

Reading Hospital School of Health Sciences
Medical Imaging Program
MI133: Clinical Seminar II
2021-2022

TOE

Routine:	AP Axial, Medial Oblique, Lateral
Position/Projection:	Supine/AP Axial
Patient Prep:	Remove shoe, sock or nylons from area of interest
Technique:	63 kVp @ 1 mAs (Tabletop)
SID:	40 inches
Collimation:	To anatomy of interest
Patient Position:	Patient supine with knee flexed. Plantar surface resting on the image receptor. Use a sandbag to immobilize the image receptor if using a free detector.
Central Ray:	Central ray angled 15 degrees towards the heel to the metatarsophalangeal joint of the toe of interest. **Merrill's Modification: Utilize a perpendicular central ray and position the patient with their foot on a 15-degree wedge sponge with the central ray through the MTP joint of interest.
Marker Placement:	Place appropriate right or left marker. Use lead number to mark toe being examined. (*number can be annotated)
Shielding:	Gonadal shielding required
Breathing:	N/A
Purpose/Structures:	Demonstrates phalanges of the toe, interphalangeal joints, and the distal portion of the metatarsal.

Evaluation Criteria:

- Evidence of proper collimation and the presence of a side marker placed clear of anatomy of interest
- Entire toe, including distal end of the metatarsal
- Toe separated from each other
- No rotation of the phalanges; soft tissue width and midshaft concavity equal on both sides
- Open interphalangeal and metatarsophalangeal joint spaces on axial projections
- Bony trabecular detail and surrounding soft tissues

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RH Note:

- The toe charge can be used to image 1 or 2 toes on the same foot. If you are imaging 2 toes that are not adjacent to one another, take 3 separate views of each under one accession number. Please label them appropriately.
- If a patient presents with an order for a specific toe, then the toe protocol should be followed. If a patient presents with an order for forefoot or toes, follow toes/forefoot protocol.

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Routine:	AP Axial, Medial Oblique, Lateral
Position/Projection:	Supine/Medial Oblique
Patient Prep:	Remove shoe, sock or nylons from area of interest
Technique:	63 kVp @ 1 mAs (Tabletop)
SID:	40 inches
Collimation:	To anatomy of interest
Patient Position:	Patient supine with knee flexed. Medially rotate the lower leg and foot and adjust the plantar surface of the foot to form a 30-45° angle with the image receptor. Use a covered sponge to support the oblique foot and a sandbag to immobilize the sponge and free receptor.
Central Ray:	Central ray to the metatarsophalangeal joint of the toe of interest.
Marker Placement:	Place appropriate right or left marker. Use lead number to mark toe being examined. (*number can be annotated)
Shielding:	Gonadal shielding required
Breathing Instructions:	N/A
Purpose/Structures:	An oblique position of the phalange and distal metatarsal
Evaluation Criteria:	<ul style="list-style-type: none">• Evidence of proper collimation and the presence of a side marker placed clear of anatomy of interest• Entire toe, including distal ends of the metatarsals• Toes separated from each other• Proper rotation of toe as demonstrated by more soft tissue width and more midshaft concavity on elevated side• Open interphalangeal and second through fifth metatarsophalangeal joint spaces• First MTP joint (not always open)• Bony trabecular detail and surrounding soft tissues
Merrill's Modification:	<ul style="list-style-type: none">• 1st - 2nd toe <u>medial</u> oblique• 4th- 5th toe – <u>lateral</u> oblique• 3rd toe – either oblique is adequate

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Position/Projection:	Supine/Lateral
Patient Prep:	Remove shoe, sock or nylons from area of interest
Technique:	63 kVp @ 1 mAs (Tabletop)
SID:	40 inches
Collimation:	To anatomy of interest
Position:	Have the patient lie in the lateral recumbent position (*see below for specifics based on the toe being imaged). To prevent superimposition, tape the toes above the one being examined into a flexed position, or a gauze pad or tongue depressor can be used to separate the toes. <i>*Manipulate toes only if no deformity is apparent.</i> <ul style="list-style-type: none">• Great toe and second toe- Place the patient on the <i>unaffected</i> side. Place the toe in the true lateral position.• Third, fourth, fifth toe- Place the patient on the <i>affected</i> side. Place the toe in the true lateral position. You may need to support the patient's heel with a sandbag or sponge
Central Ray:	Great toe - Direct the central ray perpendicular to the IP joint Second thru fifth toe – Direct the central ray perpendicular to the PIP joint **Align the toe to the image receptor and center the image receptor appropriately.
Marker Placement:	Place appropriate right or left marker. Use lead number to mark toe being examined. (*number can be annotated)
Shielding:	Gonadal shielding required
Breathing:	N/A
Purpose/Structures:	Lateral projection of phalanges of toe and the IP articulations projected free of the other toes
Evaluation Criteria:	<ul style="list-style-type: none">• Evidence of proper collimation and the presence of a side marker placed clear of the anatomy of interest• Entire toe without superimposition of adjacent toes; when superimposition cannot be avoided the proximal phalanx must be shown• Toe(s) in true lateral position<ul style="list-style-type: none">▪ Toenail in profile, if visualized and normal▪ Concave plantar surfaces of the phalanges▪ No rotation of the phalanges

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- Open IP joint spaces; the MTP joints are overlapped but may be seen in some patients
- Bony trabecular detail and surrounding soft tissue

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TOES/ FOREFOOT (1st -5th)

Routine:	AP Axial and Medial Oblique
Position/Projection:	Supine/AP Axial
Patient Prep:	Remove shoe, sock or nylons from area of interest
Technique:	63 kVp @ 1 mAs (Tabletop)
SID:	40 inches
Collimation:	To anatomy of interest
Patient Position:	Patient supine with knee flexed. Plantar surface resting on the image receptor. Use a sandbag to immobilize the image receptor if using a free detector.
Central Ray:	Central ray angled 15 degrees towards the heel to the second metatarsophalangeal joint. **Merrill's Centering Modification: Merrill's suggests centering to be to the third metatarsophalangeal joint, however, this will offer unequal collimation on each side of the forefoot. Centering to the second MTP as RH does allows for more equal collimation. **Merrill's Positioning Modification: Utilize a perpendicular central ray and position the patient with their foot on a 15-degree wedge sponge with the central ray through the MTP joint of interest.
Marker Placement:	Place appropriate right or left marker
Shielding:	Gonadal shielding required
Breathing Instructions:	N/A
Purpose/Structures:	Demonstrates 14 phalanges of the toes; interphalangeal joints and the distal portion of the metatarsals.
Evaluation Criteria:	<ul style="list-style-type: none">• Evidence of proper collimation and the presence of a side marker placed clear of the anatomy of interest• Entire toes, including distal ends of the metatarsals• Toes separated from each other• No rotation of the phalanges; soft tissue width and midshaft concavity equal on both sides• Open IP and MTP joint spaces on axial projection• Bony trabecular detail and surrounding soft tissue

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RH NOTE:

- If a patient presents with an order for a specific toe, then the toe protocol should be followed. If a patient presents with an order for forefoot or toes, follow toes/forefoot protocol.

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TOES/ FOREFOOT (1st -5th)

Routine:	AP Axial and Medial Oblique
Position/Projection:	Supine/Medial Oblique
Patient Prep:	Remove shoe, sock or nylons from area of interest
Technique:	63 kVp @ 1 mAs (Tabletop)
SID:	40 inches
Collimation:	To anatomy of interest
Patient Position:	Patient supine with knee flexed. Medially rotate the lower leg and foot and adjust the plantar surface of the foot to form a 30-45° angle with the image receptor. Use a covered sponge to support the oblique foot and a sandbag to immobilize the sponge and free receptor.
Central Ray:	Central ray to the 3 rd metatarsophalangeal joint.
Marker Placement:	Place appropriate right or left marker.
Shielding:	Gonadal shielding required
Breathing Instructions:	N/A
Purpose/Structures:	An oblique position of the phalanges and distal metatarsals.
Evaluation Criteria:	<ul style="list-style-type: none">• Evidence of proper collimation and presence of a side marker placed clear of anatomy of interest• Entire toes, including distal ends of the metatarsals• Toes separated from each other• Proper rotation of toes, as demonstrated by more soft tissue width and more midshaft concavity on the elevated side• Open IP and second through fifth MTP joint spaces• First MTP joint (not always opened)• Bony trabecular detail and surrounding soft tissues

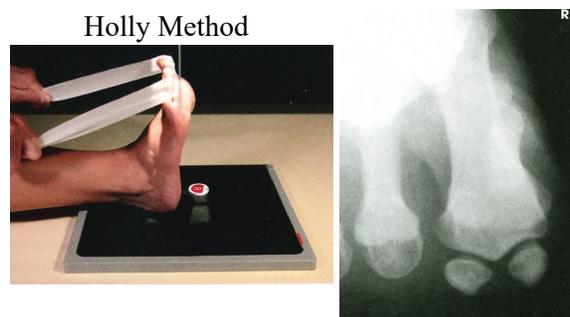
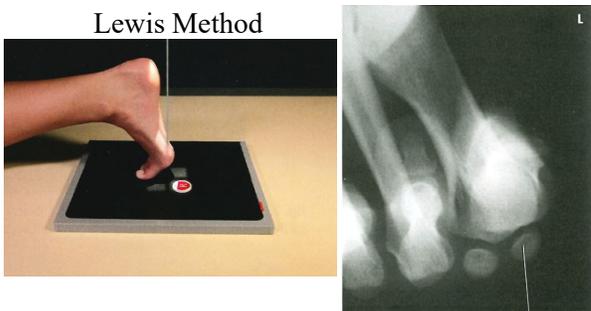
SPECIAL VIEW: TOES/FOREFOOT

Merrill's 14th ED, Vol 1, pp. 296-297

Position/Projection:	Prone or Seated Erect/Tangential (Lewis & Holly Methods)
Patient Prep:	Remove shoe, sock or nylons from area of interest
SID:	40 inches
Collimation:	To anatomy of interest
Patient Position:	Lewis Method - Patient in prone position with great toe resting on the table in a position of dorsiflexion. Ball of the foot should be perpendicular to the horizontal plane. (May use sandbag to help elevate the affected side) Holly Method – Patient seated on table with affected side held in dorsiflexion with medial border perpendicular (vertical), and the plantar surface is at an angle of 75-degrees with the plane of the image receptor. May use gauze to help hold the toes in a flexed position.
Central Ray:	Central ray perpendicular and tangential to the head of the first MTP joint
Marker Placement:	Place appropriate right or left marker.
Shielding:	Gonadal shielding required
Breathing Instructions:	N/A
Purpose/Structures:	Tangential projection of the metatarsal head in profile and the sesamoids free of superimposition

Evaluation Criteria:

- Evidence of proper collimation and the presence of a side marker placed clear of anatomy of interest
- Sesamoids free of any portion of the first metatarsal
- Metatarsal heads
- Bony trabecular detail and surrounding soft tissues



Images from Merrill's Atlas 14th Ed.

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FOOT

Routine:	AP Axial, Medial Oblique, & Lateral
Position/Projection:	Supine/AP Axial (dorsoplantar) projection
Patient Prep:	Remove shoe, sock or nylons from area of interest
Technique:	70 kVp @ 1.25 mAs (Tabletop)
SID:	40 inches
Collimation:	To anatomy of interest
Patient Position:	Patient supine with the knee of the affected side flexed enough to rest the sole of the foot firmly on the image receptor. The entire plantar surface of the foot should rest on the image receptor. Use a sandbag to immobilize the image receptor if using a free detector and ensure that there is no rotation of the foot.
Central Ray:	Central ray with a 10° angle towards the heel, to the base of the 3 rd metatarsal. *Palpate base of 5 th metatarsal, the level of the third metatarsal is about one inch anterior to the base of the 5 th metatarsal in the midline of the foot.
Marker Placement:	Place appropriate right or left marker.
Shielding:	Gonadal shielding required
Breathing Instructions:	N/A
Purpose/Structures:	Demonstrates the tarsals anterior to the talus, the metatarsals and the phalanges.
Evaluation Criteria:	<ul style="list-style-type: none">• Evidence of proper collimation and the presence of a side marker placed clear of the anatomy of interest• Anatomy from toes to tarsals; may include portions of the talus and calcaneus• No rotation of the foot, as demonstrated by equal amounts of space between the second through fourth metatarsals• Overlap of the second through fifth metatarsal bases• Axial projection resulting in improved demonstration of interphalangeal, metatarsophalangeal, and tarsometatarsal joint spaces• Open joint space between medial and intermediate cuneiforms• Bony trabecular detail and surrounding soft tissues.

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FOOT

Routine:	AP Axial, Medial Oblique, & Lateral
Position/ Projection:	Supine/Medial Oblique
Patient Prep:	Remove shoe, sock or nylons from area of interest
Technique:	70 kVp @ 1.25 mAs (Tabletop)
SID:	40 inches
Collimation:	To anatomy of interest
Patient Position:	Patient supine with the knee of the affected side flexed. Rotate the leg <i>medially</i> until the <i>plantar surface</i> of the foot forms a 30° angle with the image receptor. Support the foot with a covered sponge. Use a sandbag to immobilize the image receptor if using a free detector.
Central Ray:	Central ray to the base of the 3 rd metatarsal.
Marker Placement:	Place appropriate right or left marker.
Shielding:	Gonadal shielding required
Breathing Instructions:	N/A
Purpose/Structures:	The interspace between the cuboid and calcaneus, between the cuboid and the 4 th & 5 th metatarsals, between the cuboid and the lateral cuneiform, and between the talus and the navicular are demonstrated. The sinus tarsi is also well shown in this projection.

Evaluation Criteria:

- Evidence of proper collimation and the presence of a side marker placed clear of the anatomy of interest
- Entire foot, from toes to heel
- Proper rotation of foot:
 - Third through fifth metatarsals free of superimposition
 - Bases of the first and second metatarsals superimposed on medial and intermediate cuneiforms
 - Navicular, lateral cuneiform, and cuboid with less superimposition than in the AP projection
- Tuberosity of 5th metatarsal
- Lateral tarsometatarsal and intertarsal joints
- Sinus tarsi
- Bony trabecular detail and surrounding soft tissue

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FOOT

Routine:	AP Axial, Medial Oblique, & Lateral
Position/Projection:	Supine/Lateral
SID:	40 inches
Patient Prep:	Remove shoe, sock or nylons from area of interest
Technique:	70 kVp @ 1.25 mAs (Tabletop)
Collimation:	To anatomy of interest
Patient Position:	Have the patient turn toward the affected side until the leg and foot are lateral. Place the sole of the foot parallel with the bottom of the image receptor. Elevate the knee enough to place the patella perpendicular to the table. Adjust the foot so that the plantar surface is perpendicular to the image receptor. Place a cushion or sandbag under the knee for support. Dorsiflex the foot to form a 90° angle with lower leg and use a sponge and sandbag for support with dorsiflexion.
Central Ray:	Central ray to the base of the 3 rd metatarsal
Marker Placement:	Place appropriate right or left.
Shielding:	Gonadal shielding required
Breathing Instructions:	N/A
Purpose/Structures:	The entire foot in profile, the ankle joint, and the distal ends of the tibia and fibula.
Evaluation Criteria:	<ul style="list-style-type: none">• Evidence of proper collimation and the presence of a side marker placed clear of the anatomy of interest• Entire foot and distal leg• Superimposed plantar surfaces of the metatarsal heads• Fibula overlapping the posterior portion of the tibia• Tibiotalar joint• Bony trabecular detail and surrounding soft tissues

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SPECIAL VIEW: FOOT

Position/Projection:	Supine/Lateral Oblique
SID:	40 inches
Patient Prep:	Remove shoe, sock or nylons from area of interest
Collimation:	To anatomy of interest
Patient Position:	Patient supine with the knee of the affected side flexed. Rotate the leg <i>laterally</i> until the <i>plantar surface</i> of the foot forms a 30° angle with the image receptor. Support the foot with a covered sponge. Use a sandbag to immobilize the image receptor if using a free detector.
Central Ray:	Central ray to the base of the 3 rd metatarsal.
Marker Placement:	Place appropriate right or left marker.
Shielding:	Gonadal shielding required
Breathing Instructions:	N/A
Purpose/Structures:	Joint spaces between the first and second metatarsals and between the medial and intermediate cuneiforms

Evaluation Criteria:

- Evidence of proper collimation the presence of a side marker placed clear of the anatomy of interest
- Anatomy from toes to tarsals; may include portions of talus and calcaneus
- Proper rotation of the foot
 - 1st and 2nd metatarsal bases free of superimposition
 - Minimal superimposition between medial and intermediate cuneiforms
 - Navicular seen with less foreshortening than in the medial rotation AP oblique projection
- Bony trabecular detail and surrounding soft tissue

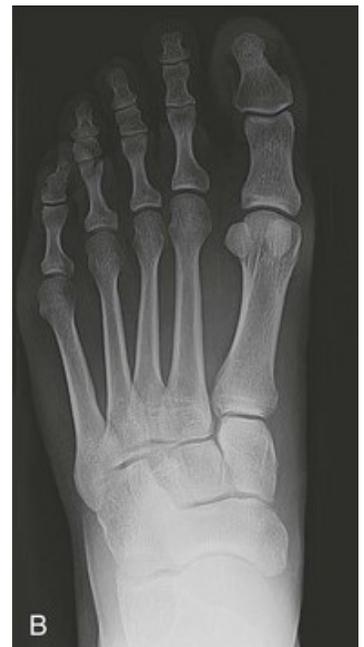


SPECIAL VIEWS: FOOT---WEIGHT-BEARING
AP AXIAL, LATERAL

Position/Projection:	Erect/AP Axial Weight-Bearing
SID:	40 inches
Patient Prep:	Remove shoe, sock or nylons from area of interest
Collimation:	To anatomy of interest
Patient Position:	Patient standing upright with foot of interest on the image receptor. The image receptor should be on a low stool or the floor that is comfortable for the patient. (Can also be performed bilaterally)
Central Ray:	Central ray angled 15 degrees towards the heel centered to the base of the 3 rd metatarsal.
Marker Placement:	Place appropriate right or left marker.
Shielding:	Gonadal shielding required
Breathing Instructions:	N/A
Purpose/Structures:	A weight-bearing, functional view of all bones of the foot

Evaluation Criteria:

- Evidence of proper collimation and the presence of a side marker placed clear of the anatomy of interest
- Both feet centered on one image (if performed bilaterally)
- Anatomy from toes to tarsals; may include portions of talus and calcaneus
- Correct right and left marker placement and a weight-bearing marker
- Bony trabecular detail and surrounding soft tissue

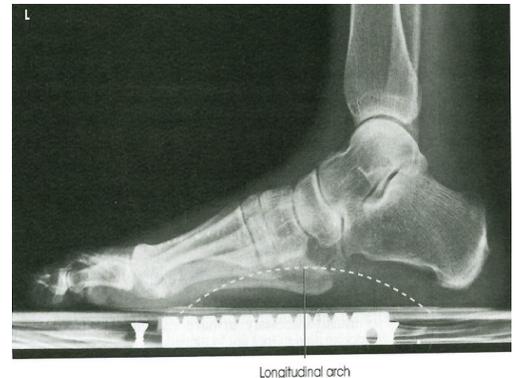


SPECIAL VIEWS: FOOT---WEIGHT-BEARING
AP AXIAL, LATERAL

Position/Projection:	Erect/Lateral Weight-Bearing (Longitudinal Arch)
SID:	40 inches
Patient Prep:	Remove shoe, sock or nylons from area of interest
Collimation:	To anatomy of interest
Patient Position:	Patient standing on block with one foot on each side of image receptor, with the patient's body weight equally distributed on each foot in a natural position.
Central Ray:	Central ray perpendicular to a point just above the base of the 3 rd metatarsal.
Marker Placement:	Place appropriate right or left marker.
Shielding:	Gonadal shielding required
Breathing Instructions:	N/A
Purpose/Structures:	Shows the structural status of the longitudinal arch and a lateromedial projection of the foot with weight-bearing.

Evaluation Criteria:

- Evidence of proper collimation and the presence of a side marker placed clear of anatomy of interest
- Entire foot and distal leg
- Superimposed plantar surfaces of the metatarsal heads
- Fibula overlapping the posterior portion of the tibia
- Tibiotalar joint
- Bony trabecular detail and surrounding soft tissues



Images from Merrill's Atlas 14th Ed

RH NOTES: Weight-bearing/erect imaging of the foot

- If the MD order requests a Foot (L/R) weight-bearing/erect with no indication of views, then technologist should obtain an AP and Lateral as per the imaging protocol for 'Weight Bearing Views'.
- If the MD order requests Foot (L/R) weight-bearing/erect with specific indication to minimum 3 views, then the technologist should obtain an AP, Medial Oblique and Lateral.
 - The medial oblique should be obtained with the patient standing on an image receptor with their weight evenly distributed. The tube is angled 35 degrees. The central ray is directed at the base of the 3rd metatarsal.

Weight Bearing Medial Oblique



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Routine:	AP Axial & Lateral
Position/Projection:	Supine/AP Axial (Plantodorsal)
Patient Prep:	Remove shoe, sock or nylons from area of interest
Technique:	70 kVp @ 1.8 mAs (Tabletop)
SID:	40 inches
Collimation:	To anatomy of interest
Patient Position:	Patient is supine with the leg fully extended. Place a gauze around the ball of the foot and have the patient pull the gauze toward them to hold the ankle in a right-angle dorsiflexion (make sure both sides are pulled equally so foot does not turn). Plantar surface of foot must be perpendicular to the image receptor. Heel should be about 1-2" above bottom of image receptor.
Central Ray:	Central ray is angled 40° cephalad (down toward heel) and enters around base of 3 rd metatarsal (midline of plantar surface at the level of the base of the 5 th metatarsal)
Marker Placement:	Place appropriate right or left marker.
Shielding:	Gonadal shielding required
Breathing Instructions:	N/A
Purpose/Structures:	An axial projection of the calcaneus from the tuberosity to the sustentaculum tali and trochlear processes is shown.

Evaluation Criteria:

- Evidence of proper collimation and the presence of a side marker placed clear of the anatomy of interest
- Calcaneus and calcaneocuboid joint
- No rotation of the calcaneus- the first or fifth metatarsals not projected to the sides of the foot
- Bony trabecular detail and surrounding soft tissues

Additional RHS Note:

- The supine AP axial image of the heel is the preferred method at RH (unless directed otherwise by the ordering physician). However, if the patient is unable to tolerate, you have the option to obtain an erect heel using the Harris-Beath Method. Please see the Heel Special Views Protocol.

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HEEL

Routine:	AP Axial & Lateral
Position/Projection:	Supine/Lateral
Patient Prep:	Remove shoe, sock or nylons from area of interest
Technique:	70 kVp @ 1.1 mAs (Tabletop)
SID:	40 inches
Collimation:	To anatomy of interest
Patient Position:	Turn patient towards the affected side until the leg is lateral. Support the knee with a sponge if needed. Adjust the heel so it is in a true lateral. Palpate the malleoli to ensure they are perpendicular the image receptor.
Central Ray:	Central ray perpendicular to the heel and about 1-1 1/2" distal to the medial malleolus. (*this will place the central ray at the subtalar joint)
Marker Placement:	Place appropriate right or left marker.
Shielding:	Gonadal shielding required
Breathing Instructions:	N/A
Purpose/Structures:	A lateral projection of the ankle joint and calcaneus in profile.
Evaluation Criteria:	<ul style="list-style-type: none">• Evidence of proper collimation and presence of side marker placed clear of anatomy of interest• Entire calcaneus, including ankle joint and adjacent tarsals• No rotation of the calcaneus<ul style="list-style-type: none">○ Tuberosity in profile○ Sinus tarsi open○ Calcaneocuboid and talonavicular joints open• Bony trabecular detail and surrounding soft tissues

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SPECIAL VIEW: HEEL

Position/Projection:	Prone/ Axial (dorsoplantar)
Patient Prep:	Remove shoe, sock or nylons from area of interest
SID:	40 inches
Collimation:	To anatomy of interest
Patient Position:	Patient is prone with affected ankle elevated on sandbags to support dorsiflexion of the ankle. Dorsiflexion should be enough to place long axis of the foot perpendicular to the tabletop. Place the image receptor is placed vertically against plantar surface of the foot. Support the image receptor with sandbags or an image receptor holder.
Central Ray:	Central ray is angled 40° caudad (down toward heel) and enters around the dorsal surface of the ankle joint.
Marker Placement:	Place appropriate right or left marker.
Shielding:	Gonadal shielding required
Breathing Instructions:	N/A
Purpose/Structures:	An axial projection of the calcaneus and calcaneocuboid joint.

Evaluation Criteria:

- Evidence of proper collimation and the presence of a side marker placed clear of the anatomy of interest
- Calcaneus and the calcaneocuboid joint
- Sustentaculum tali
- Calcaneus not rotated – the 1st or 5th metatarsals not projected to the sides of the foot
- Bony trabecular detail and surrounding soft tissues



RHS Note: If heel is requested as weight-bearing, use the Harris-Beath Method

Weight-Bearing Harris Beath Method:

This view demonstrates the calcaneotalar coalition and is also referred to as the coalition position.

- The patient stands in the upright position.
- Center the image receptor to the long axis of the calcaneus with the posterior surface of the heel at the edge of the image receptor.
- To prevent superimposition of the leg shadow, have the patient place the opposite foot one step forward.
- Central ray is angled 45 degrees anteriorly and directed through the posterior surface of the flexed ankle to a point on the plantar surface at the level of the base of the fifth metatarsal.

