Kinomatic Knee

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1 INTRODUCTION

This document describes the guidelines that radiological centers should follow when performing CT-Tech Only scans required by Kinomatic LLC to use our Surgical Planning software.

The directives contained in this document are intended to improve the quality of the resulting CT scans. Radiology technicians are, in general, required to follow the instructions outlined in this document; variations to the settings and potential modifications to the protocol are to be discussed with and approved by Kinomatic LLC in advance.

Kinomatic LLC reserves the right to refuse scans performed with settings different from the suggested ones.

For more information, please do not hesitate to contact Kinomatic LLC at e-mail address: radiology@kinomatic.com.

2 PATIENT POSITION

The patient must be in supine position at isocenter in the gantry. The legs must be in complete extension. No sponge or pillow should be placed beneath the knee or ankle.

The critical aspect is the position of the foot, which must be perpendicular to the table with the toe pointing straight up (see image below).

YES

NO

Importantly, the position of the foot should be secured to prevent motion and the consequent loss of accuracy to assess and correct any misalignment of the knee.

TIP: Tape the patient's feet to the table in the proper position to ensure they will not move during the scanning process and ensure the patient is comfortable and relaxed. This is critical for achieving a motionless scan.

2.1 MOTION ROD PLACEMENT

DURING SCAN - THE PELVIS, LEG AND MOTION ROD MUST REMAIN MOTIONLESS.

1) The motion rod should be placed on the operative side.
2) Wrap the velcro strap one complete revolution around the rod as shown in left figure below. Do this for both Velcro straps:
    a) Hip
    b) Ankle
3) Set the Motion Rod on the patient to pass from just proximal of Hip Center to distal of Ankle Center as shown in right figure below.
4) Adjust the femoral and tibial straps to secure the rod.
5) Verify the rod is in both anterior/posterior and medial/lateral field of views for all scan regions.

3 IMAGE AQUISITION

The acquisition consists of three (3) separate short **spiral axial scans:**
Scans must be the SAME FOV SIZE.

1) Both hips
2) Both knees
3) Both ankles

Please note that scans of the hips and ankles are **required** to ensure an appropriate alignment of the leg. All three scans must be in the same coordinate system (frame of reference).

3.1 FIELD OF VIEW (FOV)

Each acquisition must be centered and zoomed accurately to ensure the FOV maximizes the region of interest. Attention must be paid so that the outer bounds of the regions of interest are included in the FOV.

The whole of the **required bone regions** must be captured:

- **Hips**: femur heads to top of knees scan region
- **Knees**: femurs, fibula and tibia contours
- **Ankles**: medial and lateral malleoluses to bottom of knees scan region

3.2 IMAGE PARAMETERS

Scans should be acquired in slices of minimum 512x512 pixels. The thickness of a single slice should be no more than 4mm for the hips and ankles and 1mm for the knees. The spacing between slices should be no larger than the slice thickness; a slight overlapping is allowed. UTILIZE BONE WINDOWS TO MAXIMIZE VIEW OF BONES

The following table summarizes the recommended image settings.

NOTE: ALL 3 IMAGES MUST BE OF THE SAME SIZE

	KNEES	ANKLES & HIPS
ROWS & COLUMNS	512 x 512 pixels	512 x 512 pixels
SLICE THICKNESS	0.5 - 1mm	1 - 4mm
SPACING BETWEEN SLICES	0.5 - 1mm	1 - 4mm
FOV	Min 350mm/Max 500mm	Min 350mm/Max 500mm

The FOV should be as small as possible, as long as the articulation is completely demonstrated.

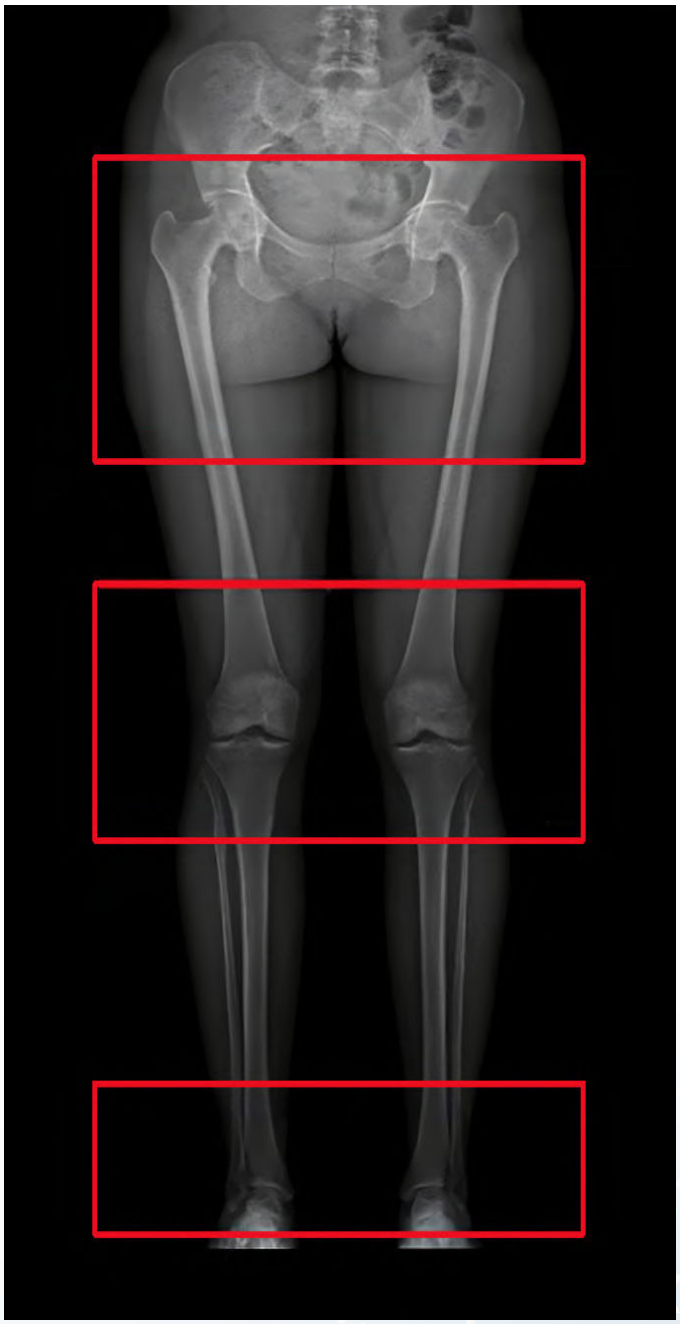
3.3 MACHINE SETTINGS

The following settings are intended to maximize the quality of the images. If different values are required on your machine, please inform Kinomatic LLC before proceeding with the acquisition.

KiloVolt Peak (KVP)	120 KV or higher
X-Ray Tube Current	120 mA or higher

3.4 SCAN RANGES

The following figure depicts the scans required of both sides:



HIPS

The whole femoral heads and continue to **15 cm** below the lesser trochanters.

KNEES

Both femoral and tibial parts of the knee joint must be included in the knees acquisition. The scan must be extended to at least **15 cm** towards the hips and **10 cm** towards the ankles, past the beginning of the fibulas.

ANKLES

The ankles scan must include at least 15 cm of the tibias and extended past the calcaneus

3.5 IMAGE EXPORTATION

The three required scans of the hips, knees and ankles must be **exported as original scans.** In particular, derived (re-sampled) series will be rejected. The DICOM dataset provided should contain only the series of interest to minimize confusion and likelihood of error. Regarding the Reconstruction Convolution Kernel, we suggest using "bone kernel" for all three scans (hip, knee and ankle).

Both the study and the series should be named according to what they represent.
As a rule of thumb, include the patient's name and affected side in the study description, and the affected side and part in the description of each series, e.g.:

Study: "John Smith, knee study"
Series 1: "Hip"
Series 2: "Knee"
Series 3: "Ankle"

In general, any localizers automatically produced by the machine should be excluded from the media. If this is not possible, please clearly distinguish between localizers and actual scans by providing a series consisting of localizers only. **DO NOT include localizers within the series.**

The image data exported should be in uncompressed RAW format (MONOCHROME2) or compressed using lossless algorithms (i.e. JPEG2000 lossless).

4 IMAGE DELIVERY

The DICOM dataset of a Kinomatic CT case can be uploaded to an online portal by the radiological center.

Alternatively, the DICOM dataset can be stored on a CD or DVD. A label must be applied including the patient's name, affected side, acquisition date and, if applicable, planned surgery date.

The storage media can then be mailed to:

Kinomatic LLC
136 W. Branch St.
Arroyo Grande, CA 93420

Do not hesitate to contact Kinomatic LLC for further assistance at: radiology@kinomatic.com.

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Kinomatic LLC
136 West Branch Street
Arroyo Grande, California 93420
Phone (800) 420-1701
info@kinomatic.com

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