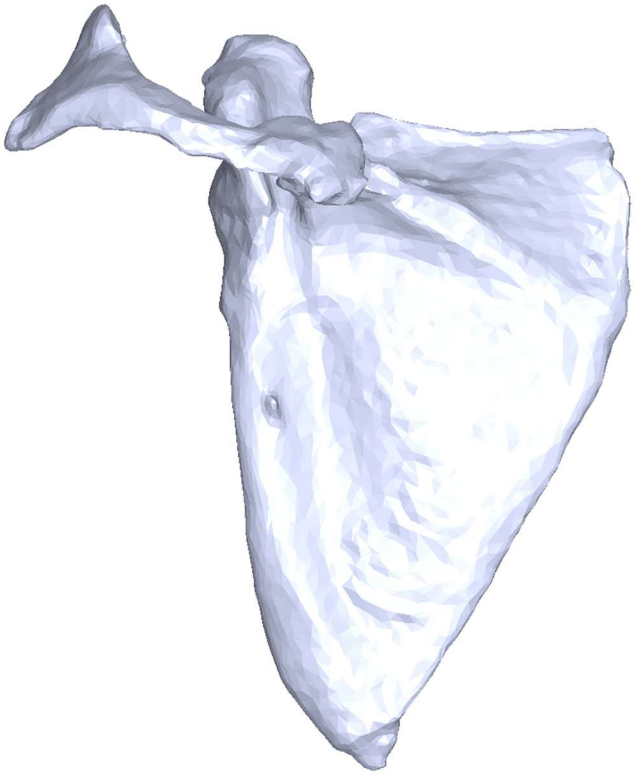
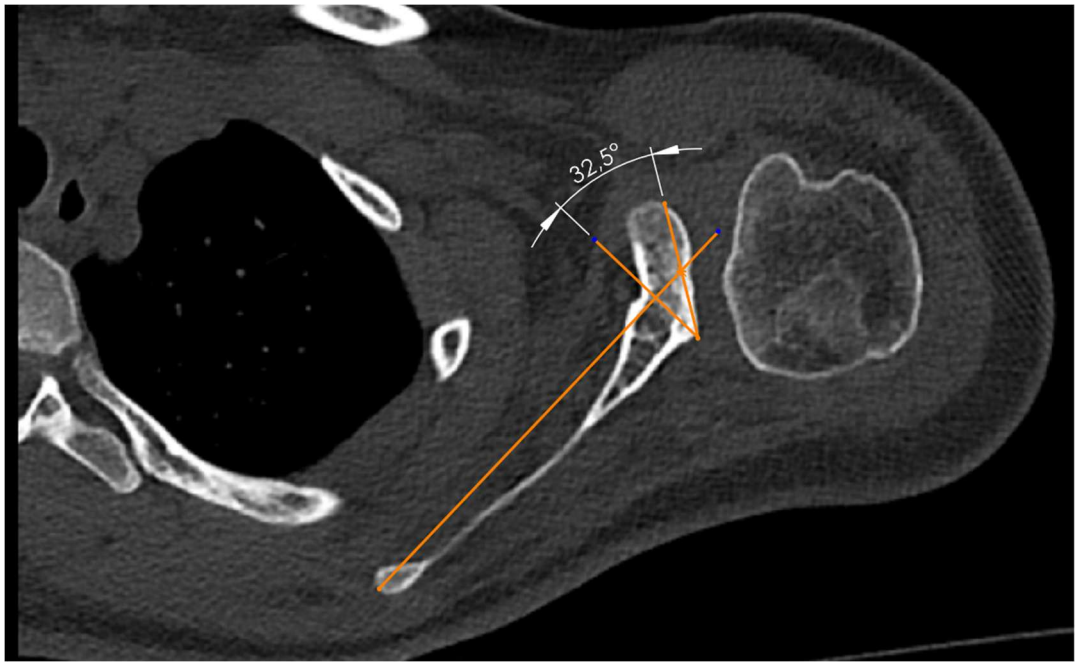
Initial data

Left shoulder to be operated



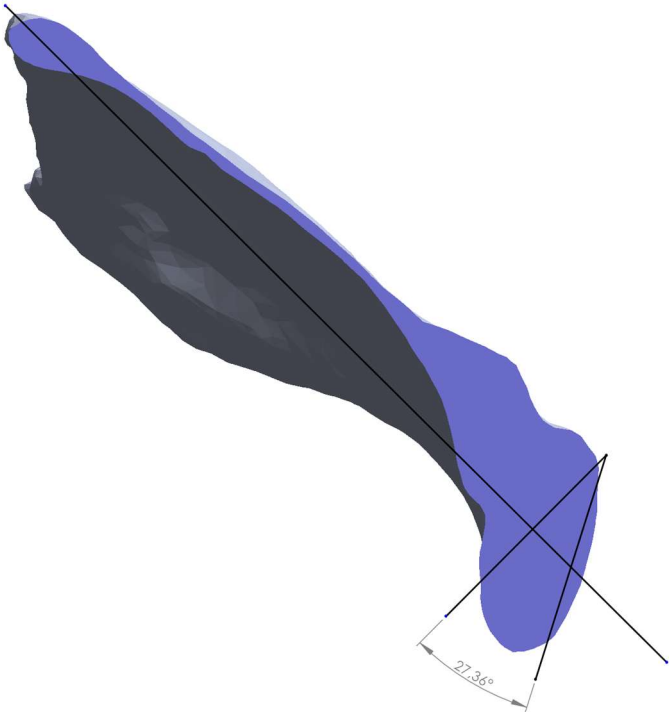
Left Shoulder Osteotomy calculations

2D calculation



The selected section plane passes through the middle of the glenoid.

3D calculation



Left shoulder results:

2D Glenoid Retroversion Angle = 32.5°

3D Retroversion Angle of the Glonoid = 27.4°

Analysis of the results

The table below summarizes the previously detailed results for the patient's sunlight using the 2D and 3D calculation methods. The objective is to compare them with values from the literature.

Patient				**Literature** **Healthy shoulder**
Retroversion angle of glenoid (°)				
Shoulder	**2D**	**3D**	**Average**	
Left	32.5	27.4	30	Between 5 and 10°

Literature data source:
*Nyffeler RW, Sheikh R, Atkinson TS, Jacob HA, Favre P, Gerber C**. Effects of glenoid component version on humeral head displacement and joint reaction forces: an experimental study**. J Shoulder Elbow Surg. 2006 Sep-Oct; 15(5):625-9. DOI: 10.1016/J.JSE.2005.09.016. PMID: 16979061*.

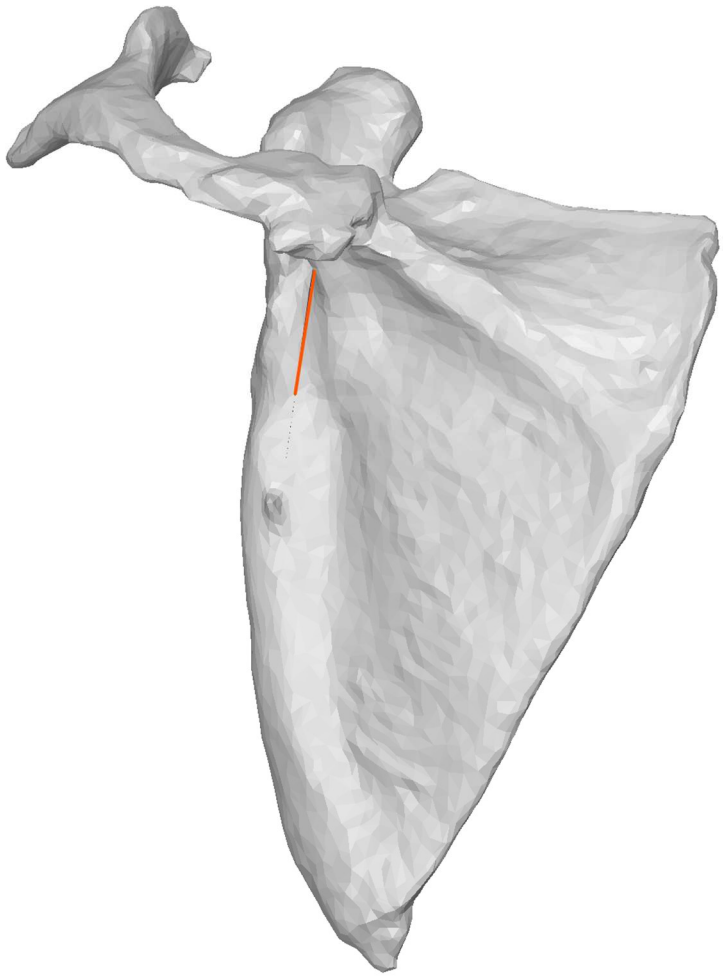
The results illustrate the difficulty of having similar results between the different methods. Indeed, for the left shoulder, the angle of retroversion varies between 32.5 and 27.4° depending on the method used. Since it is difficult to determine which method is better between the 2D and 3D calculations, the average of the two values is the one that will determine the retroversion angle later.
The results for this patient show a relatively large retroversion of the glenoid for the left shoulder with an average angle of 30°, well above the range considered healthy found in the literature. Data from the right shoulder were not provided to compare the two shoulders with each other.
For further planning, the reference value for the retroversion angle of the glenoid is set at 7°, which is in the middle of the reference interval between 5° and 10°.

Cutting Guide for Left Shoulder Glenoid

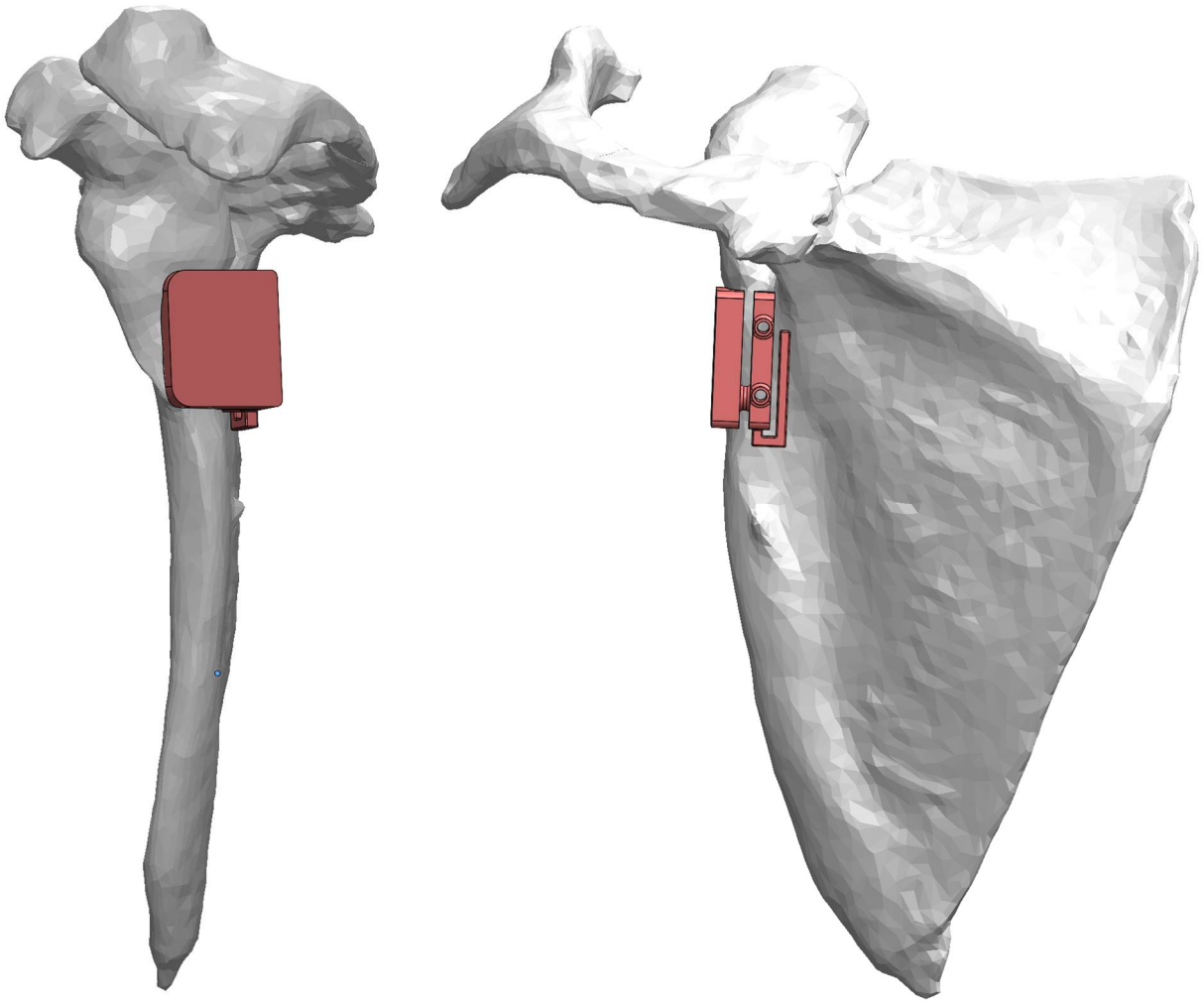
The objective here is to create a custom-made cutting guide as well as a wedge to restore the retroversion of the glenoid to an angle considered healthy. As indicated in the previous section, the retroversion angle to be found is set at 7° so that the angle after the operation is located in the reference interval between 5 and 10°. **For the patient's left shoulder, the calculations showed a retroversion angle with an average value of 30°. To restore this angle to the value of 7°, you need a wedge with an angle of 23°.**

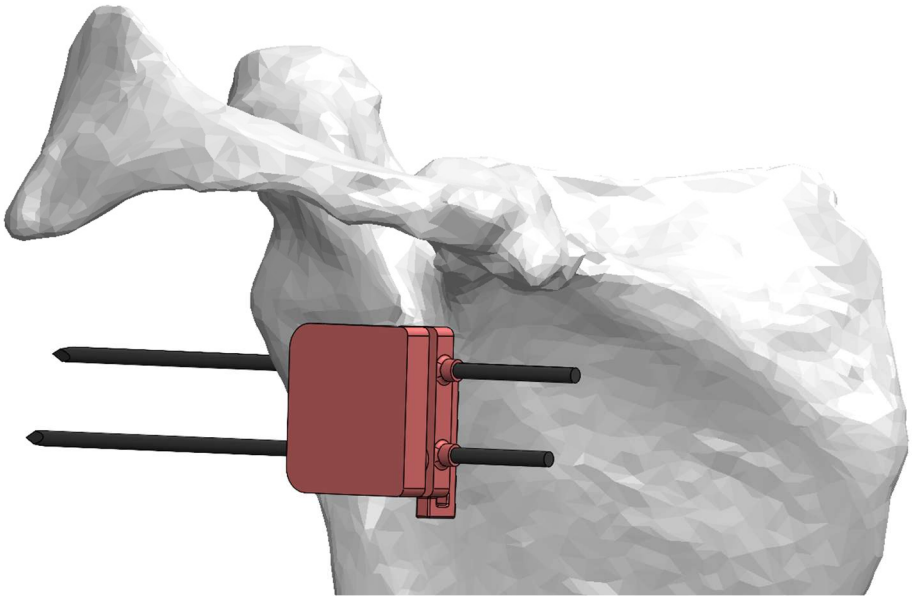
The cutting guide is custom-made for the patient by integrating an impression of the bone at the level of the glenoid so that the device is perfectly positioned in the right place. The guide also contains a slot to allow the saw blade to pass through and cut the bone at the location provided during preoperative planning.

Cutting plane



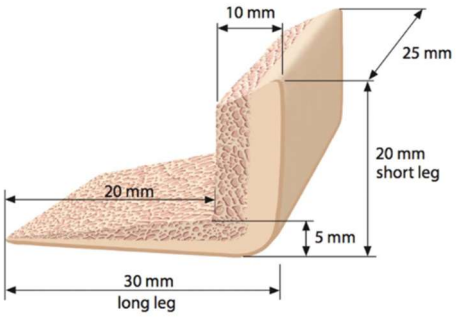
Cut line in red on the image.





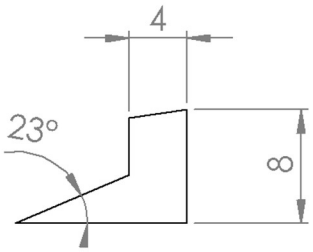
Wedge for the left shoulder glenoid

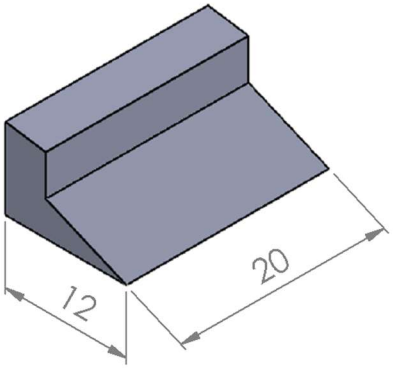
The purpose of the wedge is to hold the glenoid at the correct retroversion angle. The shape of the wedge follows that shown in the 2021 Gerber et al paper as shown in the image below.



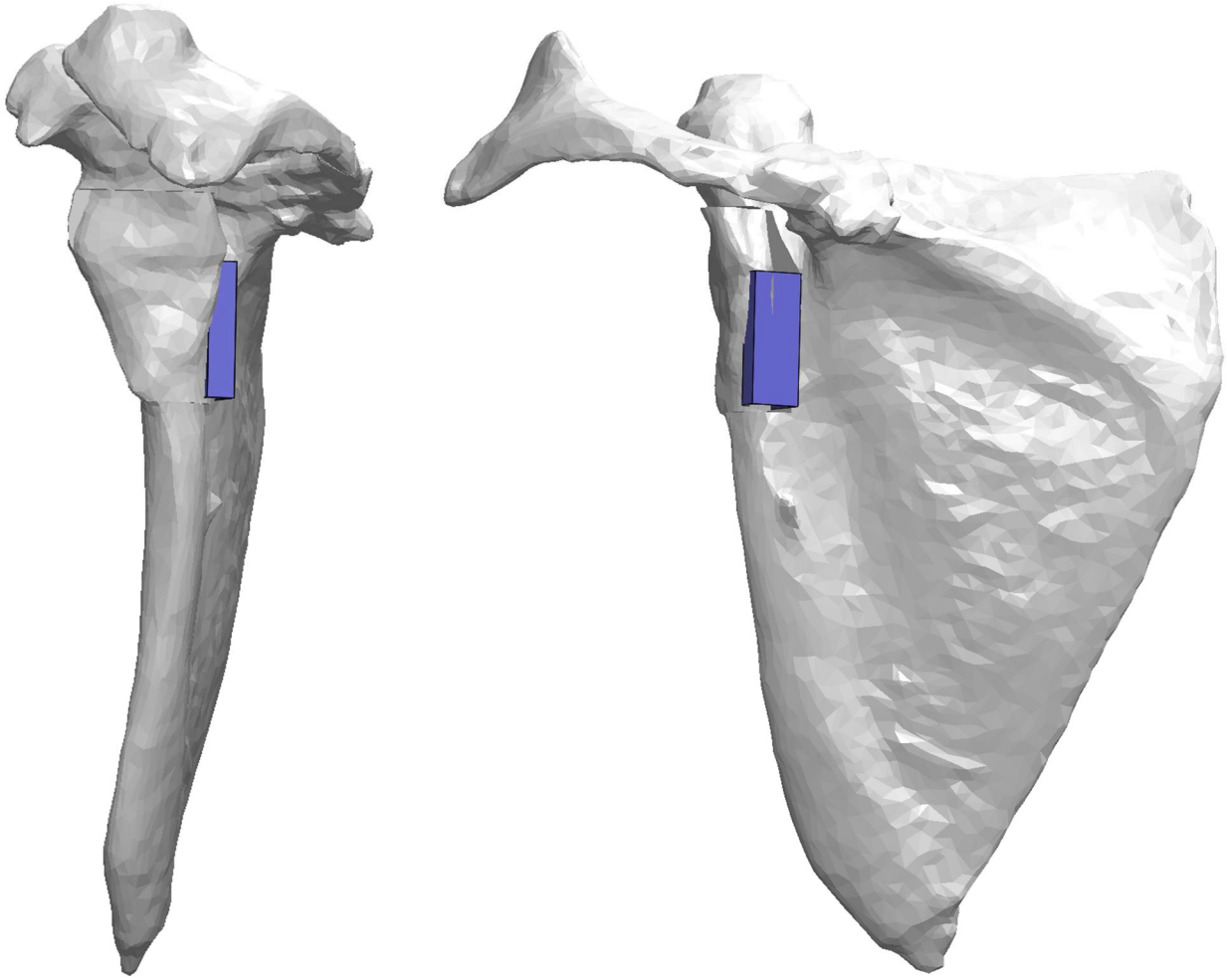
Source: **Posterior Open-wedge Osteotomy and Glenoid Concavity Reconstruction Using an Implant-free, J-shaped Iliac Crest Bone Graft in Atraumatic Posterior Instability with Pathologic Glenoid Retroversion and Dysplasia: A Preliminary Report** (2021)
Authors: Ernstbrunner L, Häller T, Waltenspül M, Wieser K, Gerber C.

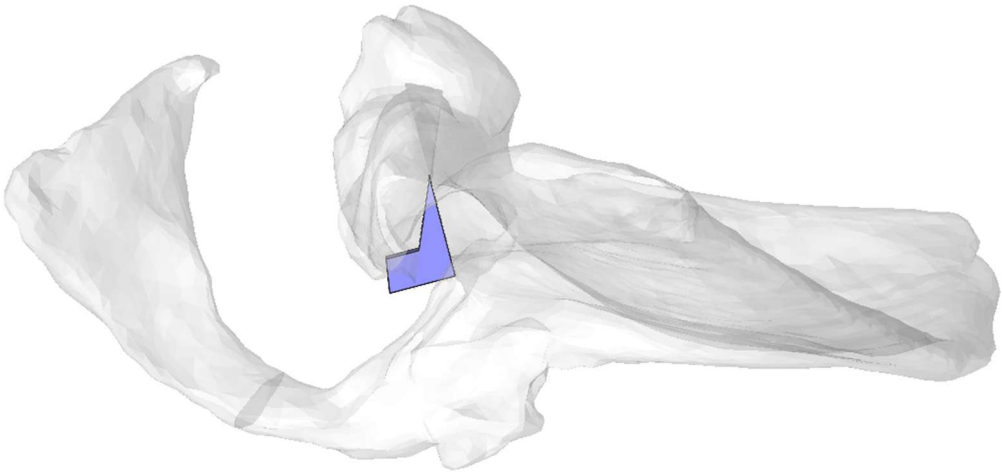
The measurements were adapted to the patient, in particular by taking into account the angle of correction of the glenoid while keeping a shape similar to that of the article.





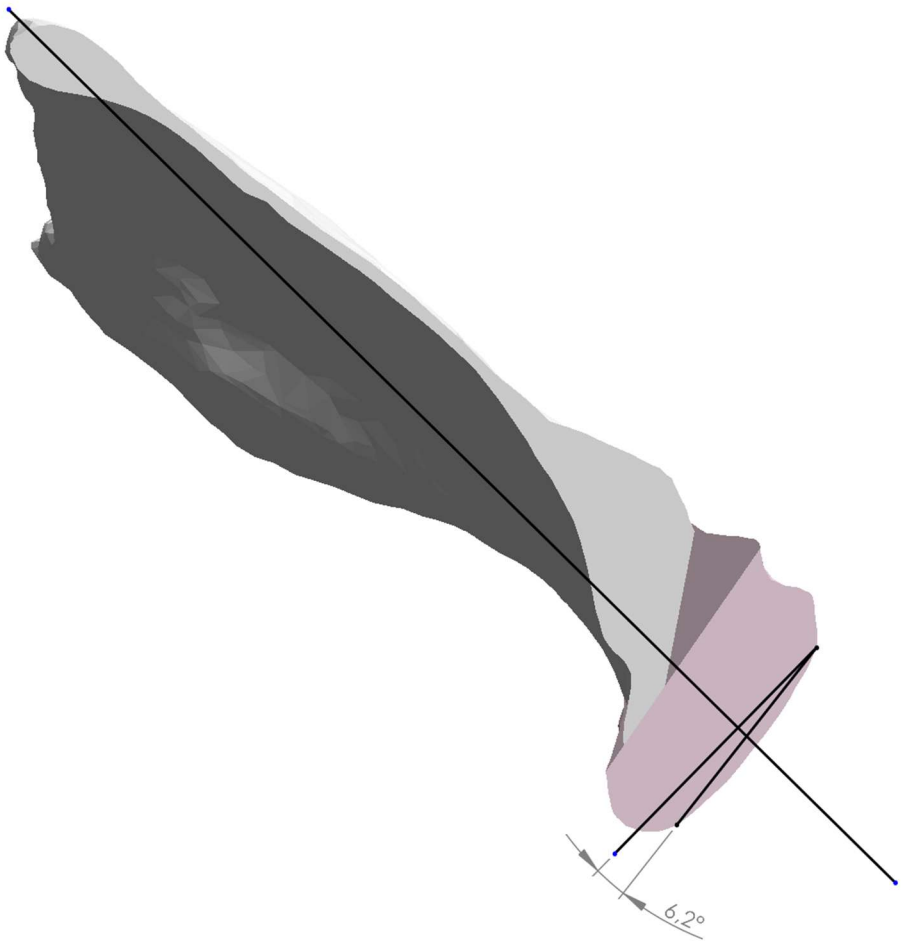
The wedge positioned in the incision made by the cutting guide gives the following result on the glenoid which is inclined with the desired 23°:





Calculating the Retroversion Angle After Changing the Glenoid

The calculation was made using the same plan as that determined in the 3D osteotomy calculation part.



The retroversion angle of the glenoid is now between 5 and 10° as initially desired. The result obtained is only a simulation of the possible correction for the glenoid and this may vary with the actual conditions during the operation, especially with the depth of cut to insert the shim.