

Purpose and Summary

This protocol describes the guidelines for a CT scan intended for the creation of Ricoh 3D for Healthcare Craniomaxillofacial Anatomic Models.

Important

Use of this scanning protocol as a guideline will result in a more anatomic accurate model.

Preparation of the Patient

- Remove any non-fixed metal prosthesis or jewelry that might interfere with the region to be scanned.
- Non-metal dentures may be worn during the scan.
- Make the patient comfortable and instruct not to move during the procedure. Normal breathing is acceptable but any other movement, such as tilting and/or turning the head, can cause motion artifacts that compromise the reconstructed images, requiring the patient to be rescanned.
- Stabilize the relationship of the jaws during the scan. The patient is preferably scanned with a very thin bite wafer that does not influence the facial soft tissues.
- During scanning, the position of the lower jaw needs to be controlled. The patient should be scanned in occlusion with the condylar heads in centric relation. This occlusion needs to be in a relaxed position without clenching the teeth or posturing the lower jaw. A pre-scan occlusion training or a thin non-radiopaque bite wafer that allows contact points between the teeth can be used to achieve this position. This bite wafer should not influence the surrounding soft tissues such as the lips.

Reconstruction of the Images

- Use a proper image reconstruction algorithm to get sharp reformatted images for locating internal structures such as the alveolar nerves. Use the sharpest reconstruction algorithm available (usually described as bone or high resolution).
- Reconstruct the images with a 512 × 512 matrix or 768 x 768 matrix.
- Only the axial images are required, no additional reformatting of the images must be done.
- Save the images in uncompressed standard DICOM format.
- Choose appropriate image modality during export of images. Non-corresponding modality can be a reason for rejection of images.

CT Scanning Instructions

- Use only primary axial images.
- Images scanned under a gantry tilt and oblique or reformatted images negatively influence the accuracy.
- All slices must have the same field of view, reconstruction center, and table height.
- Scan each slice in the same direction.
- Scan with the same slice spacing, less than or equal to the slice thickness. Non-overlapping axial slices may decrease the quality of reformatted images.

Patient Positioning

- Place the patient supine on the scanner table and move the patient into the gantry, head first. Adjust the table height in order to position the patient's head in the field of view of the scanner.
- Stabilize the patient's head using a headrest without deforming the facial soft tissues (do not use chin-cups or straps). The patient's head must not move.
- Minimize the artifacts caused by metallic dental restorations or orthodontic brackets or metal implants in the craniomaxillofacial region by aligning the patient's occlusal plane as much as possible with the axial slices.
- Depending on the diagnosis and anatomic region of interest requested, the field of view should include:
 - Nose and chin
 - Left and right temporomandibular joint (TMJ)
 - Other regions of interest if required (ex. cranium)
 - For reconstruction cases the complete tumor/defect

In the Presence of Metal

- Check whether strategies of optimizing scan parameters to reduce metal artifacts seem beneficial, such as using thin slice collimation and reconstructing to slices of 1.25 mm, lowering pitch, and increasing kVp.
- Use a Metal Artifact Reducing algorithm/ filter, if available. Include this along with the standard scan.
- Increase the HU scan range by using a 16 bit or extended CT scale, if available.

Dose Optimization

- Adjust parameters depending on patient body habitus (e.g. kVp, mAs).
- Dose information displayed at your scanner (such as CTDIvol) can be used to optimize scan parameters.
- Apply dose reduction techniques such as automatic tube current modulation and automatic voltage selection whenever possible and applicable (e.g. only apply automatic tube current modulation when your system can apply it correctly in the presence of metal in the scan region).
- For patients of standard body size without metal implants it is often possible to use a low-dose protocol for bone imaging and 3D applications.
- Tip: On some scanners, prospective selection of thin reconstructed slice thickness (e.g. 1mm) can lead to higher doses. Consider a retrospective reconstruction from thin acquisitions according to scan protocol parameters (Image Type needs to be ORIGINAL).

CT Scanning Parameters

Craniomaxillofacial	
Scanner Type	Multi-detector row CT with number of detector rows ≥ 16
Scan Mode	Helical
Collimation	Slice thickness: 1.25 mm or smaller Slice increment: contiguous or overlapping slices (50% overlap): slice increment \leq slice thickness
Gantry tilt/oblique angle	0°
kVp	90-140 (automatic voltage selection, if available)
mAs	Automatic tube current modulation
Rotation Time	Use 1-second or smaller
Pitch	Use 1 or smaller
Field of View (FOV)	Use smallest FOV that includes the complete bony anatomy of interest
Matrix	Use a 512 x 512 matrix

Craniomaxillofacial	
Reconstruction Algorithm	<p>Use the following reconstruction algorithms and provide axial images:</p> <ol style="list-style-type: none">1) Use a standard or soft tissue algorithm without edge enhancement. Always provide this reconstruction.2) Axial images must be provided. No reformatting, no oblique reconstructions; no MPRs.3) If metal is present, provide additional reconstruction(s) with metal artifact reduction applied if available. (Always provide a reconstruction without metal artifact reduction applied.) <p>Reconstructions should be obtained from one single acquisition.</p>
HU Scale	If metal implants are present, use a HU scale of 16-bit.