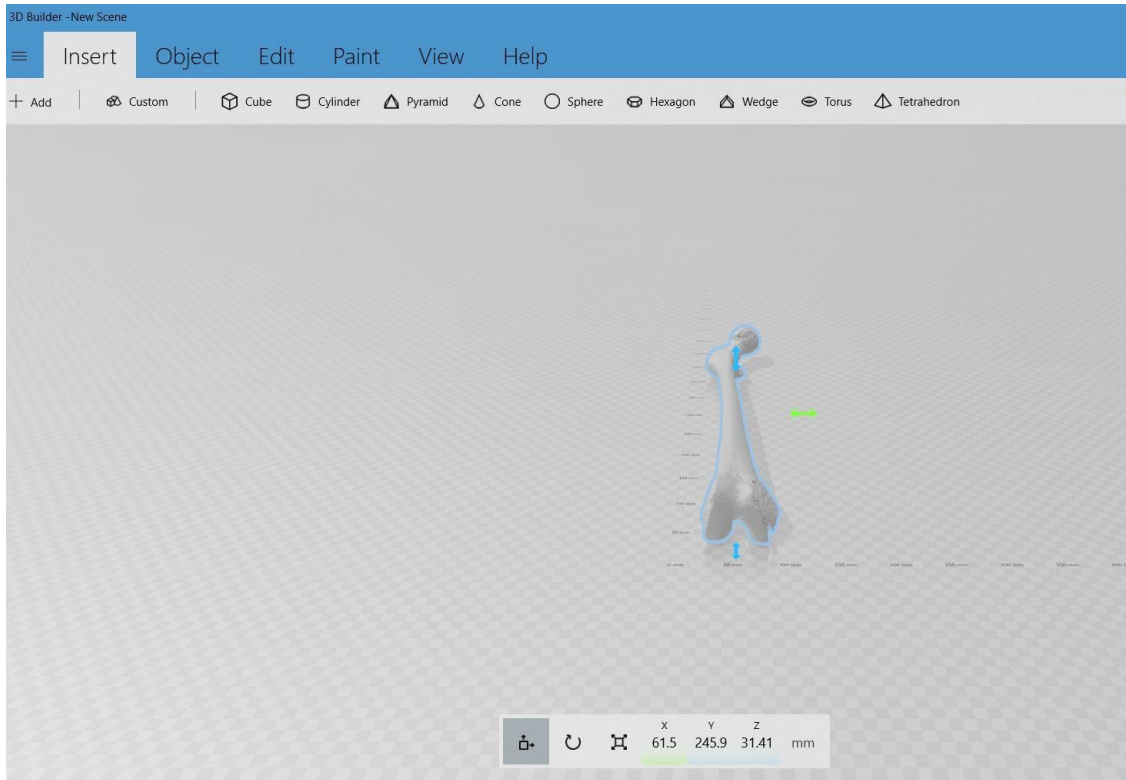
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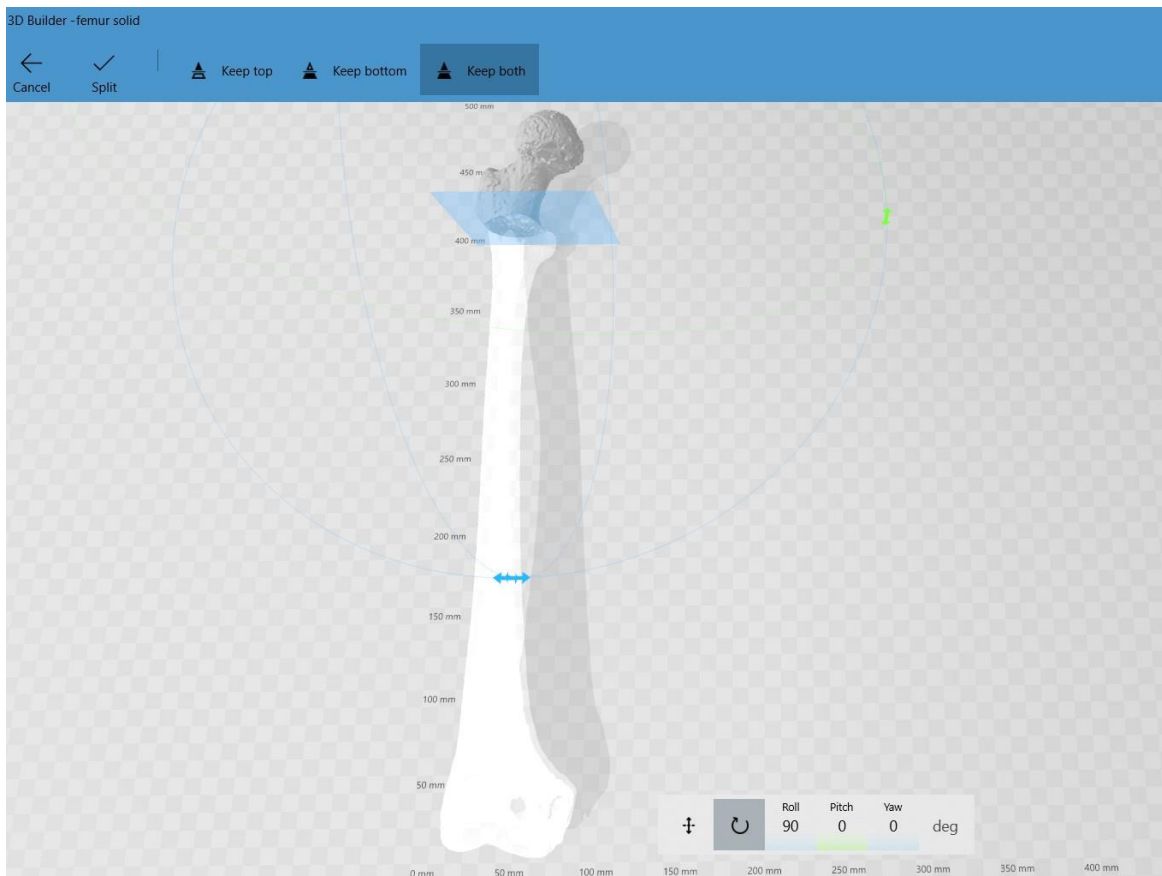
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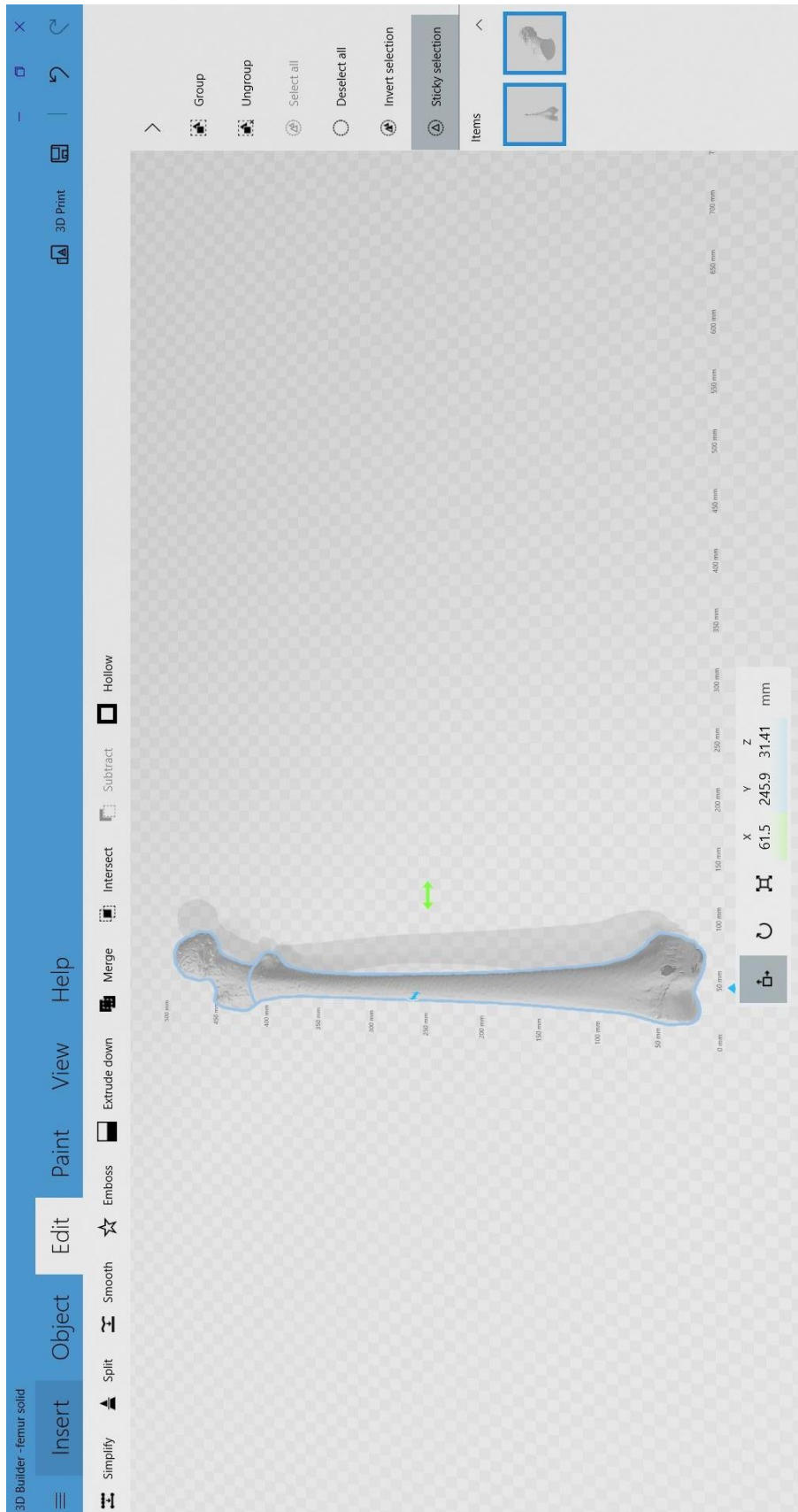
76 **3.3.** The object rests on the femoral condyles and the trochanter. It is parallel to the *y*-
77 *axis* and perpendicular to the *x*-*axis* (**Supplementary Figure S13**).



78 **3.4.** How to split the femur (**Supplementary Figure S14**): Click on **Edit | Split** from the top
79 menu. When a rectangular cut plane appears, select **Keep Both**



80 **3.5.** Perform the femoral osteotomy (keeping both parts of the femur) (**Supplementary**
81 **Figure S15**).



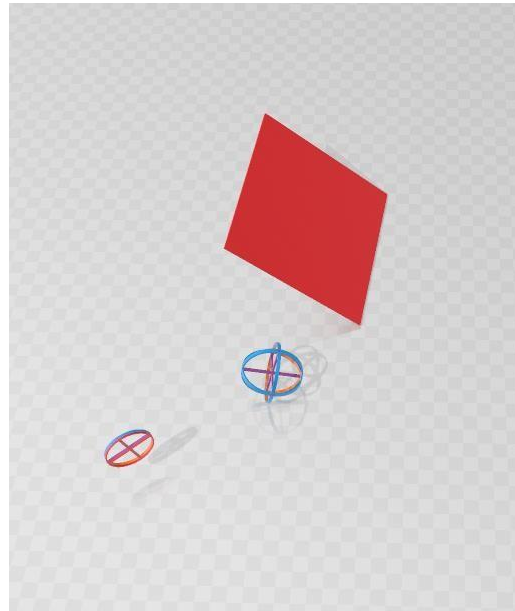
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83 **3.6.** The guides make it possible to establish the reference points to measure the femoral
84 anteversion in the 3D environment in accordance with Murphy's method. **Red circular**
85 **guide; Purple circular guide; Sphere; Red plane (Supplementary Figure S16A,B).**

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A

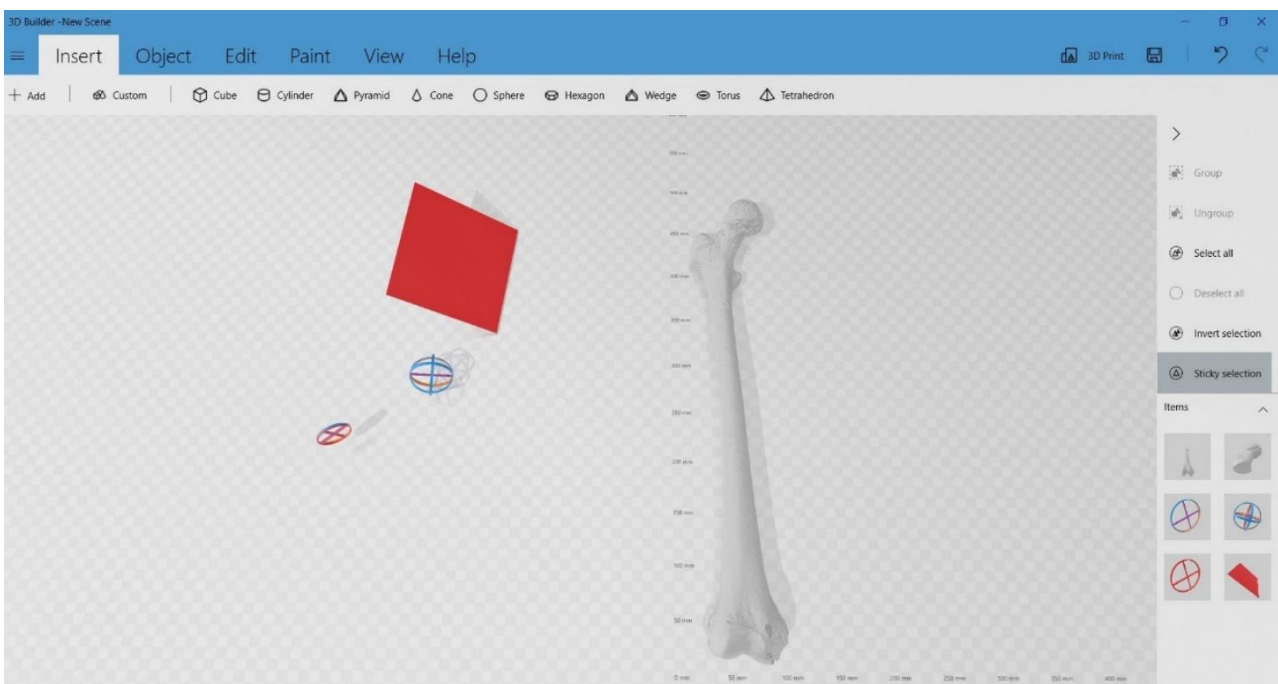
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B

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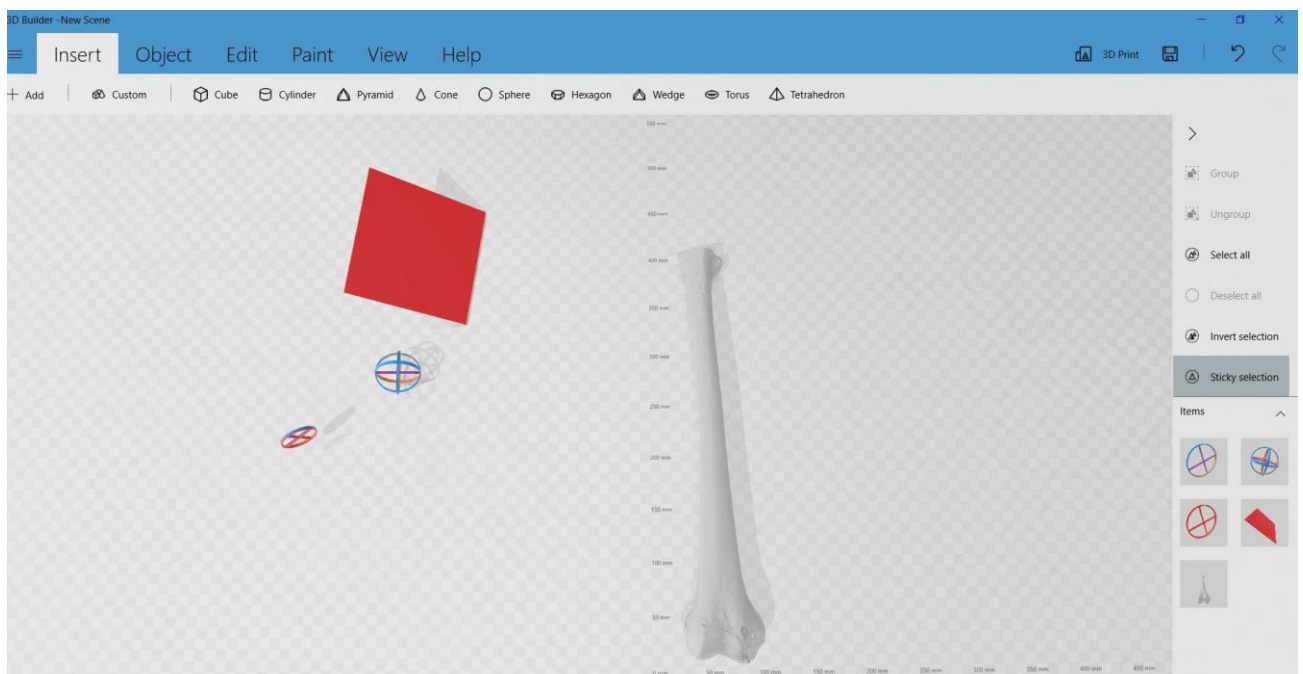
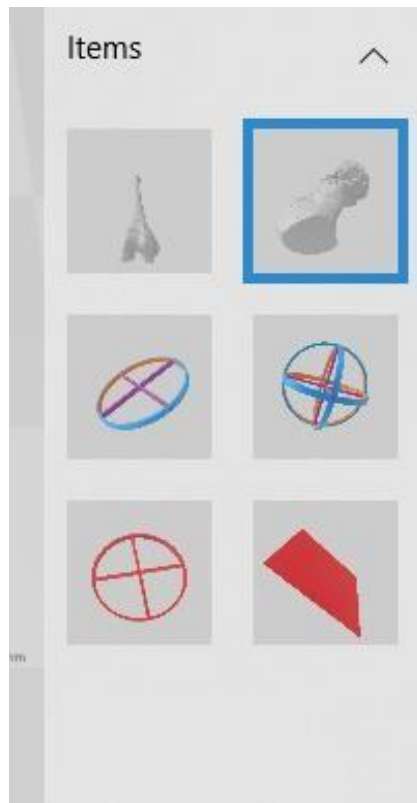
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96 **3.7.** How to cut the proximal femur (**Supplementary Figure S17**):

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98 **3.8.** Select **only** the proximal part of the femur and click on **CTRL + X** to cut the selection.

99 This is how the femoral diaphysis turns out.



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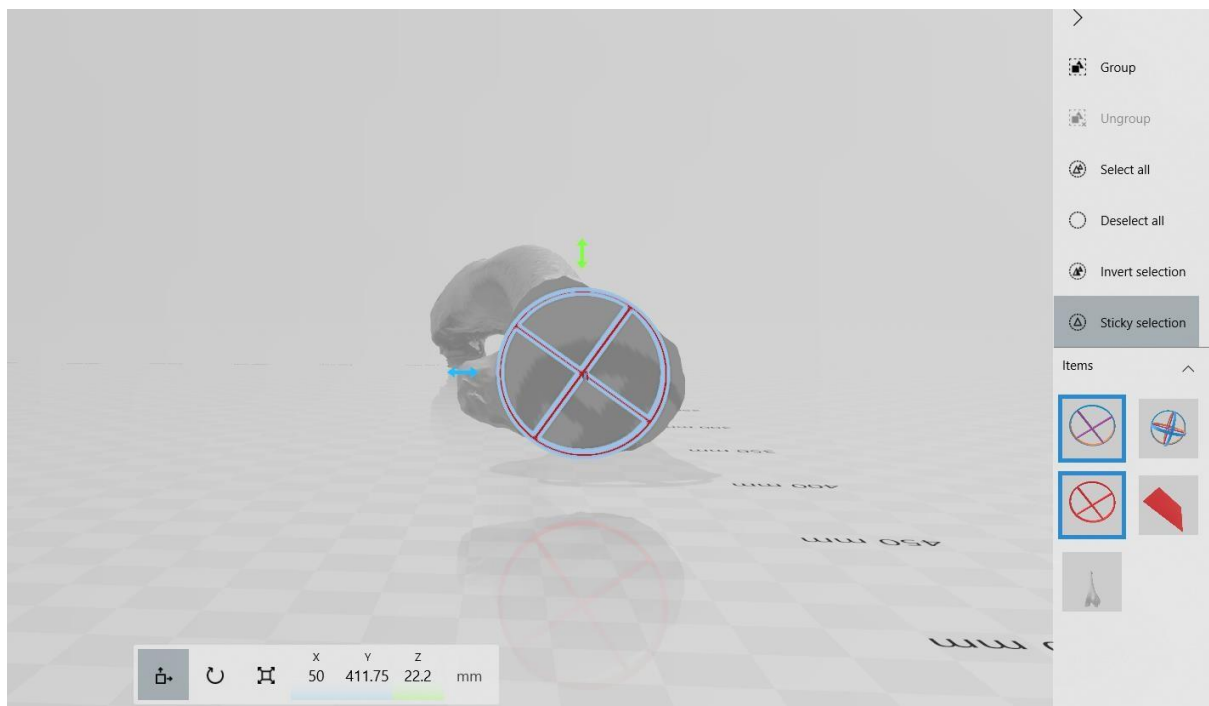
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104 **3.9.** How to calculate femoral anteversion:

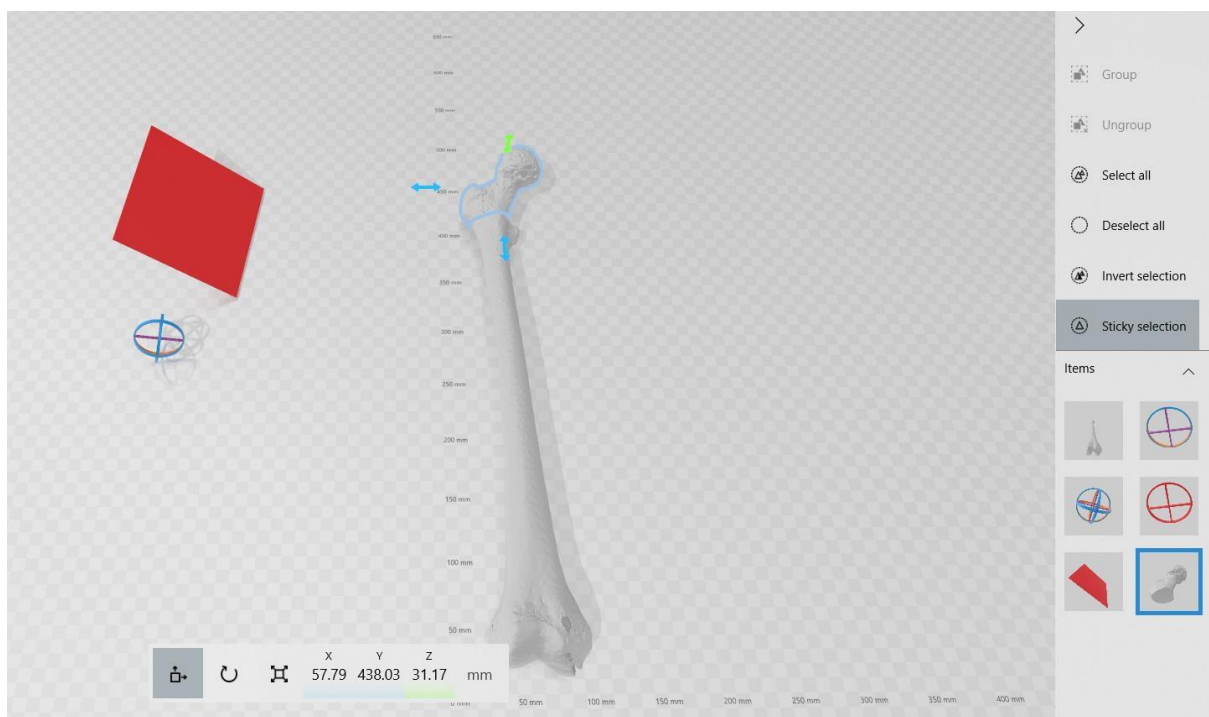
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106 **3.9.1.** Select the red circular guide and the purple circular guide together. Position the
107 guides in the center of the femoral diaphysis (**Supplementary Figure S18**).



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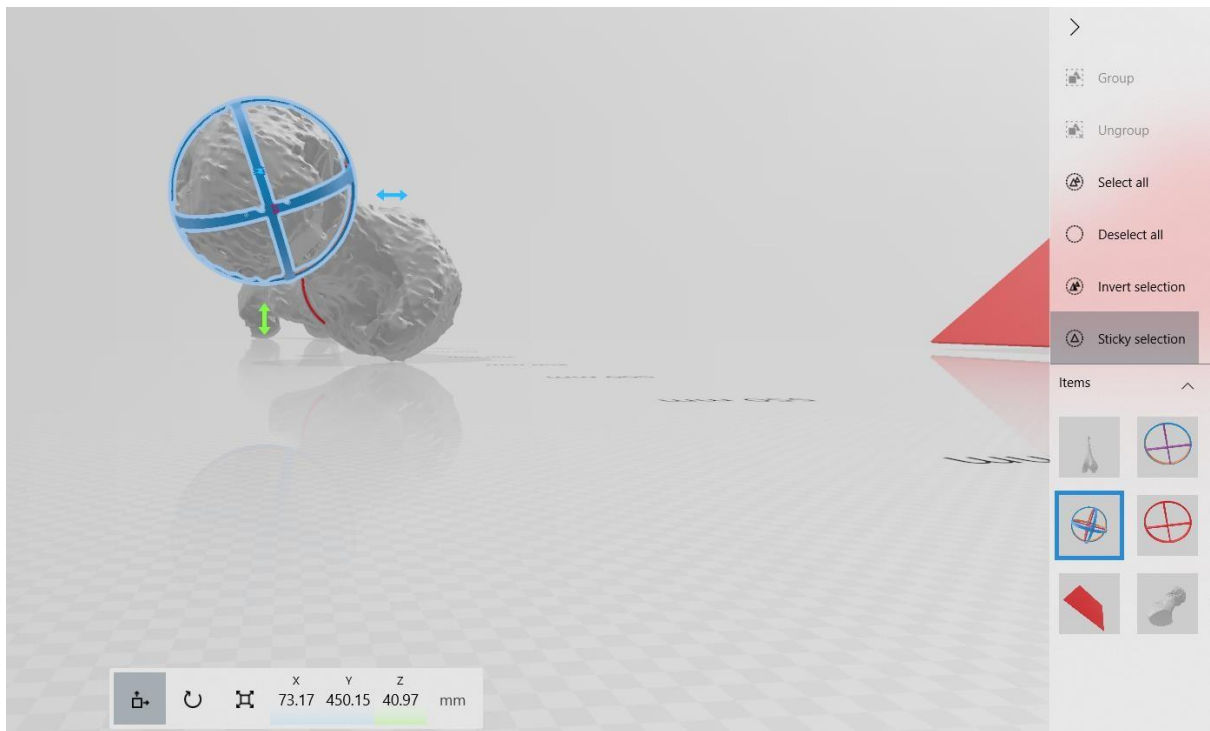
109 **3.9.2.** Press **CTRL+ V** to paste the proximal femur again (**Supplementary Figure S19**).



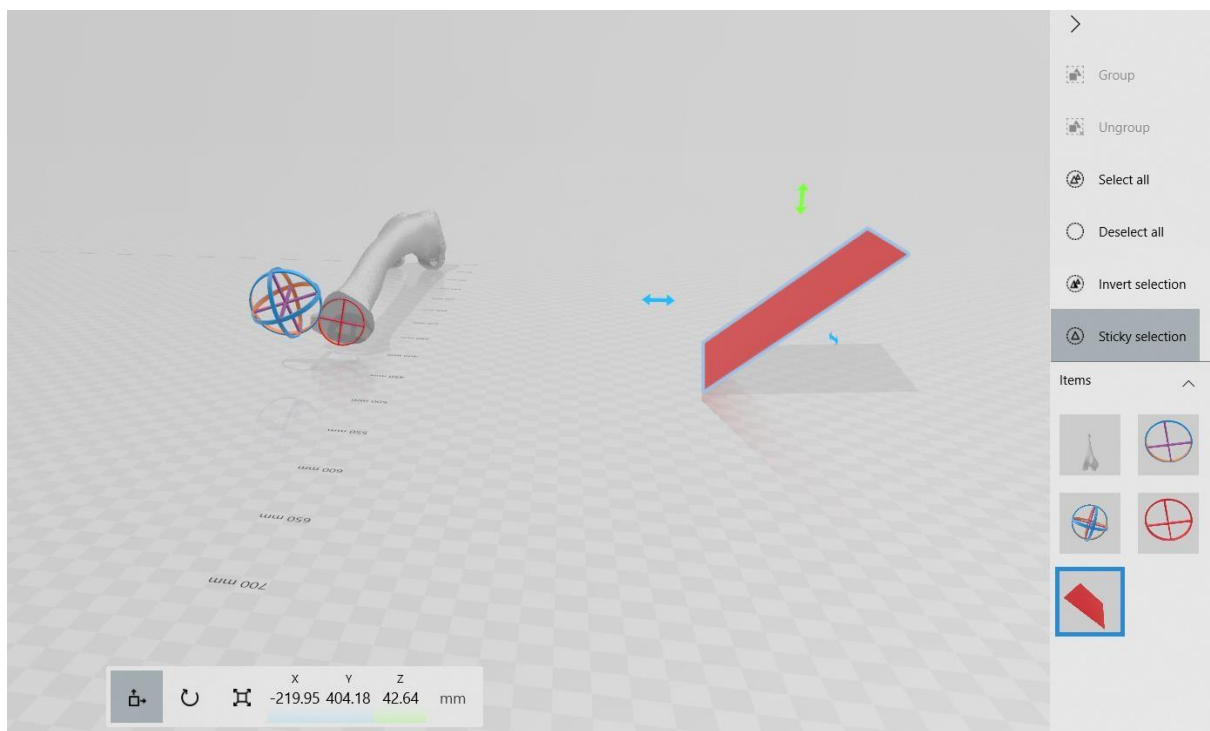
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112 **3.9.3.** Select only the **sphere**. Adjust the size, including all the edges touching the cortical
113 bone (**Supplementary Figure S20**).



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115 **3.9.4.** Cut the proximal femur and select the **red plane** on the right side of the screen
116 (**Supplementary Figure S21**).
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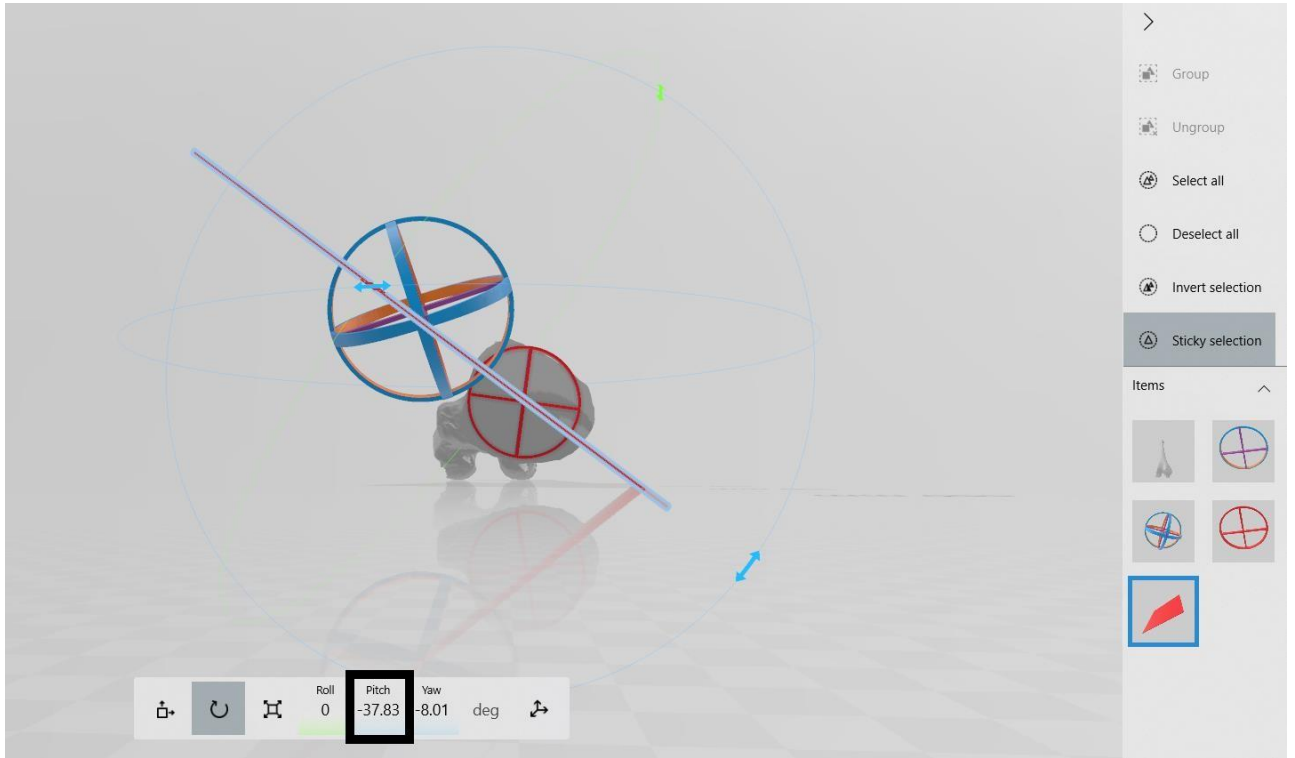


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121 **3.9.5.** Select only the **red plane** move and place it so that it passes through the center of
122 the sphere and through the center of the circular guides (**Supplementary Figure S22A,B**).
123 The degrees marked by the panel in the lower margin correspond to the pathological
124 femoral anteversion calculated in the CT, using Murphy's method. In this case, it was **37.83°**.

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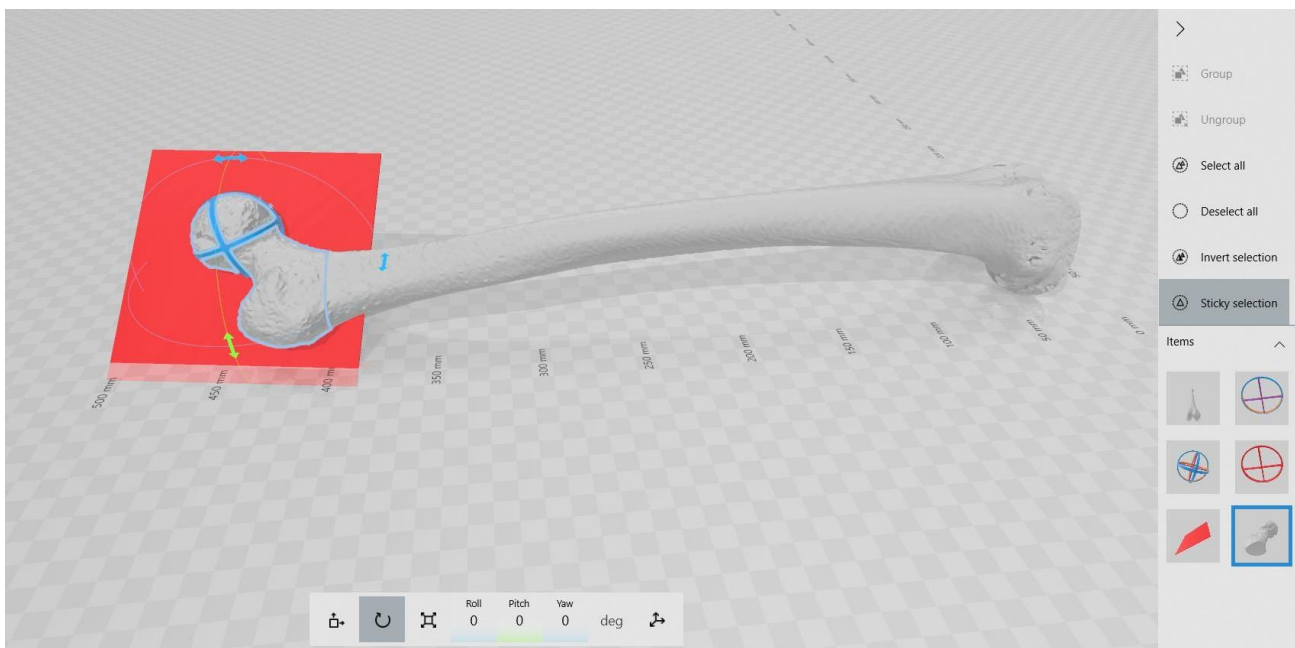
A



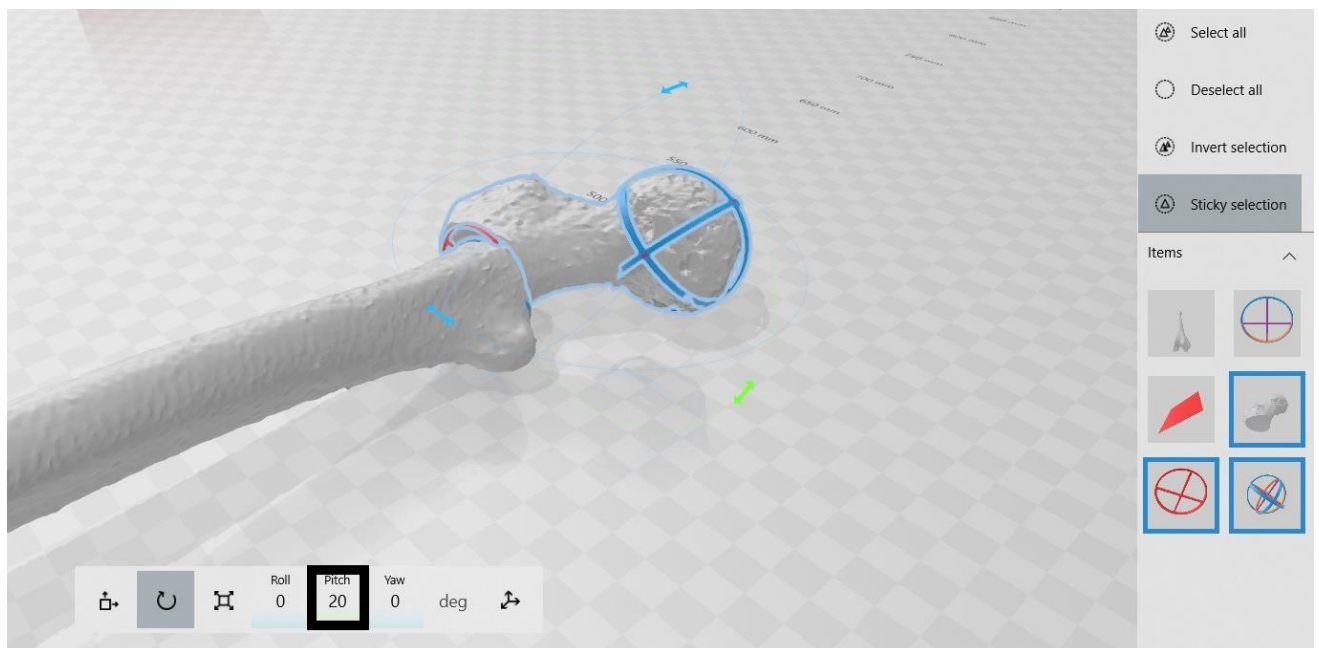
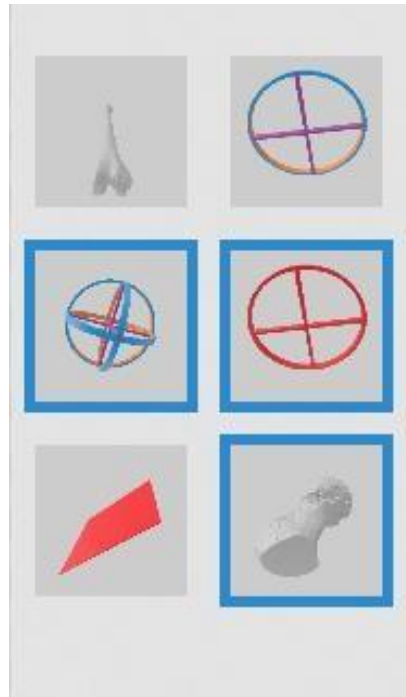
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B

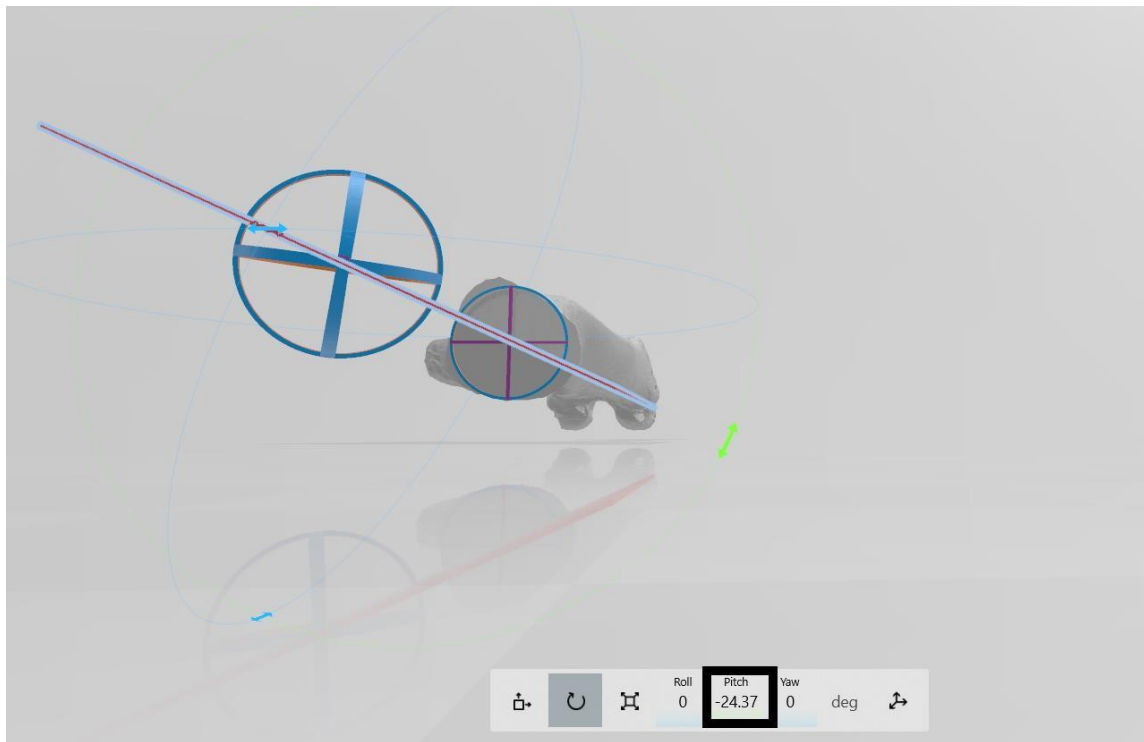


131 **3.10.** Perform rotational osteotomy of the proximal femur (**internal rotation of 20°**,
132 **Supplementary Figure S23**).

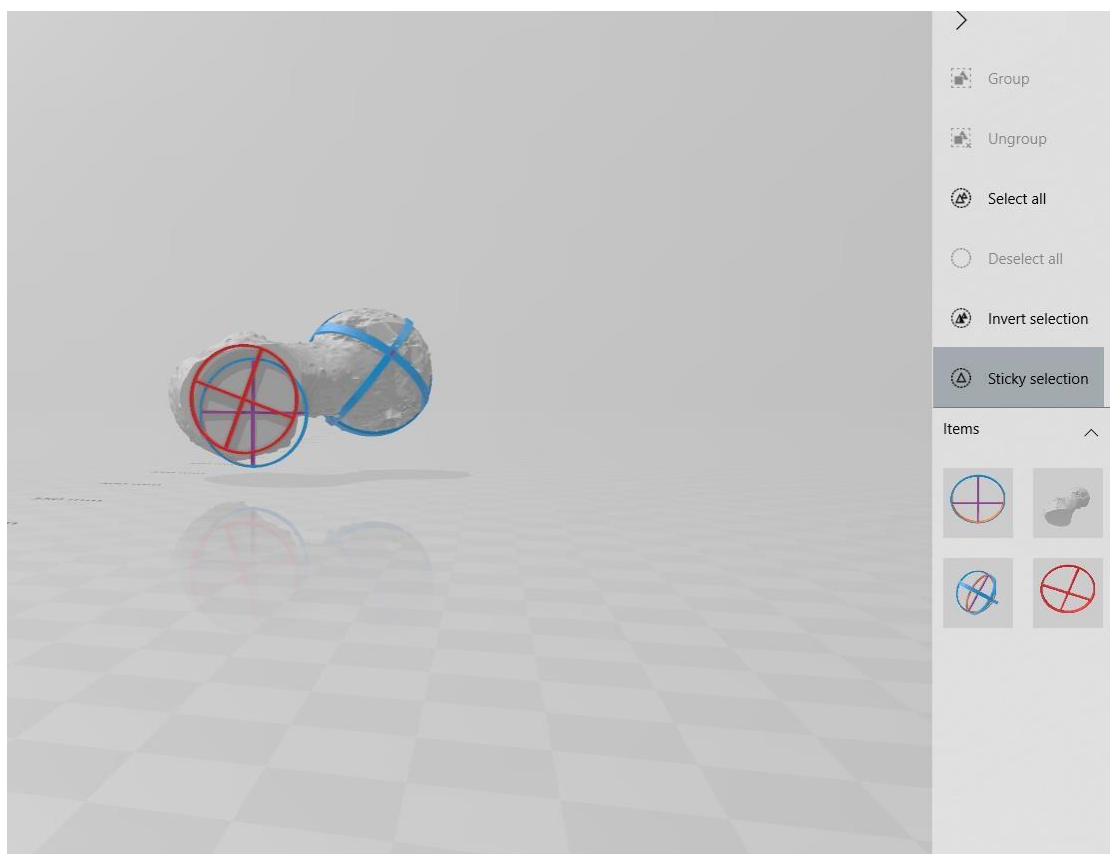


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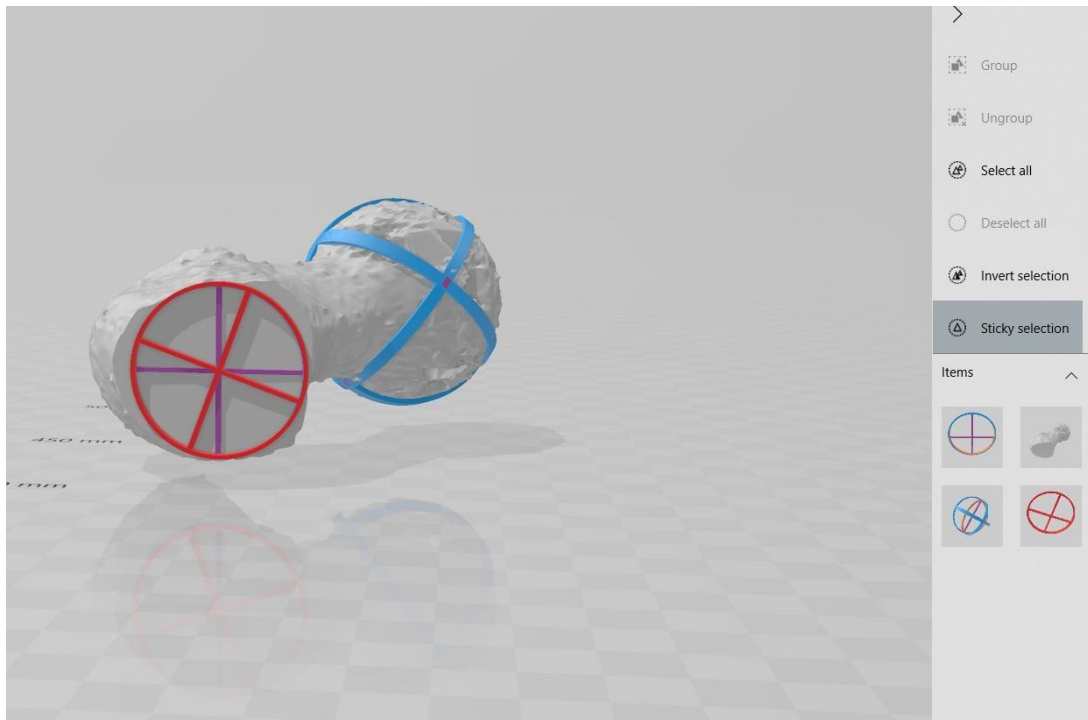
140 **3.11.** Observe the new femoral anteversion after rotational osteotomy of the proximal
141 femur (**Supplementary Figure S24**)—**24.37°**, after a rotation of 20 degrees. The final
142 correction does not coincide with the planned correction.



143
144 **3.12.** Observe that the **guides** do not match (**Supplementary Figure S25**). For this reason,
145 it is necessary to perform an adjustment of the osteotomy.



146 **3.13.** Now the center of the red circumference matches with the center of the **purple**
147 **circumference (Supplementary Figure S26).**



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149 **3.14.** Recalculate the new femoral anteversion with the adjustment made
150 **(Supplementary Figure S27).** It is **17.99°**. The final correction coincides with the planned
151 **correction (37.83°–20°).**

