Reading Hospital School of Health Sciences
Medical Imaging Program
MI 133: Clinical Seminar II
2021-2022

# Hand

**Routine:** PA, Oblique, and Lateral

**Position/Projection:** **Prone (PA)**

**Patient Prep**: Remove all jewelry from area of interest and clothing articles, if possible
*Be aware of ID bracelets showing up over anatomy

**Technique:** **66 kVp @ 0.7 mAs (Tabletop)**

**SID:** 40 inches

**Collimation:** To anatomy of interest

**Patient Position**: Patient is seated with forearm resting on the table with palmar surface down on the image receptor. Spread fingers *slightly*.

**Central Ray:** Perpendicular to the third metacarpophalangeal (MCP) joint.

**Marker Placement:** R or L as appropriate

**Shielding:** Gonadal shielding required

**Breathing:** N/A

**Purpose/Structures:** PA projections of the carpals, metacarpals, phalanges (except for thumb), interarticulations of the hand, and distal radius and ulna are shown. This image also shows a PA oblique projection of the first digit.

**Evaluation Criteria:**

- Evidence of proper collimation and presence of side marker placed clear of anatomy of interest
- Anatomy from fingertips to distal radius and ulna
- No rotation of the hand:
    - Equal concavity of the metacarpal and phalangeal bodies on both sides
    - Equal amount of soft tissue on both sides of the phalanges
    - Fingernail, if visualized, in the center of each distal phalanx
    - Equal distance between the metacarpal heads
- Open MCP and interphalangeal (IP) joints, indicating that the hand is placed flat on the IR
- Bony trabecular detail and surrounding soft tissues

# Hand

**Routine:** PA, Oblique, and Lateral

**Position/Projection:** **Oblique (PA oblique with lateral rotation)**

**Patient Prep**: Remove all jewelry from area of interest and clothing articles, if possible
*Be aware of ID bracelets showing up over anatomy

**Technique:** **66 kVp @ 0.8 mAs (Tabletop)**

**SID:** 40 inches

**Collimation:** To anatomy of interest

**Patient Position:** Patient is seated with forearm resting on the table with palmar surface down. Then rotate the hand laterally. Adjust the obliquity of the hand so that the metacarpophalangeal (MCP) joints form an angle of approximately 45 degrees to the image receptor. Use a 45-degree foam wedge sponge to support the fingers in the extended position (this will demonstrate the *Interphalangeal (IP) Joints)*

** Merrill's states that if visualizing the metacarpals: obtain a PA oblique projection of the hand by rotating the hand laterally (externally) from the pronated position until the fingertips touch the image receptor. If the correct position is obtained with all fingertips touching the image receptor, elevate the index finger and thumb on a sponge (this elevation opens the joint spaces and reduces the degree of foreshortening of the phalanges).

**Central Ray:** Perpendicular to the third metacarpophalangeal (MCP) joint.

**Marker Placement:** R or L as appropriate

**Shielding:** Gonadal shielding required

**Breathing:** N/A

**Purpose/Structures:** PA oblique projection of the bones and soft tissues of the hand

**Evaluation Criteria:**

- Evidence of proper collimation and presence of side marker placed clear of anatomy of interest
- Anatomy from fingertips to distal radius and ulna
- Digits separated slightly with no overlap of their soft tissues
- 45 degrees of rotation of anatomy
    - Decreasing amounts of separation between metacarpal bodies two through five, with the second and third having the greatest separation
    - Partial superimposition of the third, fourth, and fifth metacarpal bases and heads
- Open MCP joints
- Open IP joints, when digits are positioned parallel to image receptor
- Bony trabecular detail and surrounding soft tissues

# Hand

**Routine:** PA, Oblique, and Lateral

**Position/Projection:** **Lateral -Fan (Lateromedial)**

**Patient Prep**: Remove all jewelry from area of interest and clothing articles, if possible
*Be aware of ID bracelets showing up over anatomy

**Technique:** **70kVp @ 1.25 mAs (Tabletop)**

**SID:** 40 inches

**Collimation:** To anatomy of interest

**Patient Position:** Patient is seated at the end of the radiographic table. Turn hand and wrist into the lateral position with the ulnar aspect down. Place fingers on lateral hand sponge with thumb abducted and on sponge for support.

**Central Ray:** Perpendicular to the second digit metacarpophalangeal (MCP) joint.

**Marker Placement:** R or L as appropriate

**Shielding:** Gonadal shielding required

**Breathing:** N/A

**Purpose/Structures:** Fan lateral superimposes the metacarpals but shows almost all of the individual phalanges. The most proximal portions of the proximal phalanges remain superimposed.

**Evaluation Criteria:**

- Evidence of proper collimation and presence of side marker placed clear of anatomy of interest
- Anatomy from fingertips to distal radius and ulna
- Extended digits
- Hand in a true lateral position
    - Superimposed phalanges (individually seen on fan lateral)
    - Superimposed metacarpals
    - Superimposed distal radius and ulna
- Thumb free of motion and superimposition
- Bony trabecular detail and surrounding soft tissues

**Additional Note:**

- In cases of foreign body- Obtain the lateral view with the hand in extension. Do not fan the fingers (Exception: splinters- obtain lateral with fingers fanned). Refer to the imaging protocol for FB, punctures, lacerations, open wounds and lumps/palpable masses.

# Hand - Special Views

*14th edition Merrill's Volume I, page 172-173

**Position/Projection:** **Extension Lateral (RH- used for foreign body)**

**Patient Prep**: Remove all jewelry from area of interest and clothing articles, if possible
*Be aware of ID bracelets showing up over anatomy

**Technique:** **70kVp @ 1.25 mAs (Tabletop)**

**SID:** 40 inches

**Collimation:** To anatomy of interest

**Patient Position:** Patient is seated at the end of the radiographic table. Turn hand and wrist into the lateral position with the ulnar aspect down. Extend the patient's digits and adjust the first digit at a right angle to the palm. This allows the palmar surface to be perpendicular to the Image receptor.

**Central Ray:** Perpendicular to the second digit metacarpophalangeal (MCP) joint.

**Marker Placement:** R or L as appropriate

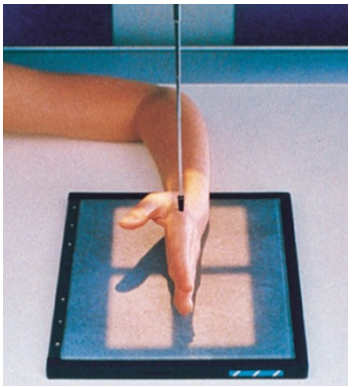
**Shielding:** Gonadal shielding required

**Breathing:** N/A

**Purpose/Structures:** Shows a lateral projection of the hand in extension, presents the customary position for localizing foreign bodies and metacarpal fracture displacement.
**Done for foreign bodies imbedded in the hand or fingers (Exception: Splinters)

**Evaluation Criteria:**

- Evidence of proper collimation and presence of side marker placed clear of anatomy of interest
- Anatomy from fingertips to distal radius and ulna
- Extended digits
- Hand in a true lateral position
  - Superimposed phalanges (individually seen on fan lateral)
  - Superimposed metacarpals
  - Superimposed distal radius and ulna
- Thumb free of motion and superimposition
- Bony trabecular detail and surrounding soft tissues

*Revised: 10/2020*

# Special Views for Hand

**Position/Projection:** **Bone Age - Left Hand PA Projection**

**Patient Prep**: Remove all jewelry from area of interest and clothing articles, if possible
*Be aware of ID bracelets showing up over anatomy

**Technique:** **66 kVp @ 0.7 mAs (Tabletop)**

**SID:** 40 inches

**Collimation:** To anatomy of interest

**Patient Position**: Patient is seated with forearm resting on the table with palmar surface down on the image receptor. Spread fingers *slightly*.

**Central Ray:** Perpendicular to the third metacarpophalangeal (MCP) joint.

**Marker Placement:** L marker

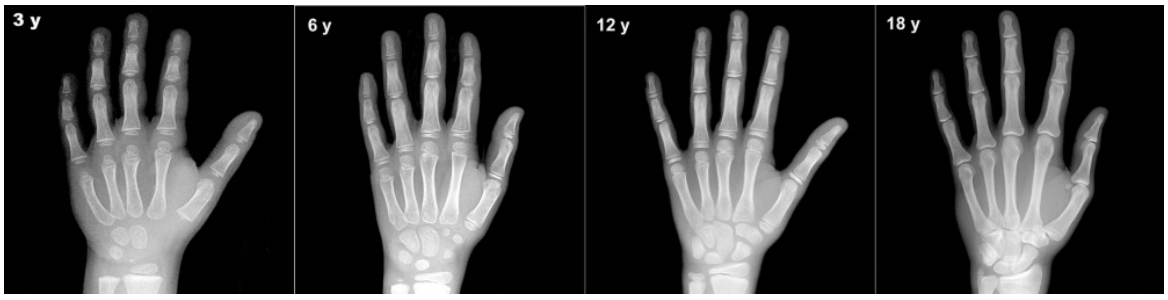
**Shielding:** Gonadal shielding required

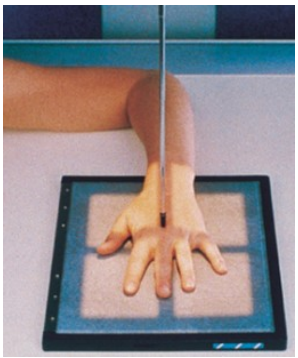
**Breathing**: N/A

**Purpose/Structures:** Helps doctors estimate the maturity of a child's skeletal system by visualizing the growth plates of the carpals. PA projection of a hand is demonstrated.

**Evaluation Criteria:**

- Evidence of proper collimation and presence of side marker placed clear of anatomy of interest
- Anatomy from fingertips to distal radius and ulna
- No rotation of the hand:
    - Equal concavity of the metacarpal and phalangeal bodies on both sides
    - Equal amount of soft tissue on both sides of the phalanges
    - Fingernail, if visualized, in the center of each distal phalanx
    - Equal distance between the metacarpal heads
- Open MCP and interphalangeal (IP) joints, indicating that the hand is placed flat on the IR
- Bony trabecular detail and surrounding soft tissues



*Revised: 10/2020*

# Hand - Special Views

*14th edition Merrill's Volume I, page 174-175

**Position/Projection:** **Arthritis Hands (Norgaard Method) – Ball Catcher's position**
**AP Oblique projection (Medial Rotation)**

**Patient Prep**: Remove all jewelry from area of interest and clothing articles, if possible
*Be aware of ID bracelets showing up over anatomy

**Technique:** **66 kVp @ 0.8 mAs (Tabletop)**

**SID:** 40 inches

**Collimation:** To anatomy of interest

**Patient Position:** Patient is seated at the end of the radiographic table. Place both hands palm together (both in lateral position). Center the MCP joints on the medial aspect of both hands to the image receptor. Place two 45-degree sponges against the posterior of each hand. Rotate the hands to a half-supinated position until the dorsal surface of each hand rests against each sponge. Cup the patient's fingers and abduct the thumbs slightly to avoid superimposition of the second MCP joints.

**Central Ray:** Perpendicular to a point midway between both hands at the level of the MCP joints.

**Marker Placement:** R and L as appropriate

**Shielding:** Gonadal shielding required

**Breathing:** N/A

**Purpose/Structures:** Used for early diagnosis of rheumatoid arthritis. Area of interest is the MCP joints of the 2nd through 5th digits.

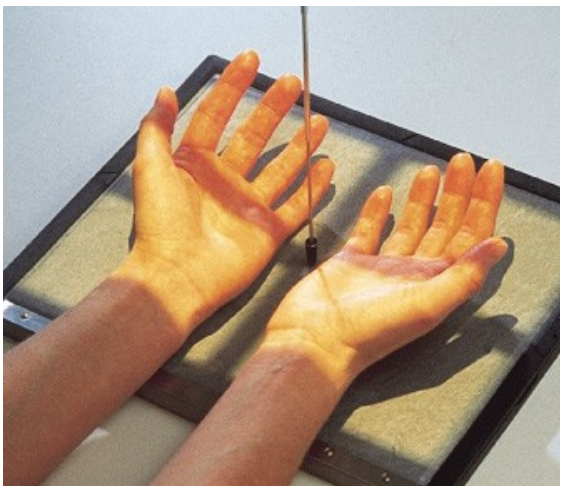
An AP 45-degree oblique projection of both hands. If rheumatoid is diagnosed, the image will show symmetric, very slight, indistinct outline of the bone corresponding to the insertion of the joint capsule dorsoradial on the proximal end of the first phalanx of the for fingers. In addition, associated demineralization of the bone structure is always present in the area directly below the contour defect.

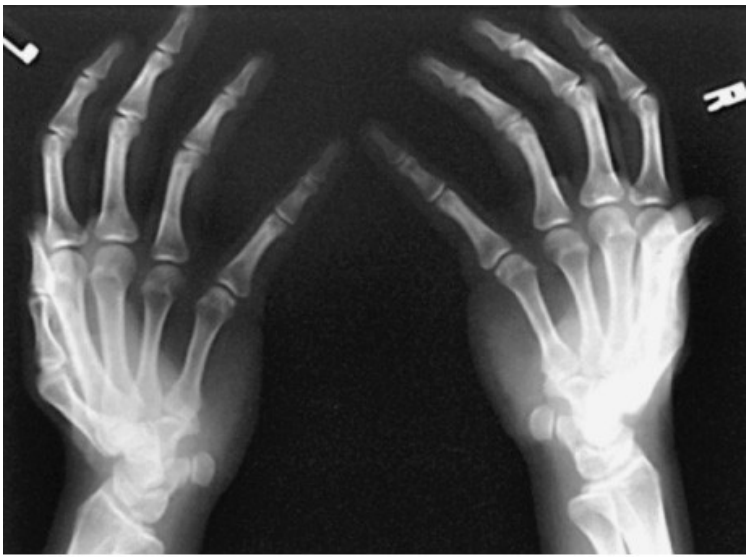
**Evaluation Criteria:**

- Evidence of proper collimation and presence of side marker placed clear of anatomy of interest
- Both hands from the carpal areas to the tip of the digits
- Metacarpal heads and proximal phalangeal bases free of superimposition
- Bony trabecular detail and surrounding soft tissues

**RH Protocol:**

- Each hand is imaged separately.
- Perform a PA image of each hand and an AP oblique image with straight (extended) fingers





*This view assists in detecting early radiologic changes in the dorsoradial aspects of the second through fifth proximal phalangeal bases that may be associated with rheumatoid arthritis. It is possible to make an early diagnosis of rheumatoid arthritis by using this position before lab tests are positive*

*Please note: Technologists image at the discretion of the Radiologist. The below are guidelines established by our Radiologists to ensure consistent imaging practices throughout the department. If a question of appropriate imaging protocol arises, questions should be directed to a Supervisor or Radiologist for clarification.

**Protocols included:**

- Foreign Bodies, Punctures, Lacerations, Open Wounds and Lumps/Palpable Masses Protocol
- Image Check Protocol

## Foreign Bodies, Punctures, Lacerations, Open Wounds and Lumps/Palpable Masses Protocol

**Procedure:**

- If the patient arrives with a puncture wound with no history of a foreign body, mark the wound with a BB and document this in the electronic note.
- If the patient arrives with an open, gaping wound with presence of a foreign body, no BB or marker should be placed on the wound, document this in the electronic note.
- If the patient arrives with a laceration and the technologist believes there may be a presence of a foreign body, mark the laceration with a BB and document this in the electronic note (this should occur even if the patient's history states there is no evidence of a foreign body).
- If the patient arrives with a laceration and the patient gives a history of a foreign body, mark the laceration with a BB and document this in the electronic note.
- If the patient arrives with a lump or palpable mass, mark it with a BB and document this in the electronic note.

## Image Check Protocol

**Procedure:**

- If patient presents with an injury within 2 weeks, an Image Check should be requested.
- In addition, an Image Check can be requested at the discretion of the performing technologist if an obvious abnormality is identified (fracture, large effusion, etc.). This is regardless of injury timeframe.

Revised: 5/20/16 SRK

## RH Trauma Wrist Imaging Protocol

| Adult | Pediatric (Under 18) |
|---|---|
| | |
| PA, Oblique, Lateral, Navicular | 8 years and younger: PA, Oblique, Lateral |
| | 9 years and older: PA, Oblique, Lateral, Navicular |

## RH Non Trauma Wrist Imaging Protocol

| Adult | Pediatric (Under 18) |
|---|---|
| | |
| PA, Oblique, Lateral | PA, Oblique, Lateral |

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# Wrist

**Routine:** **Non-Trauma:** PA, Oblique, Lateral
**Trauma:** PA, Oblique, Lateral, Ulnar Deviation (scaphoid /navicular view)

**Position/Projection:** **Prone PA**

**Patient Prep:** Remove all jewelry from area of interest and clothing articles, if possible
*Be aware of ID bracelets showing up over anatomy

**Technique:** **66 kVp @ 0.9 mAs (Tabletop)**

**SID:** 40 inches

**Collimation:** To anatomy of interest

**Patient Position:** Patient is in a seated position. Have the patient place their forearm on the image receptor and bend their elbow so the arm forms a 90-degree angle. Adjust the wrist, so the carpals are in the center of the image receptor (at the level just distal to the ulnar styloid). Ensure that the hand/forearm lie parallel with image receptor. Slightly arch the hand at the MCP joints by flexing the digits to place the wrist in close contact with the image receptor.

**Central Ray:** Perpendicular to the radiocarpal joint (just distal to the ulnar styloid)

**Marker:** Right or Left as appropriate

**Shielding:** Shield gonads

**Breathing:** N/A

**Purpose/Structures:** Carpals, distal radius and ulna, and proximal metacarpals. The projection gives a slightly oblique rotation to the ulna

**Evaluation Criteria:**

- Evidence of proper collimation and presence of side marker placed clear of anatomy of interest
- Distal radius and ulna, carpals, and proximal half of metacarpals
- No excessive flexion of digits to overlap and obscure metacarpals
- No rotation in carpals, metacarpals, radius, and ulna
- Open radioulnar joint space *(Merrill's only)*
- Bony trabecular detail and surrounding soft tissues

***Merrill's recommends for patient position: Seat the patient low enough to place the axilla in contact with the table or elevate the extremity to shoulder level on a suitable support***

# Wrist

**Routine:** **Non-Trauma:** PA, Oblique, Lateral
**Trauma:** PA, Oblique, Lateral, Ulnar Deviation (scaphoid /navicular view)

**Position/Projection:** **Oblique (PA oblique with lateral rotation)**

**Patient Prep:** Remove all jewelry from area of interest and clothing articles, if possible
*Be aware of ID bracelets showing up over anatomy

**Technique:** **66 kVp @ 0.9 mAs (Tabletop)**

**SID:** 40 inches

**Collimation:** To anatomy of interest

**Patient Position:** Patient is in a seated position. Have the patient place their forearm on the image receptor and bend their elbow so the arm forms a 90-degree angle. From the pronated position, rotate wrist laterally (externally) until it forms a 45-degree angle with the plane of the image receptor. Extend fingers slightly and support the wrist and fingers with the small angle sponge.

**Central Ray:** Perpendicular to the midcarpal area (just distal to the radius slightly inferior to the navicular)

**Marker:** Right or Left as appropriate

**Shielding:** Shield gonads

**Breathing:** N/A

**Purpose/Structures:** Carpals on the lateral side of the wrist, particularly the trapezium and the scaphoid

**Evaluation Criteria:**

- Evidence of proper collimation and presence of side marker placed clear of anatomy of interest
- Distal radius and ulna, carpals and proximal half of metacarpals
- 45-degree rotation of anatomy:
    - Slight interosseous space between the third, fourth and fifth metacarpal bodies
    - Slight overlap of the distal radius and ulna
- Carpals on lateral side of wrist
- Trapezium and distal half of the scaphoid without superimposition
- Open trapeziotrapezoid and scaphotrapezial joint space
- Bony trabecular detail and surrounding soft tissues

***Merrill's recommends for patient position: Seat the patient low enough to place the axilla in contact with the table or elevate the extremity to shoulder level on a suitable support***

# Wrist

**Routine:** **Non-Trauma:** PA, Oblique, Lateral
**Trauma:** PA, Oblique, Lateral, Ulnar Deviation (scaphoid /navicular view)

**Position/Projection: Lateral**

**Patient Prep:** Remove all jewelry from area of interest and clothing articles, if possible
*Be aware of ID bracelets showing up over anatomy

**Technique:** **70 kVp @ 1.1 mAs (Tabletop)**

**SID:** 40 inches

**Collimation:** To anatomy of interest

**Patient Position:** Patient is in a seated position. Have the patient place their forearm on the image receptor and bend their elbow so the arm forms a 90-degree angle. Rotate ulna to lateral position. Adjust the forearm and hand so it is in true lateral position.

**Central Ray:** Perpendicular to the radiocarpal *(wrist)* joint

**Marker:** Right or Left as appropriate

**Shielding:** Shield gonads

**Breathing:** N/A

**Purpose/Structures:** Lateral projection of the proximal metacarpals, carpals, and distal radius and ulna. The position can show anterior or posterior displacement in fractures.

**Evaluation Criteria:**

- Evidence of proper collimation and presence of side marker placed clear of anatomy of interest
- Distal radius, and ulna, carpals, and proximal half of metacarpals
- Superimposed distal radius and ulna
- Superimposed metacarpals
- Bony trabecular detail and surrounding soft tissues

# Wrist

**Routine:** **Non-Trauma:** PA, Oblique, Lateral
**Trauma:** PA, Oblique, Lateral, Ulnar Deviation (scaphoid /navicular view)

**Position/Projection:** **Ulnar Deviation PA Projection (Scaphoid/Navicular view)**

**Patient Prep:** Remove all jewelry from area of interest and clothing articles, if possible
*Be aware of ID bracelets showing up over anatomy

**Technique:** **66 kVp @ 0.9 mAs (Tabletop)**

**SID:** 40 inches

**Collimation:** Tightly collimate to carpals (*suggested size 4 x 4*)

**Patient Position** Patient is in a seated position. Have the patient place their forearm on the image receptor and bend their elbow so the arm forms a 90-degree angle. Place the patient's wrist on the image receptor into a PA position. Without moving the forearm, turn the hand outward until the wrist is in extreme ulnar deviation. Angle the tube 30 degrees towards the elbow. (****Merrill's states central ray angulation of 10 to 15 proximally or distally required for clear delineation)*** Ensure alignment of the central ray to the image receptor and maintain a 40-inch SID.

**Central Ray:** Perpendicular to the scaphoid

**Marker:** Right or Left as appropriate

**Shielding:** Shield gonads

**Breathing:** N/A

**Purpose/Structures:** This position reduces foreshortening of the scaphoid which occurs with a Perpendicular CR. It also opens the spaces between adjacent carpals.

**Evaluation Criteria:**

- Evidence of proper collimation and presence of side marker placed clear of anatomy of interest
- Distal radius and ulna carpals, and proximal half of metacarpals *(Merrill's only)*
- Scaphoid with adjacent articulations open
- No rotation of wrist
- Maximum ulnar deviation, as revealed by the angle formed between longitudinal axis of the ulna and the longitudinal axis of the 5$^{th}$ metacarpal
- Bony trabecular detail and surrounding soft tissues

**RH Additional Notes:**

- This view is obtained on patient's **9 years and older** with trauma
- If navicular is obviously fractured on initial views, this view should be obtained as tolerated by the patient

# Special Views for Wrist

*14th edition Merrill's Volume I, page 184

**Position/Projection:** **Scaphoid Stecher Method (PA Axial Projection)**

**Patient Prep:** Remove all jewelry from area of interest and clothing articles, if possible
*Be aware of ID bracelets showing up over anatomy

**Technique:** **66 kVp @ 0.9 mAs (Tabletop)**

**SID:** 4 inches

**Collimation:** 2.5 inches proximal and distal to the wrist joint and 1 inch on the sides

**Patient Position** Seat the patient at the end of the radiographic table, with the arm and axilla in contact with the table. Rest forearm on table. Place one end of the image receptor on a support and adjust the image receptor so that the finger end of the image receptor is elevated 20 degrees. Adjust wrist on the image receptor for a PA projection and center the wrist to the image receptor.

*Variation:* **S**imilar position can be obtained by placing the image receptor and wrist horizontally and directing the central ray 20 degrees toward the elbow.

*Also, may perform with ulnar deviation or clenched fist if ordered

**Central Ray:** Perpendicular to the table and directed to enter the scaphoid

**Marker:** Right or Left as appropriate

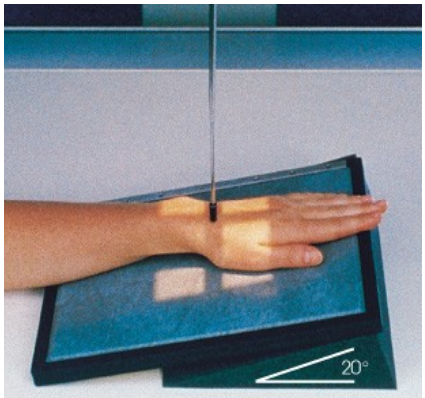
**Shielding:** Shield gonads

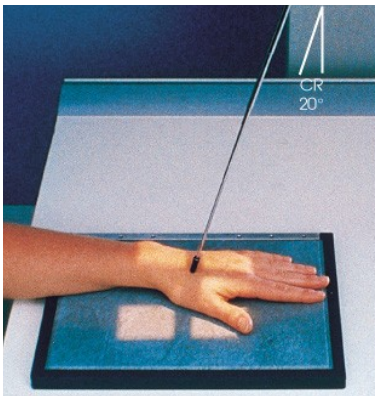
**Breathing:** N/A

**Purpose/Structures:** Used for diagnosis of navicular/ scaphoid fracture. 20-degree angulation of the wrist places the scaphoid at right angles to the central ray, so that it is projected with minimal superimposition.

**Evaluation Criteria:**

- Evidence of proper collimation and presence of side marker placed clear of anatomy of interest
- Distal radius and ulna, carpals, and proximal half of the metacarpals
- Scaphoid with adjacent articulations open
- No rotation of wrist
- Bony trabecular detail and surrounding soft tissues


*Revised: 10/2020*

# Special Views for Wrist

*14th edition Merrill's Volume I, page 190-191

**Position/Projection:** **Tangential Carpal Canal (Gaynor-Hart Method)**

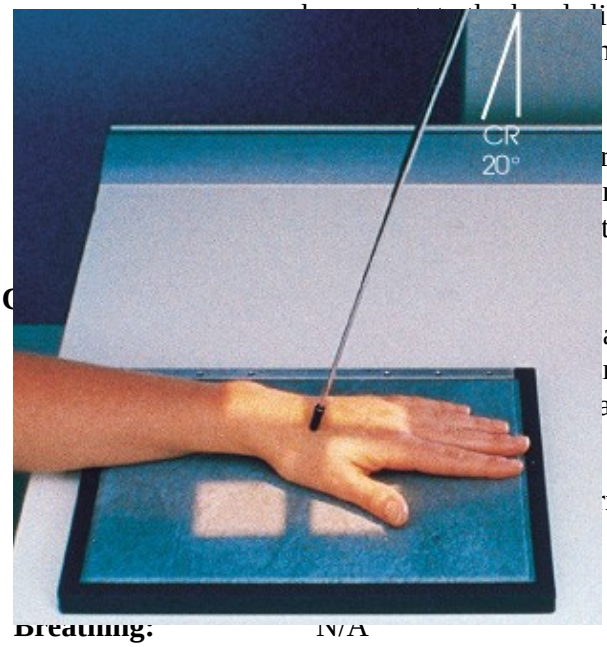
**Patient Prep:** Remove all jewelry from area of interest and clothing articles, if possible
*Be aware of ID bracelets showing up over anatomy

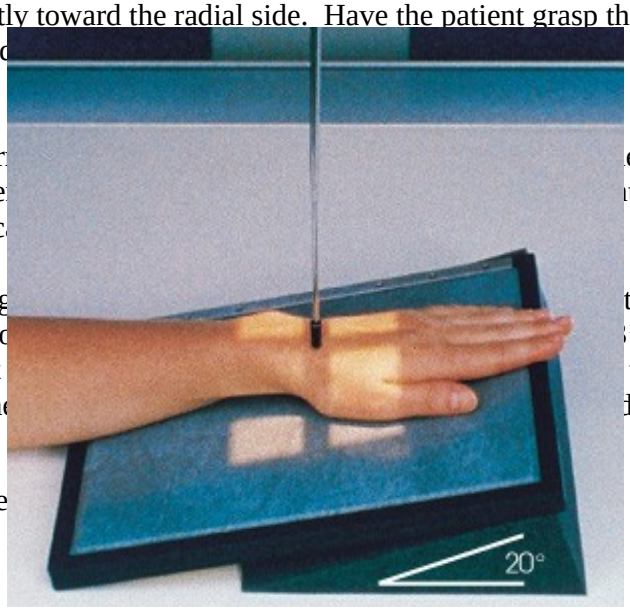
**Technique:** **70 kVp @ 1.25 mAs (Tabletop)**

**SID:** 40 inches

**Collimation:** 1 inch on the three sides of the shadow of the wrist

**Patient Position:** *Inferiorsuperior*: Seat the patient at the end of the radiographic table, so that the forearm can be adjusted to be parallel with the long axis of the table. Hyperextend the wrist and center the mage receptor to the joint at the level of the radial styloid process. For support, place a radiolucent pad approximately ¾ inch thick under the lower forearm. Adjust the position of the hand to make its long axis as vertical as possible. To prevent superimposition of the shadows of the hamate and pisiform
ightly toward the radial side. Have the patient grasp the
hand

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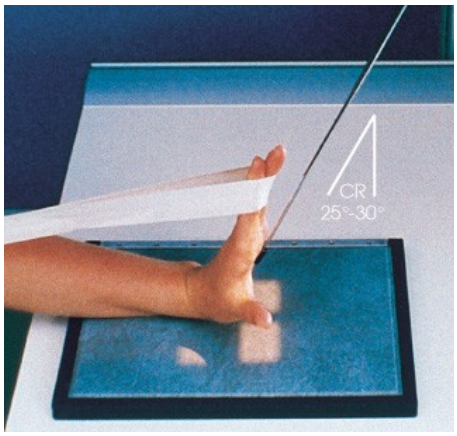
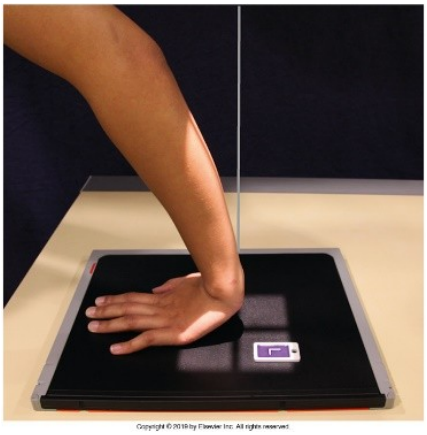
**Breathing:** N/A

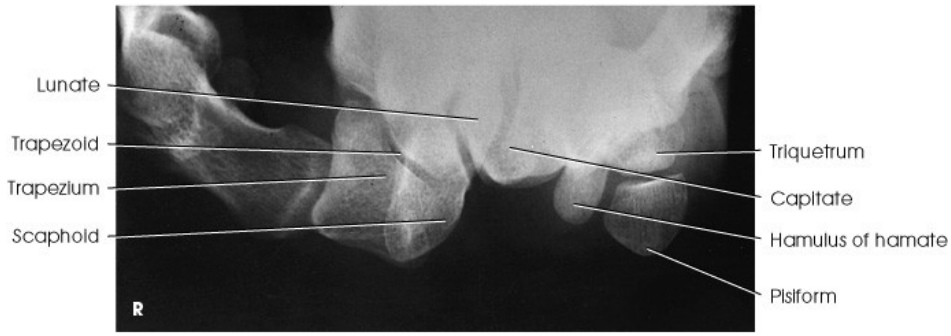
**Purpose/Structures**: Used for early diagnosis of carpal tunnel syndrome. Evaluates abnormalities of bones and soft tissue that may compress nerves causing pain. Helpful in evaluating fractures of hook of hamate, trapezium, and pisiform. Shown is palmar aspect of trapezium, tubercle of trapezium, scaphoid, hook of hamate, triquetrum, and entire pisiform.

**Evaluation Criteria:**

- Evidence of proper collimation and presence of side marker placed clear of anatomy of interest
- Carpals in an arch arrangement
- Pisiform in profile and free of superimposition
- Hamulus (hook) of hamate
- Bony trabecular detail and surrounding soft tissues.





# Special Views for Wrist

*Reading Hospital Protocol (Not in Merrill's)

**Position/Projection:** **Clenched Fist (PA) – (Powergrip)**

**Patient Prep**: Remove all jewelry from area of interest and clothing articles, if possible
*Be aware of ID bracelets showing up over anatomy

**Technique:** **66 kVp @ 0.9 mAs (Tabletop)**

**SID:** 40 inches

**Collimation:** To anatomy of interest

**Patient Position**: Patient is in a seated position. Have the patient place their forearm on the image receptor and bend their elbow so the arm forms a 90-degree angle. Place wrist in PA position. Have the patient curl fingers into a fist and clench fist as tight a possible while taking the exposure.

**Central Ray:** Perpendicular to the center of the wrist

**Marker:** Right or Left as appropriate

**Shielding:** Shield gonads

**Breathing:** N/A

**Purpose/Structures**: Demonstrates scapholunate separation if scapholunate tear is present

# Special Views for Wrist

*Reading Hospital Protocol (Not in Merrill's)

**Position/Projection:** **20-degree Angle Lateral**

**Patient Prep**: Remove all jewelry from area of interest and clothing articles, if possible
*Be aware of ID bracelets showing up over anatomy

**Technique:** **70 kVp @ 1.1 mAs (Tabletop)**

**SID:** 40 inches

**Collimation:** To anatomy of interest

**Patient Position**: Patient is in a seated position. Have the patient place their forearm on the image receptor and bend their elbow so the arm forms a 90-degree angle. Place wrist in lateral position. Angle central ray 20 degrees towards elbow.

**Central Ray:** Center to wrist

**Marker:** Right or Left as appropriate

**Shielding:** Shield gonads

**Breathing:** N/A

**Purpose/Structures**: 20-degree angle towards the elbow matches radial inclination

*Revised: 10/2020*