RADIOLOGICAL PROTOCOL

Unique anatomies, customized solutions

LOWER LIMB

VALOR IMPLANT

Radiological protocol
CT - Lower Limb

The basic requirement for digital surgical planning is a high-quality computed tomography (CT) scan with clear and well-defined bone anatomy. These qualities are essential for the accurate design of customized surgical guides and implants.

Indications
This protocol is indicated for personalized surgical planning studies involving lower limb alignment evaluation and deformity correction, including femoral and/or tibial osteotomies. It includes acquisition of the hip, knee, and ankle regions within a single lower limb CT study. In cases of bilateral planning, acquisition of both lower limbs may be performed following the same protocol.

Recommendations
The X and Y centers should not be modified between acquisitions, nor should the table height be changed during the examination. The study should be performed using a consistent field of view and reconstruction center throughout the entire scan to ensure accurate alignment assessment and 3D reconstruction.

Acquisition

Topogram	Acquisition of the entire lower limb from the pelvis to the foot 
Field of view (FOV)	Adjust the FOV so that no anatomical region is cropped
Matrix	512 x 512
Detector collimation	1.25 mm

Pitch	≤ 2
kVp	120
Automatic exposure control	Enabled
Rotation time	≤ 1 s

Reconstruction:

Multiplanar reconstruction (MPR)	Reconstruction of the complete study in all three planes
Reconstruction algorithm	Soft tissue/moderate algorithm. Do not use the bone algorithm. Use a single window
MPR slice thickness	1.25 - 1.50 mm
Slice increment	1.25 - 1.50 mm (continuous slices)

Appendix - Reduction of metal artefacts (MAR) and noise

Objective

Minimise artefacts caused by prostheses, screws, or osteosynthesis in the lower limb region, while preserving diagnostic image quality of bone and soft tissues and enabling valid reconstructions for 3D planning and STL export.

Acquisition settings (add without modifying the original ROI)

Parameter	Recommended	Notes / Justification
Region	Hip: include the entire prosthesis or femoral head and 5 cm of the femur. Knee: distal third of the femur to proximal third of the tibia. Ankle: distal third of the tibia to entire talus.	Prevents implant truncation
kVp	140 kVp (fallback 120 kVp)	Reduces beam hardening from metallic materials
mA / AEC	Automatic with an upper limit 20–30% above standard	Compensates for increased noise due to MAR and high kVp
Rotation time	0.5-1.0 s (prioritise 0.5 s)	Minimises motion artefacts
Pitch	0.6-1.0 (recommended 0.8)	Balance between coverage and resolution
Collimation/slice thickness	≤0.625 mm	Isotropy for MAR and 3D reconstructions

FOV	Anatomically centred in each region (pelvis, knee and foot). Adjust to include all metallic material	Prevents the prosthesis from being located at the detector edge
Patient position	Supine, geometrically centred. Avoid misalignment between the three parts	Centring the metal reduces asymmetrical streaks

ALWAYS generate paired series with and without MAR.

- Reference (without MAR): Soft/moderate kernel, FBP or mild IR; slices 0.6 mm / 0.4 mm increment.
- MAR activated: Soft/moderate kernel + manufacturer algorithm (iMAR/O-MAR/Smart MAR/ SEMAR).
- DECT / Spectral (if available): VMI 100–140 keV (save at least 100, 120, and 140 keV); consider 70 keV for soft tissues if artefact saturation is absent.
- 3D volume (planning): Use the series without MAR, isotropic 0.6 mm, intended for STL export.

Post-processing and verification

- Check bone and soft tissue windows; confirm cortical continuity near metal..
- If streak artifacts persist, increase VMI keV (120 → 140 keV) and/or compare with the series without MAR.
- Confirm implant centering and absence of truncation before sending to PACS.
- Always export STL from the series without MAR (MAR can alter geometries).

Console setup sheet

```
Name: ORTO_[3PARTS]_MAR
 kVp: 140 (fallback 120)
 mA (AEC): ON, upper limit +20–30%
 Rotation: 0.5–1.0 s
 Pitch: 0.8 (≤1)
 Collimation: 0.6 mm (recon 0.6 / inc. 0.4)
 Kernels: B40s (soft) + B70f (bone)
 Series:
    1) Standard IR (B70f)
    2) MAR ON
    3) VMI 100–140 keV (if DECT)
    4) 3D export (without MAR)
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FOV: Ankle 120–160 mm; Femoral head 180-220 mm; Knee 140-180 mm