

# Knee & Patella Radiography

- Ltd Knee Series: A-P and Lateral
- Complete Knee: A-P, Lateral, Tunnel, Sunrise or Settegast & Oblique Views  
may include
- B/L Knees: A-P Weight-bearing & Both Laterals

# Knee & Patella Radiography

- May be taken erect or recumbent.
- Lateral Views more difficult erect due to taper of the femur.
- Tunnel view very difficult erect.
- Weight-bearing good to access joint spaces.
- A B/L P-A Tunnel type view is best for joint assessment but difficult to set up.

# Knee & Patella Radiography

- Some tube angulations is used for all knee views except for the erect lateral view.
- A 5 degrees cephalad angle is used for the A-P, P-A, Oblique and recumbent lateral views.
- Because of the density of the bone of the distal femur, views are taken Bucky.

# A-P Knee



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## 16.2 Knee A-P

- **Measure:** A-P at patella
- **Protection:** recumbent :  
Apron ; erect: Males: Bell;  
Females: Apron
- **SID:** 40'' Bucky
- **Tube angle:** 5° cephalad
- **Film:** 8'' x 10'' I.D. up



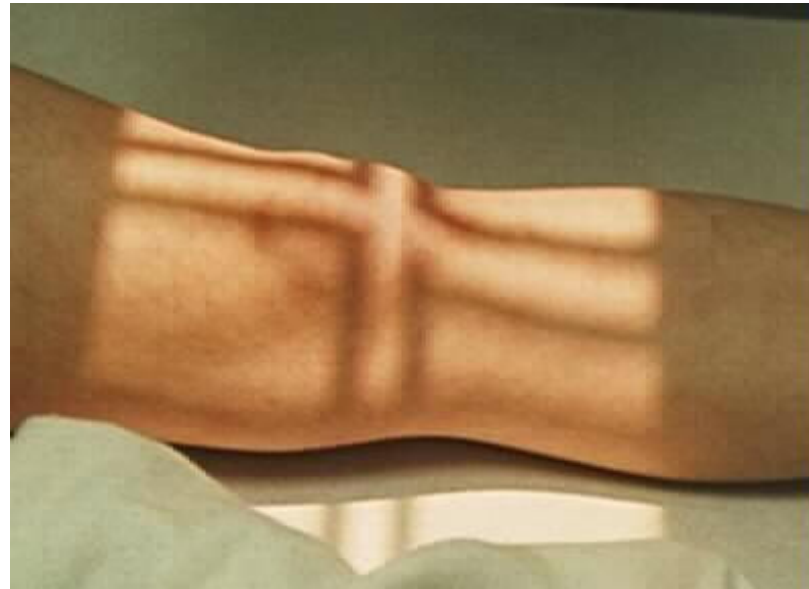
# Knee A-P

- Erect: Patient standing facing tube. Recumbent: Patient supine with knee centered to vertical center of table.
- Patient internally rotates leg  $15^\circ$  until the knee is in a true A-P position. Femur condyles parallel to film.



# Knee A-P

- **Horizontal CR:** 1 cm distal to apex of patella
- **Vertical CR:** long axis of knee and femur.
- **Film centered to horizontal CR.**
- **Collimation Top to Bottom:** slightly less than film size



# Knee A-P

- **Collimation Side to Side:**  
soft tissue of distal femur  
and proximal lower leg.  
Slightly less than film  
size.
- **Patient Instructions:**  
hold still.
- **Make exposure and let  
patient relax**





# Knee A-P Film

- **The joint space should be open.**
- **The patella should be midline.**
- **The adjacent soft tissues should be well visualized.**



# Medial Oblique Knee



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## 16.3 Knee Medial Oblique

- **Measure:** A-P at patella
- **Protection:** Recumbent: apron; Erect: Male: Bell, Female: Apron
- **SID:** 40" Bucky
- **Tube Angle:** 5° cephalad
- **Film:** 8" x 10" Regular I.D. up



# Knee Medial Oblique

- Patient lies supine on table with affected knee centered on table.
- Patient internally rotates lower leg as far as possible or until the femur condyles form a 40 to 45° angle to film. Avoid letting patient raise pelvis and increase object to film distance.



# Knee Medial Oblique

- **Horizontal CR:** 1 cm distal to medial condyle.
- **Film centered to horizontal CR.**
- **Vertical CR:** long axis of femur.
- **Collimation Top to Bottom:** slightly less than film size.



# Knee Medial Oblique

- **Collimation side to side:**  
soft tissue of knee region  
or slightly less than film  
size.
- **Patient instructions:**  
remain still



# Knee Medial Oblique Film

- The fibular head will be clear of the tibia.
- The Knee joint space should be open.
- The soft tissue of the knee should be visualized.
- This view is useful in detecting loose bodies.



# Lateral Oblique Knee

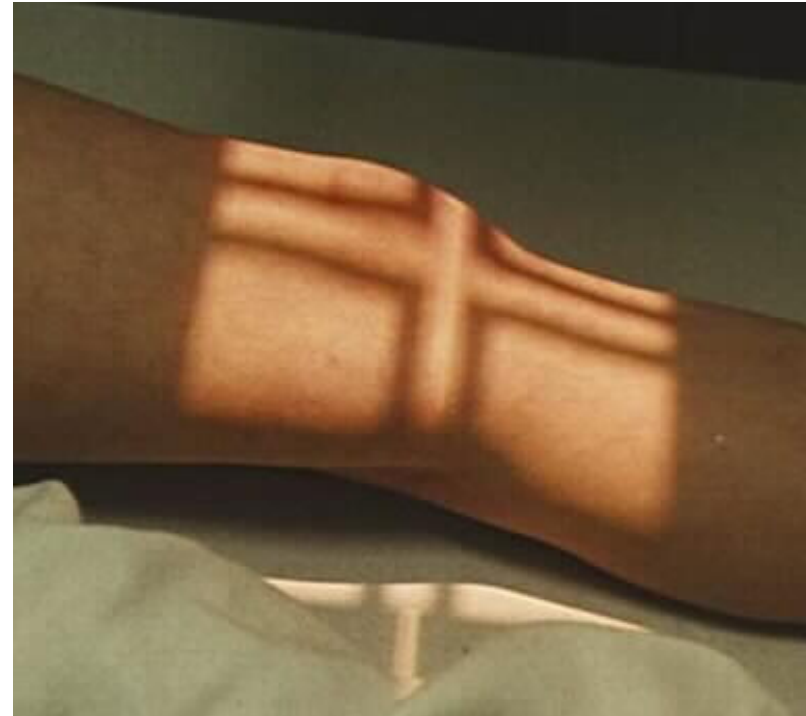


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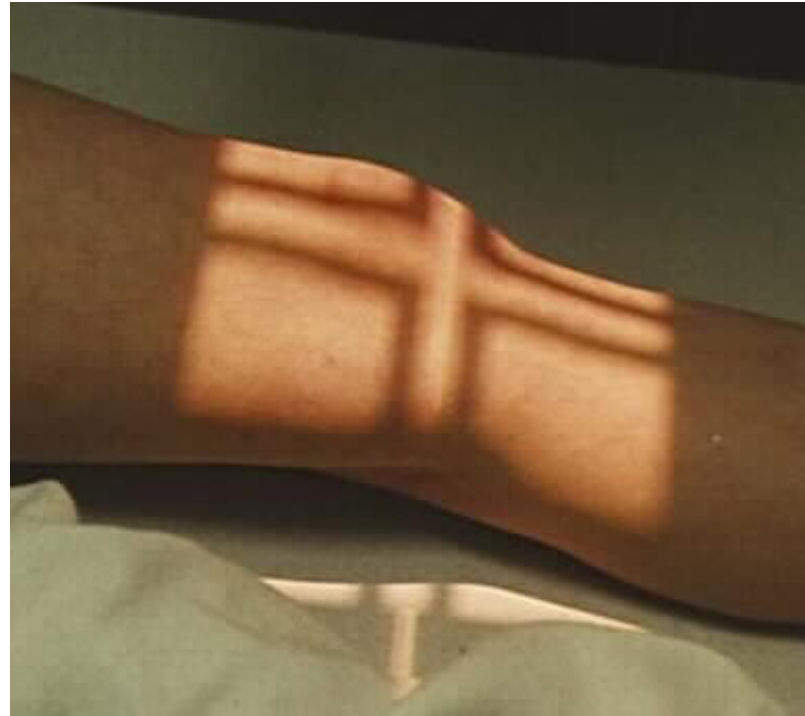
# 16.5 Knee Lateral Oblique

- **Measure:** A-P at patella
- **Protection:** Recumbent: Apron; Erect: Male: Bell; Females: Apron
- **SID:** 40" Bucky
- **Tube Angle:** 5° cephalad
- **Film:** 8" x 10" I.D. up
- **Accessories:** 45° sponge



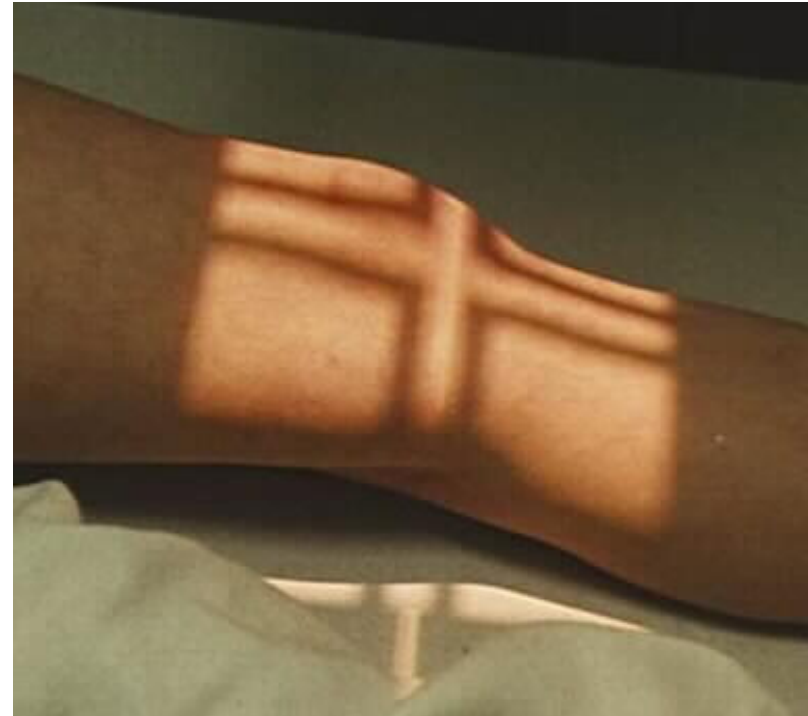
# Knee Lateral Oblique

- The patient lies supine on table or stands facing tube.
- The knee is externally or laterally rotated 40 to 45°.
- The 45° sponge may be used as a rest for the lateral side of the foot.
- The vertical long axis of the femur is centered to the Bucky or table center.



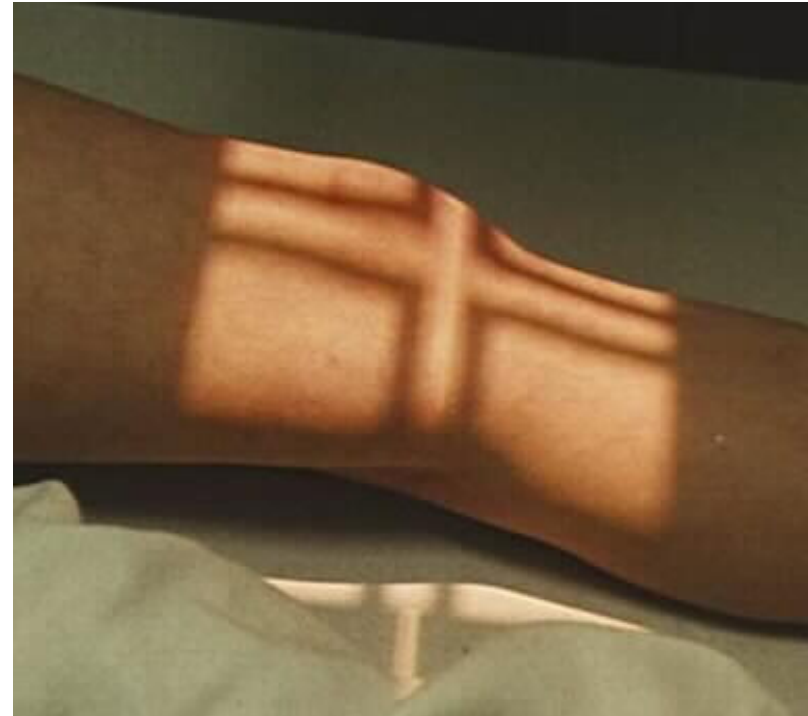
# Knee Lateral Oblique

- **Horizontal CR:** 1 cm distal to medial condyle of femur or through the knee joint space.
- **Vertical CR:** centered to long axis of femur.
- **Collimation:** slightly less than film size or soft tissues of knee.



# Knee Lateral Oblique

- **Patient Instructions:**  
Hold still
- **Make exposure and let patient relax**
- **Note:** It is easy to have too much rotation. The leg should not be turned more than 45 degrees measured at the condyles.



# Knee Lateral Oblique Film

- The medial condyle will be in profile.
- The fibular head, neck and shaft will be superimposed.
- Oblique view of the knee are useful in detecting loose bodies.



# Lateral Knee no flexion



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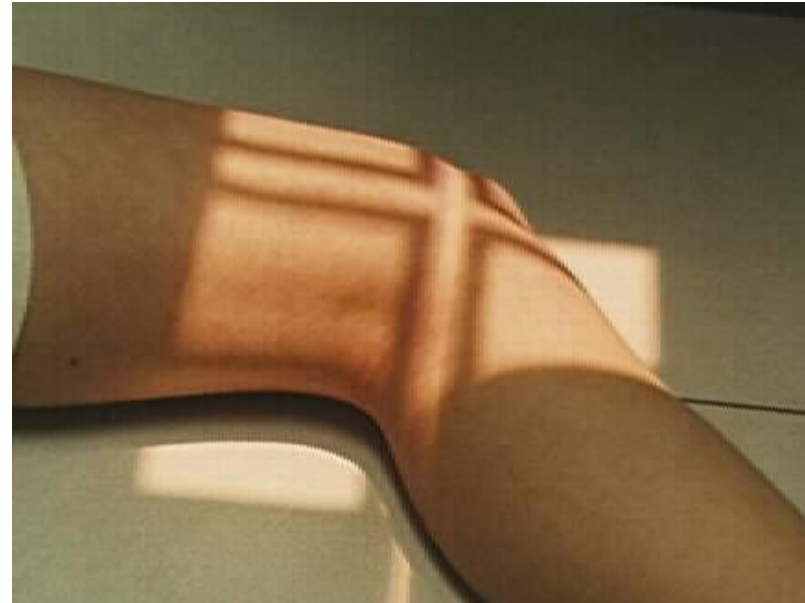
## 16.5 Knee Lateral View

- **Measure:** Lateral at Condyles
- **Protection:** Apron
- **SID:** 40" Bucky
- **Tube Angle:** 5° cephalad
- **Film:** 8" x 10" I.D.  
Up



# Knee Lateral View

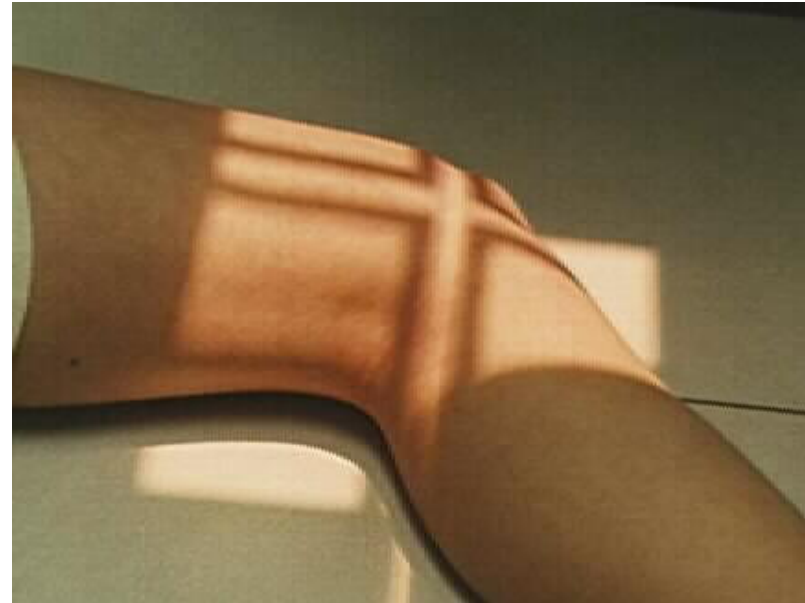
- **Recumbent**
- Patient lies on the affected side with femur aligned with vertical center line of table. The unaffected leg is brought in front of the body. The pelvis is lateral.
- Knee is bent 45 degrees.
- **Horizontal CR:** 1 cm distal to medial condyle.





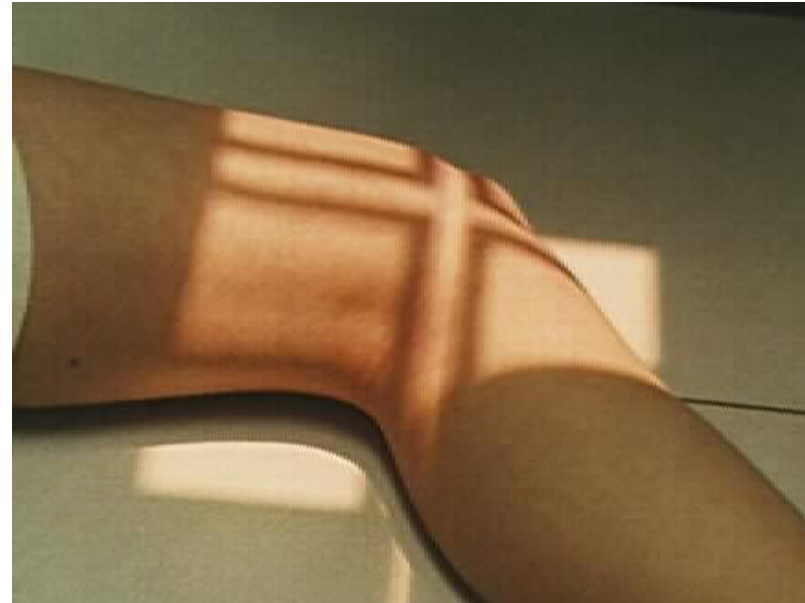
# Knee Lateral View

- **Film centered to horizontal CR.**
- **Vertical CR:** centered to medial condyle of femur
- **Collimation top to bottom:** Distal femur and patella to proximal tibia
- **Collimation side to side:** Soft tissues of knee



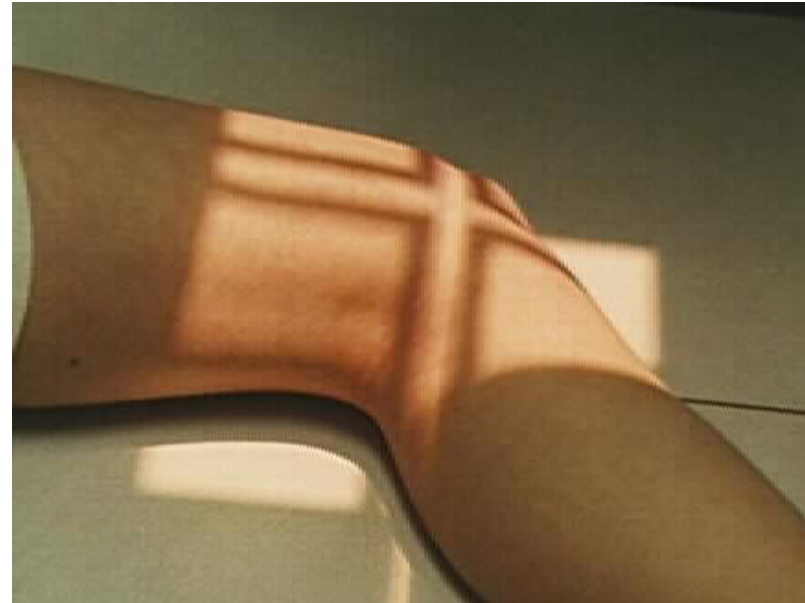
# Knee Lateral View

- **Erect**
- Patient stands with affected knee next to Bucky.
- Place stool next to Bucky and have patient place foot on rung of stool.
- Knee should not be flexed more than 90 degrees.



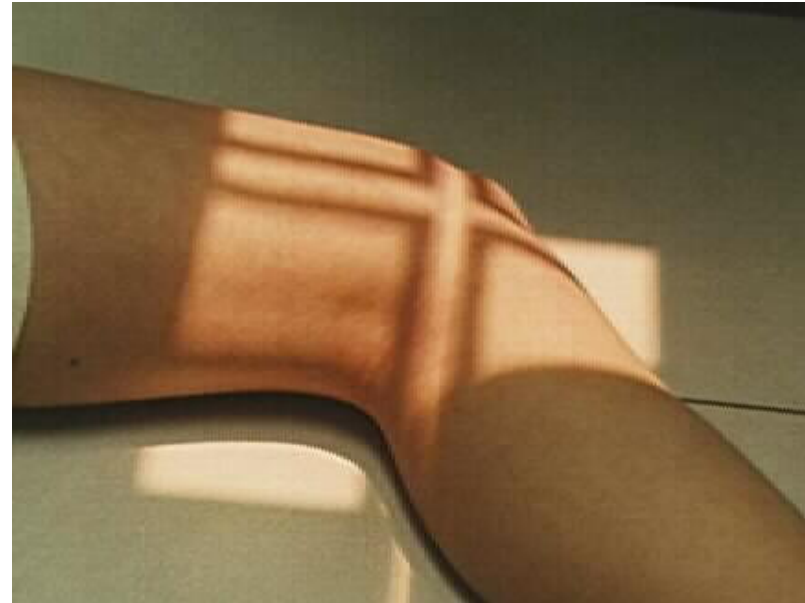
# Knee Lateral View

- **Horizontal CR:** 1 cm distal to medial condyle. For large patients, through the joint space.
- **Vertical CR:** centered to tibia.
- Make sure the femur and tibia are parallel to film.
- **Film centered to horizontal CR.**



# Knee Lateral View

- **Collimation side to side:**  
Soft tissue of patella to include distal femur.
- **Collimation top to bottom:** Soft tissue superior to femur to include distal tibia.
- **Either method**  
**Instructions:** Remain still
- **Make exposure**



# Knee Lateral View Film

- Soft tissues surrounding knee should be well visualized.
- Femoral condyles should be superimposed.
- Patella should be in profile.
- Proximal Tibia and Fibula should be seen.



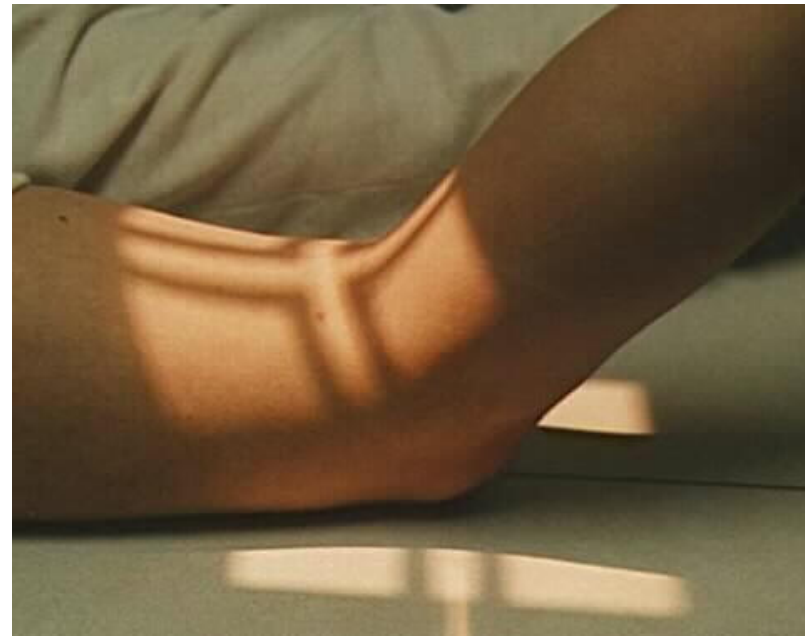
# P-A Knee



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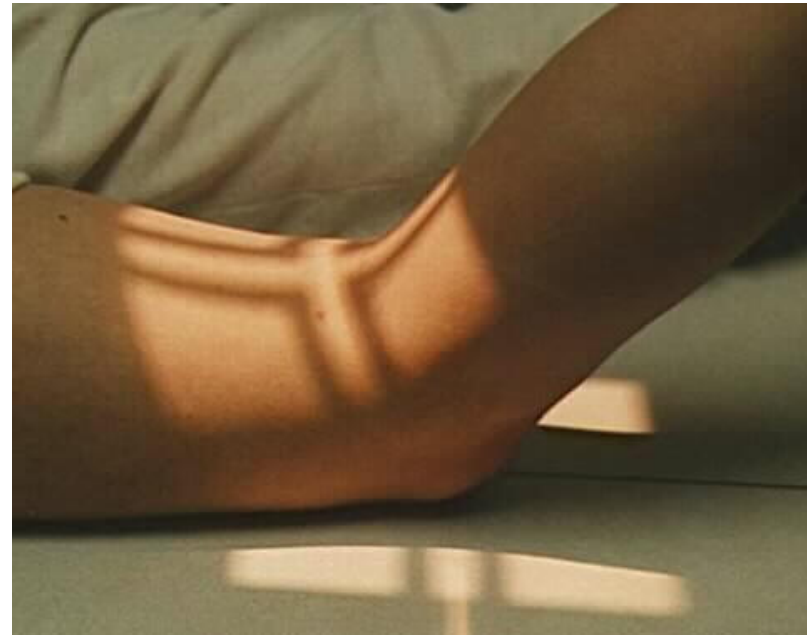
## 16.6 Knee Camp-Coventry or Tunnel View

- **Measure:** A-P at patella
- **Protection:** Apron
- **SID:** 40" Bucky
- **Tube Angle:** 30 to 35°  
Caudal or perpendicular to long axis of tibia
- **Film:** 8" X 10" I.D. up



# Knee Camp-Coventry or Tunnel View

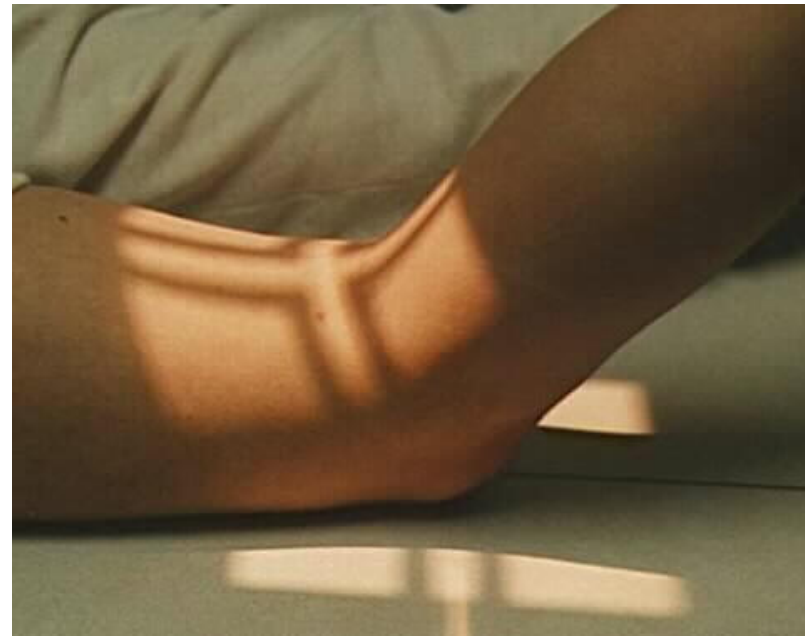
- The patient lies prone on table. The affected knee is centered to the table.
- A stool or similar device is placed on the table for the patient to rest their shin on.
- The knee is bent 30 to 35° and resting on the rung of the stool.





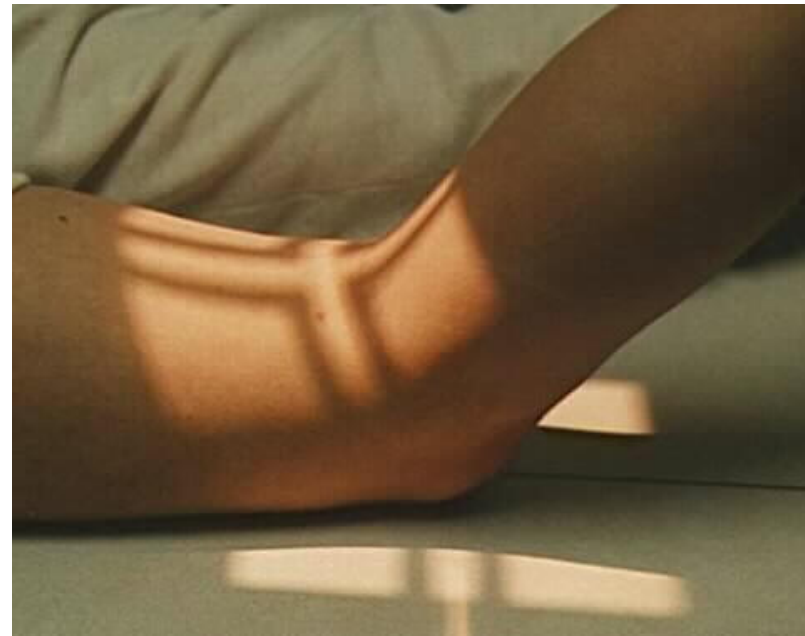
# Knee Camp-Coventry or Tunnel View

- The tibia should be perpendicular to the beam
- **Horizontal CR:** centered through the intercondylar fossa.
- **Vertical CR:** long axis of femur.
- **Film centered to horizontal CR.**



# Knee Camp-Coventry or Tunnel View

- **Collimation top to bottom:** slightly less than film size
- **Collimation side to side:** soft tissue of knee
- **Patient instructions:** Remain still
- **Make exposure and let patient relax.**



# Knee Camp-Coventry or Tunnel Film

- The joint space should be open.
- The intercondylar fossa should be well visualized including the proximal and lateral surfaces free of rotation.
- The intercondylar eminence will be seen.



## 16.7 Knee A-P Bilateral W/B

- **Measure:** A-P at patella
- **Protection:**
  - Males: Bell;
  - Females: Apron
- **SID:** 40" Bucky
- **Tube angle:** 5° cephalad
- **Film:** 17" x 7" or 17" x 14" I.D. up



# Knee A-P Bilateral W/B

- Erect: Patient standing facing tube.
- Patient internally rotates leg  $15^{\circ}$  until the knee is in a true A-P position. The heels and toes should be touching.
- Femur condyles parallel to film.



# Knee A-P Bilateral W/B

- **Horizontal CR:** 1 cm distal to apex of patella
- **Vertical CR:** long axis of knee and femur.
- **Film centered to horizontal CR.**
- **Collimation Top to Bottom:** slightly less than film size



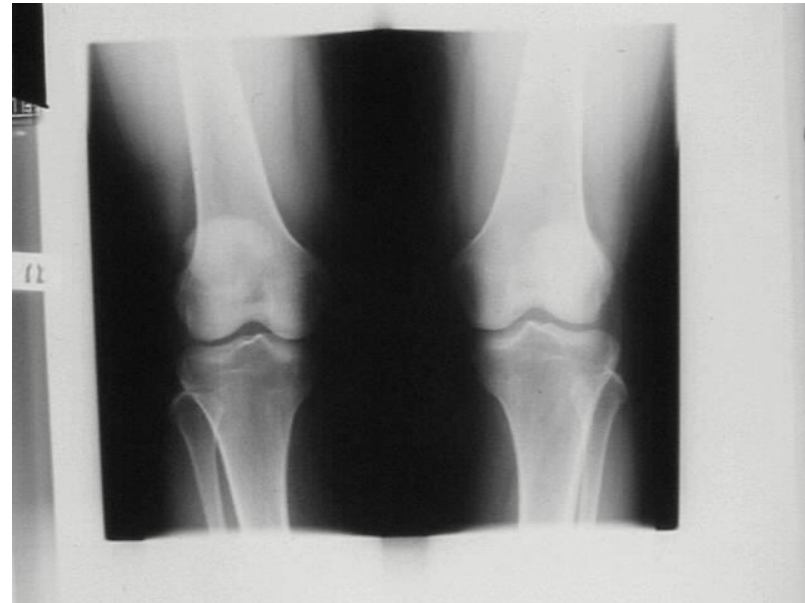
# Knee A-P Bilateral W/B

- **Collimation Side to Side:**  
soft tissue of distal femur  
and proximal lower leg of  
both knees.
- **Collimation Top to Bottom:** Slightly less  
than film size.
- **Patient Instructions:**  
hold still.
- **Make exposure and let  
patient relax**



# Knee A-P Bilateral Film

- **The joint space should be open.**
- **The patella should be midline.**
- **The adjacent soft tissues should be well visualized.**





## 16.8 Patella P-A

- **Measure:** A-P at the Patella
- **Protection:** Apron
- **SID:** 40'' Bucky
- **Tube Angle:** 5° cephalad
- **Film:** 8'' x 10'' I.D. up



# Patella P-A

- Patient lies prone on table or stands facing Bucky.
- The affected knee is aligned with the center line of the table or Bucky.
- The limb is internally rotated until it is in a true P-A position.



# Patella P-A

- **Horizontal CR:** mid patella
- **Vertical CR:** centered to middle of knee and patella
- **Film centered to Horizontal CR**
- **Collimation Top to Bottom:** 5" or to include patella or slightly less than film size.



# Patella P-A

- **Collimation side to side:**  
soft tissue of distal femur
- **Patient Instructions:**  
remain still
- **Make exposure and let patient relax.**



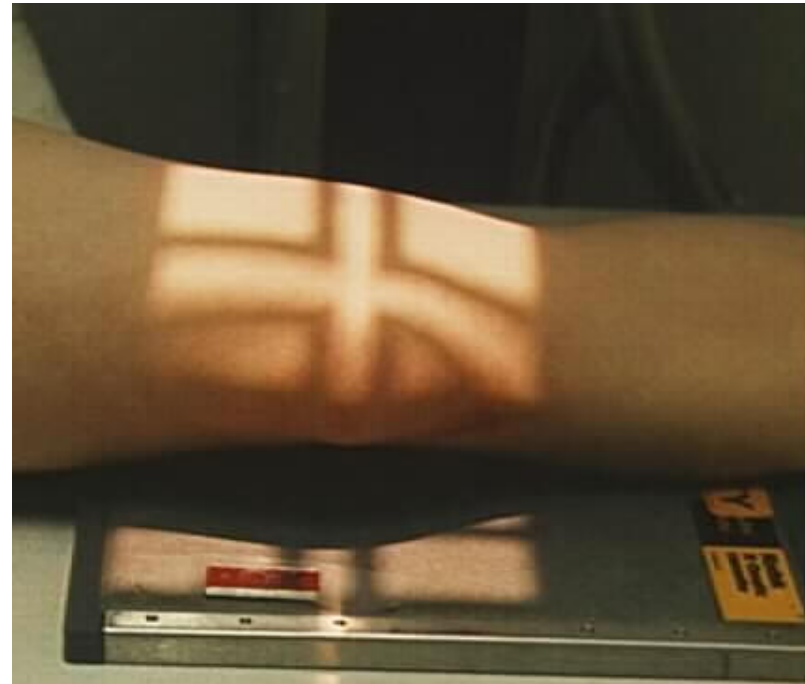
# Patella P-A Film

- **There should be no rotation.**
- **The knee joint and patella should be well visualized.**
- **Soft tissue adjacent to patella should be seen.**
- **Note collimation side to side is too tight.**



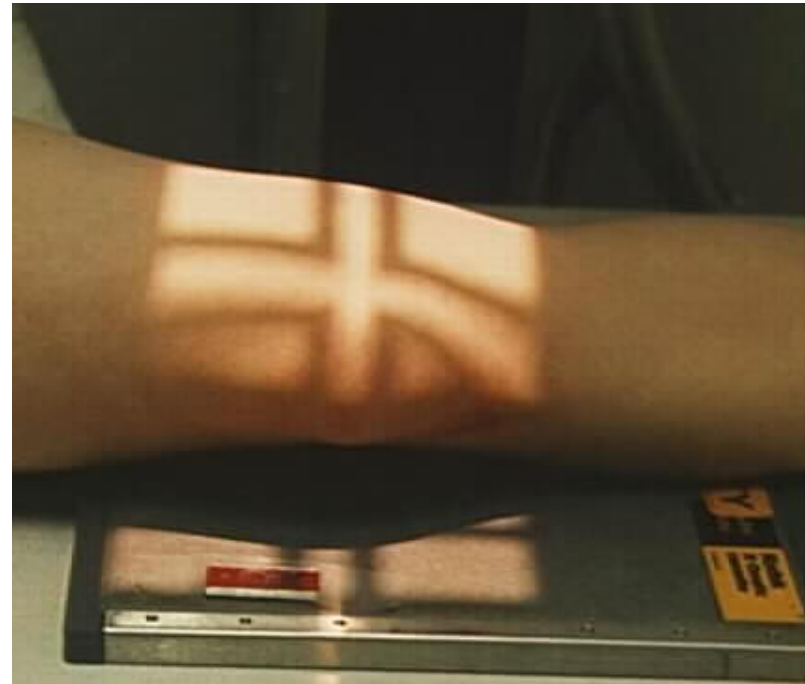
## 16.9 Patella Lateral

- **Measure:** Lateral at condyles
- **Protection:** Lead apron draped over pelvis
- **SID:** 40" table top
- **Tube Angle:** 5° cephalad
- **Film:** 8" x 10" Extremity or Detail Cassette I.D. up



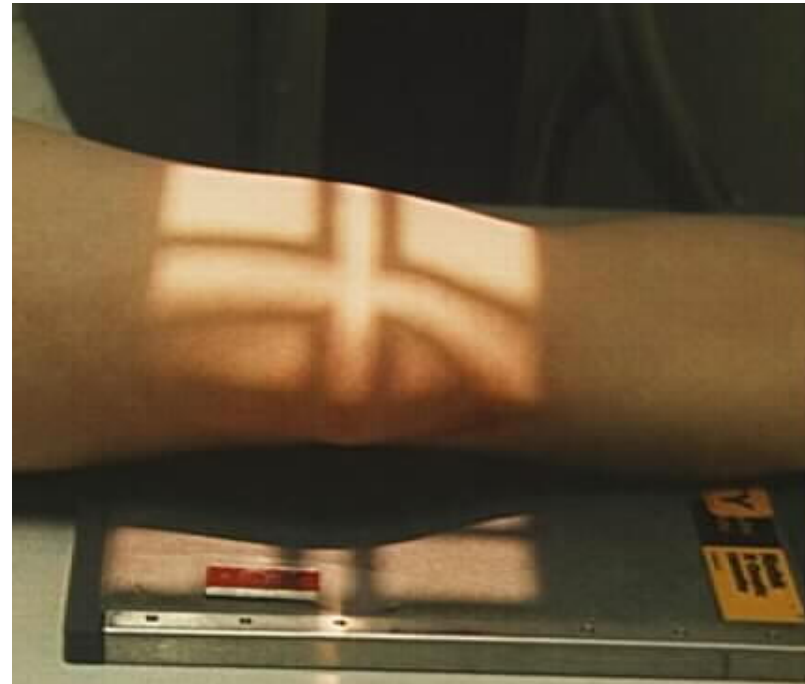
# Patella Lateral

- Patient lies on affected side with knee flexed 10 to 15°. Lower leg will be in a lateral position.
- Extremity cassette placed under affected knee.
- **Horizontal CR:** centered to patella.
- Film may be centered to Horizontal CR.



# Patella Lateral

- **Vertical CR:** through the femoral condyle and patella joint space.
- **Collimation top to bottom:** 5" or to include patella
- **Collimation side to side:** anterior femur and patella
- Note: the entire knee need not be visualized.





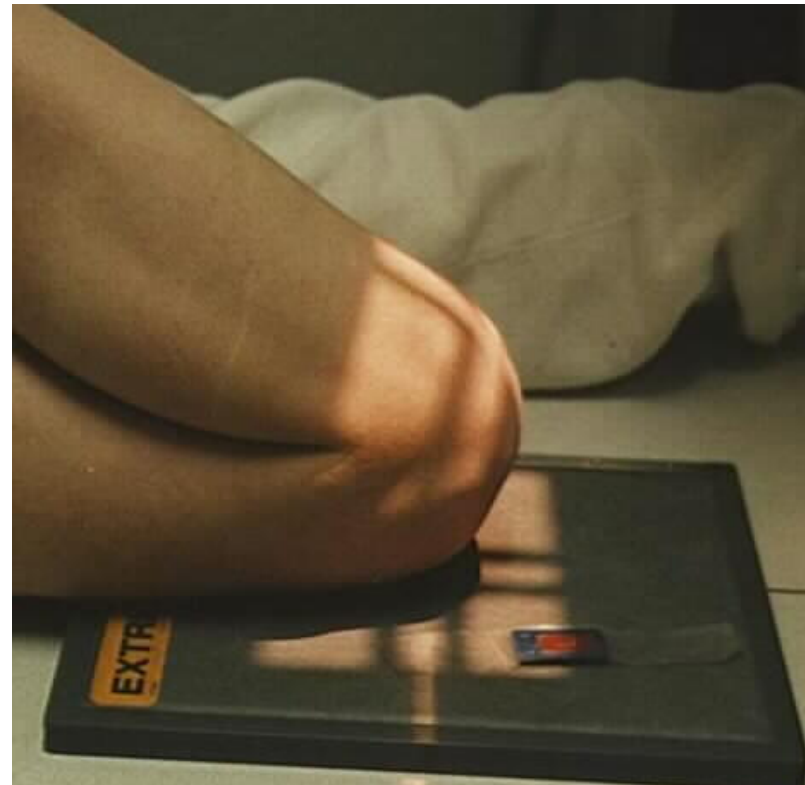
# Patella Lateral Film

- The patella and anterior knee should be in a true lateral position.
- The distal femur may appear under exposed.



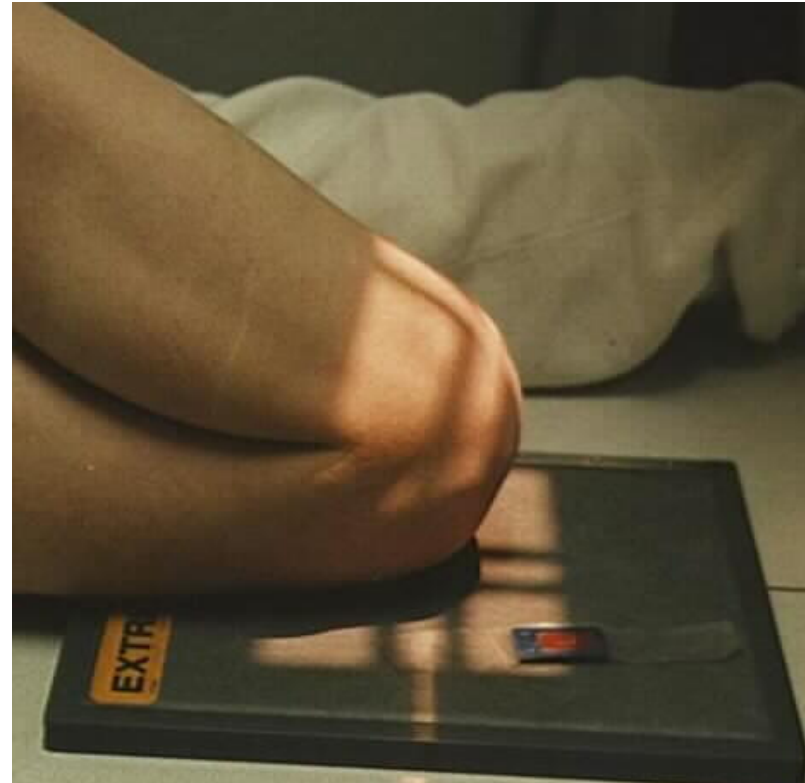
## 16.10 Settegest or Sunrise View

- **Measure:** A-P at patella
- **Protection:** Apron draped over patient
- **SID:** 40" Table Top
- **Tube Angle:** 20° cephalad
- **Film:** 8" x 10" Extremity or Detail Cassette



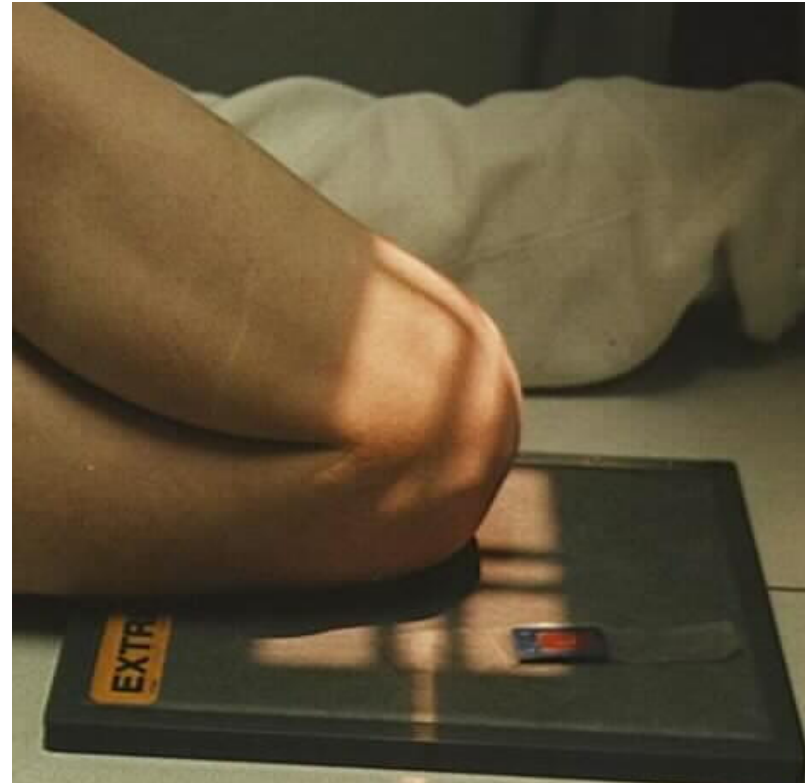
# Settegest or Sunrise View

- Patient lies prone on table.
- Patient bends knee about 110°.
- The belt used for the gonad shield or Velcro may be used to assist patient hold position. Wrapping belt around ankle and giving other end to patient to hold..



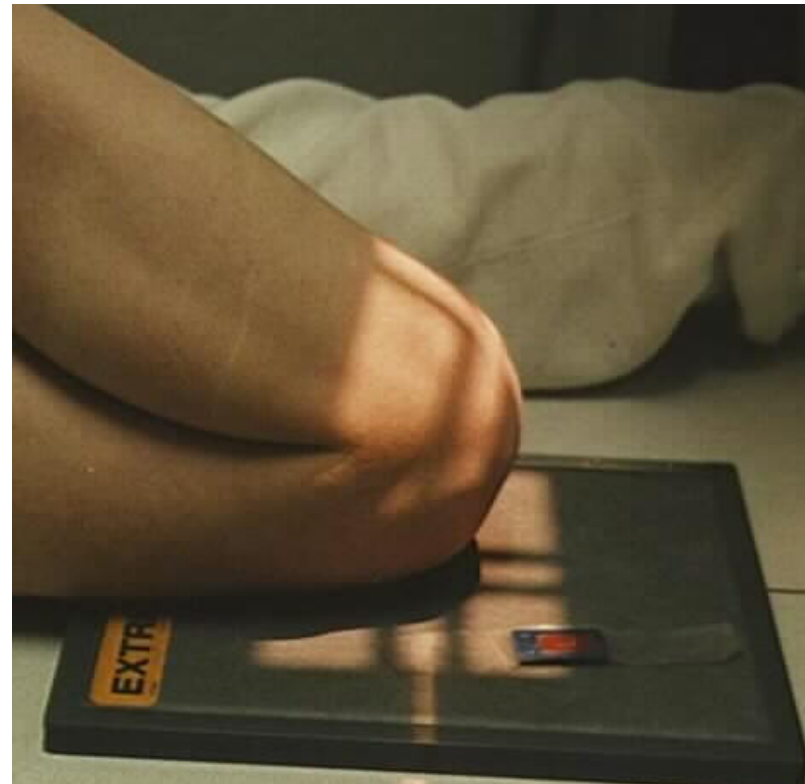
# Settegest or Sunrise View

- The leg should be in a true P-A position, internally rotated 15°.
- Place extremity cassette under leg.
- **Horizontal CR:** through the patella-femoral joint space.
- **Film centered to Horizontal CR.**



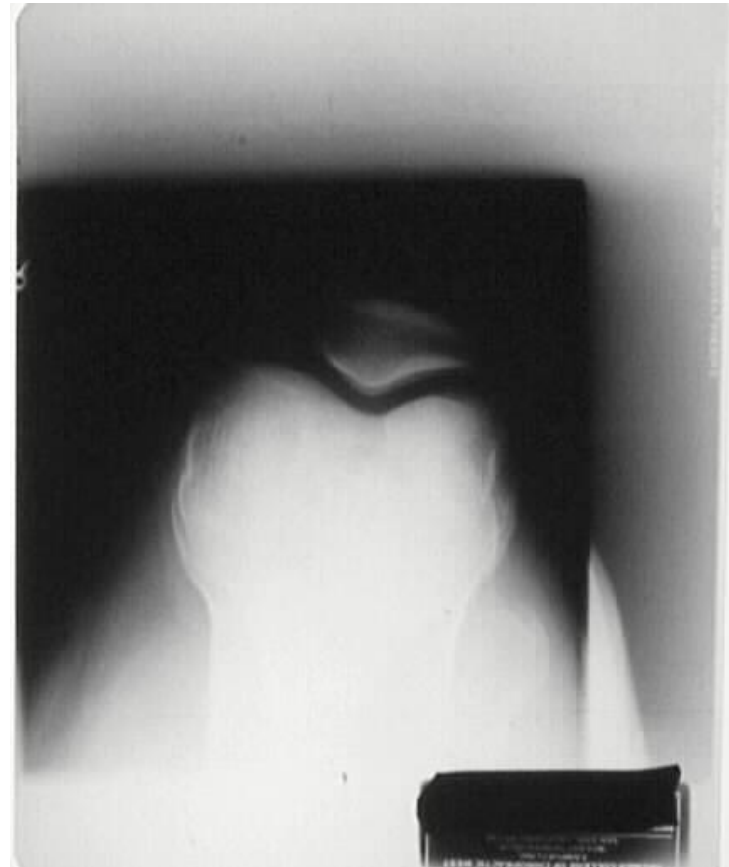
# Settegest or Sunrise View

- **Vertical CR:** long axis of femur or mid patella
- **Collimation:** 5" x 5"
- **Instructions:** Remain still
- **Make exposure and let patient relax**



# Settegest or Sunrise Film

- **The patella will be visualized. The patella-femoral joint space will be seen but the view can not be used to diagnose a tracking problem due to the extreme flexion.**
- **Lauren or Merchants Views are used to evaluate tracking.**



# 16.11 Lauren Views of Interpatellar Fossa

- **Measure:** A-P at mid patella
- **Protection:** None is practical
- **SID:** 60" non-Bucky
- **Tube Angle:** varies with amount of knee flexion
- 1. Knee flexed 30°: 30° cephalad tube angle





# Lauren Views of Interpatellar Fossa

- 2. Knee flexed 45°:  
45° cephalad tube angle
- **Film:** 17" x 7"  
Regular Speed with  
I.D. to unaffected side.
- Patient is seated on  
table with legs over  
side.





# Lauren Views of Interpatellar Fossa

- The thighs and lower legs are strapped together to prevent external rotation of femur.
- Patient flexes knee to form a 30° angle. The tube is angled 30° cephalad.
- **Horizontal CR:** through the patella-femoral joint space.



# Lauren Views of Interpatellar Fossa

- **Vertical CR:** mid-sagittal plane of patient.
- Patient holds film perpendicular to central ray.
- **Collimation:** slightly less than film size or to soft tissue around patella.
- **Instructions:** Remain still



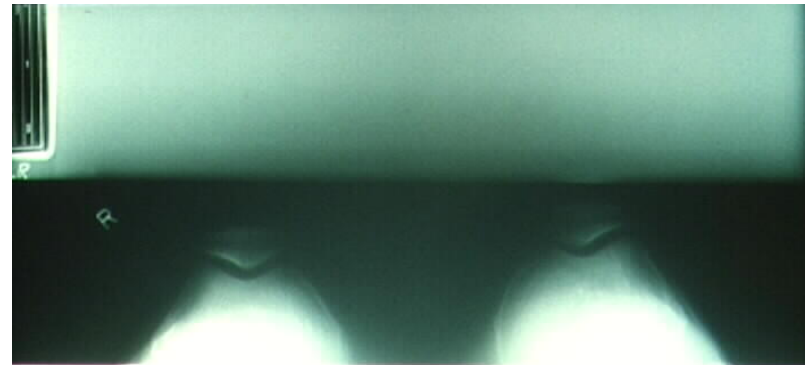
# Lauren Views of Interpatellar Fossa

- Get new film and proceed with the 45° flexion view and if needed the 60° flexion views.
- The tube angle is set so the central ray is parallel with the long axis of the patella at the varied degrees of flexion.



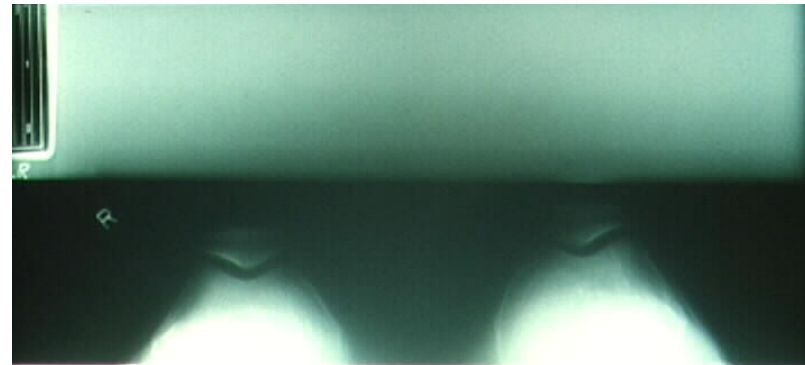
# Lauren Views of Interpatellar Fossa Film

- Both patella-femoral joint spaces must be seen on all views.
- Legs must be strapped together to diagnose, a low lateral condyle.



# Lauren Views of Interpatellar Fossa Film

- Flexion more than 60° will reduce an otherwise subluxed patella and distort the depth of the sulcus.
- The Settegest View is of little value in evaluation of the extensor mechanics of the knee or anterior knee pain.



# 22.1 Radiographic Quality Control

## Variables in Radiographic Equipment

- kVp Calibration
  - Impacts technique
- mA Calibration
  - Impacts technique
- Timer accuracy
  - Impacts Technique
- Collimator accuracy
  - Impacts Collimation
- Beam Alignment
  - Impacts Grid Cut off
- Grid Centering
  - Impacts Grid Cut Off
- Focal Spot
  - Impacts Resolution

# Radiographic Quality Assurance

- Begins with the Acceptance Tests to set baseline values and assure proper operation.
- Periodic monitoring to assure continued compliance. Annual or Semiannual
- After major component repair or replacement

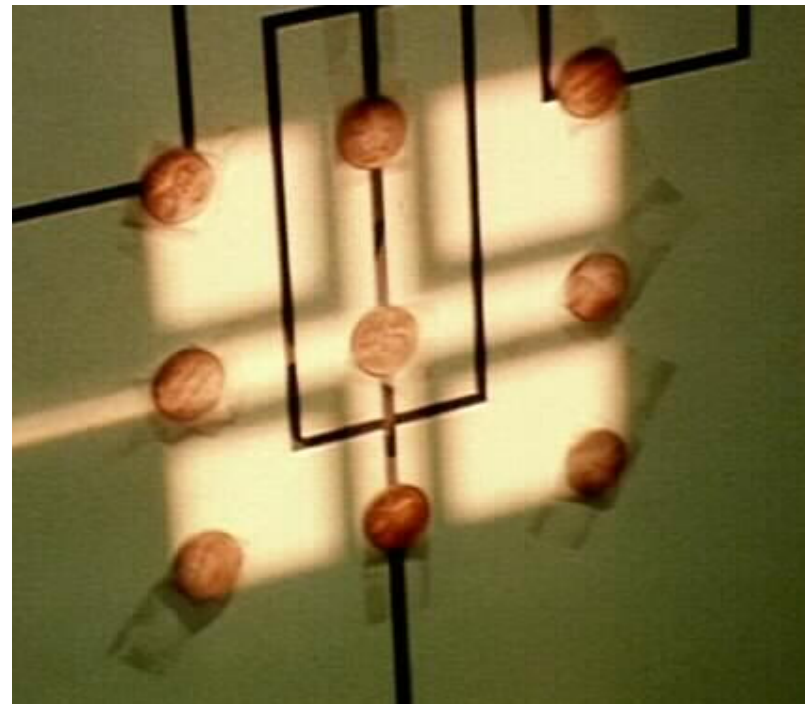
# Radiographic Performance Standards

- kVp Accuracy
  - $\pm 5\%$ ;  $\pm 2$  between 60 and 100 kVp
- mA, Timer, mAs
  - $\pm 5\%$
- Collimator
  - $\pm 2\%$  of SID
- Beam Alignment
  - $\pm 2^\circ$
- Grid Centering
  - $\pm 2^\circ$
- Exposure Reproducibility
  - $\pm 5\%$



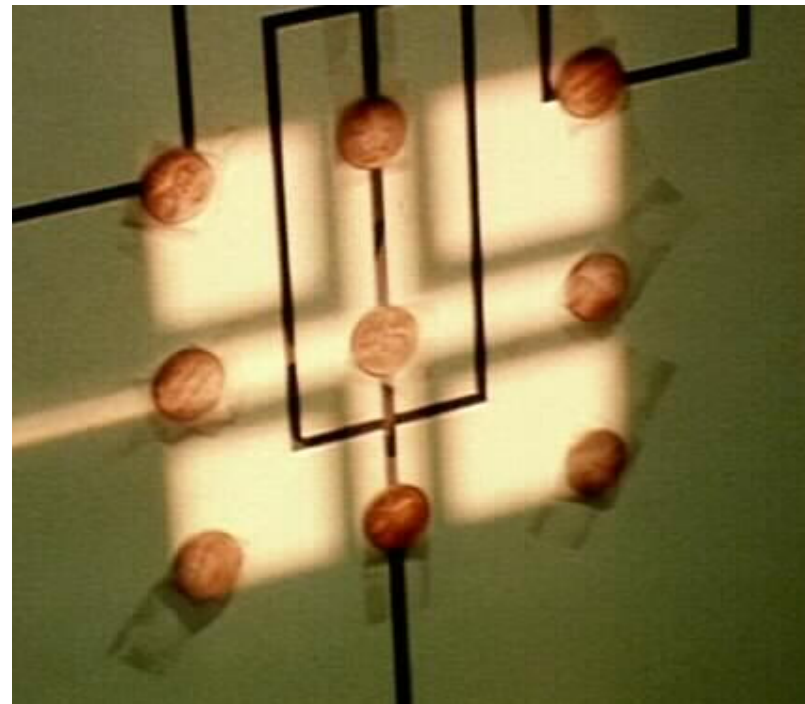
## 22.2 Collimator Accuracy and Beam Alignment

- **Tools needed:**
  - 9 pennies or
  - Collimator alignment tool
  - Beam perpendicularity test tool
- **Standard:** Must be within 2% of SID or 0.8" at 40" SID



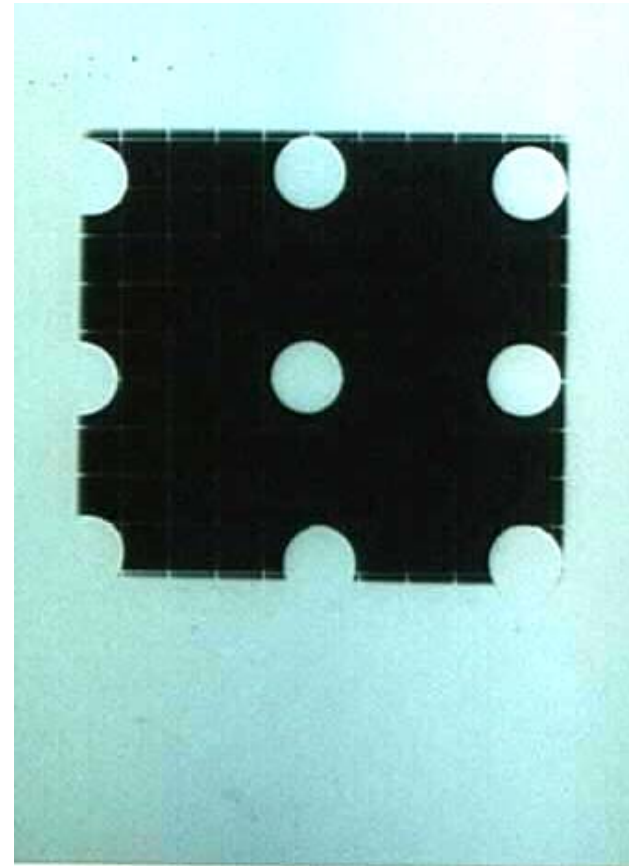
# Collimator Accuracy and Beam Alignment

- **Procedure:**
- Set SID @ 40" to Bucky
- Place 8"X10 Cassette in Bucky
- Center beam to film center
- Collimate to 5" square
- Mark borders with pennies taped to Bucky
- Make exposure and process film.



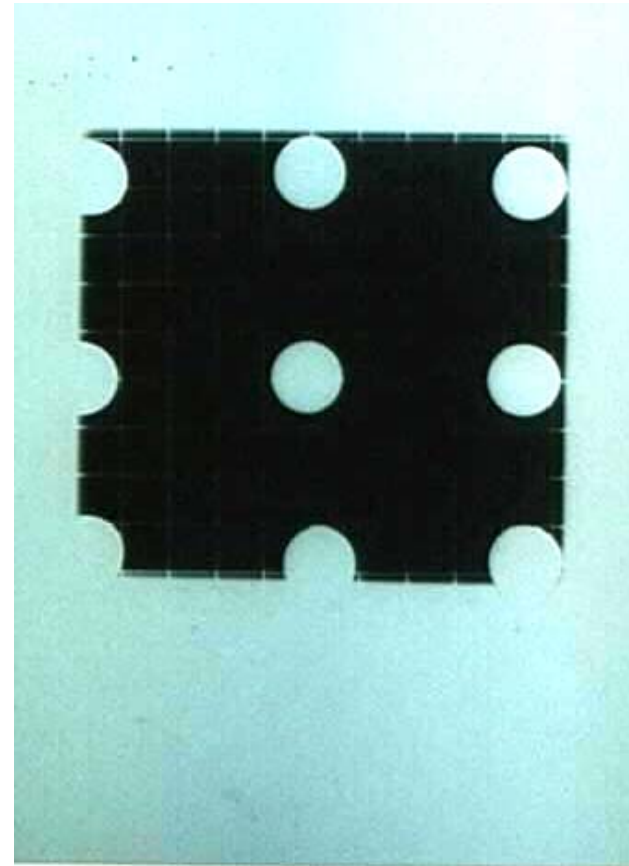
# Collimator Accuracy and Beam Alignment

- **Procedure:**
- mark center and horizontal and vertical axis of beam
- The exposure should be to the outer edges of the pennies.
- Must be within the diameter of the pennies to pass the test.



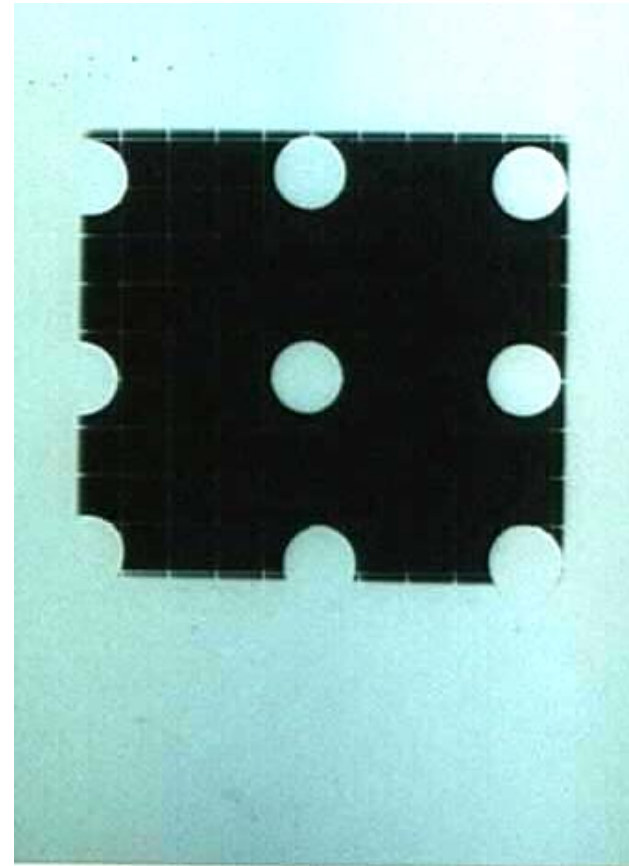
# Collimator Accuracy and Beam Alignment

- **Procedure:**
- mark center and horizontal and vertical axis of beam
- The exposure should be to the outer edges of the pennies.
- Must be within the diameter of the pennies to pass the test.



# Collimator Accuracy and Beam Alignment

- **Frequency:** semiannual or after replacement of collimator light bulb or tube replacement.
- You should hold the x-ray machine supplier to a much higher standard.
- **The beam and light fields should match!**



# Collimator Accuracy and Beam Alignment

- **Procedure with beam alignment test tool:**
- Set SID to 40'' to Bucky
- Center 8'' x 10'' film to Beam
- Tape collimator test tool to Bucky centered to light field.
- Collimate to marked borders on tool (5'' x 7'')



# Collimator Accuracy and Beam Alignment

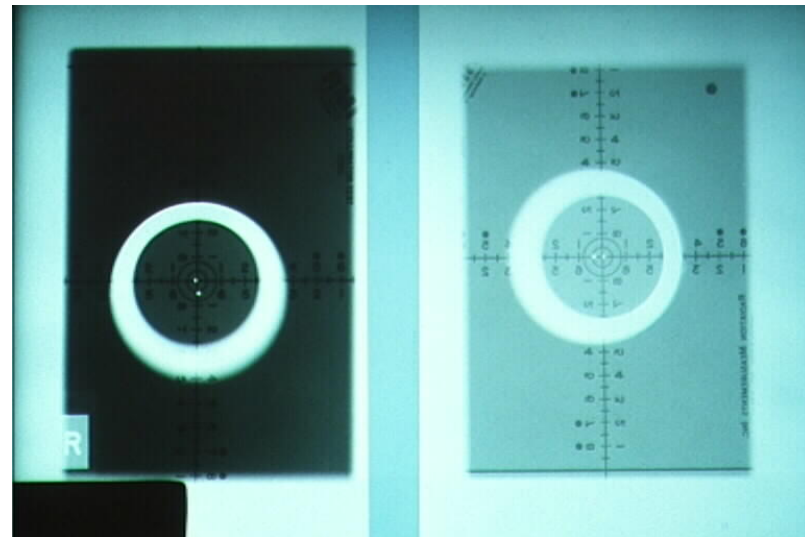
- **Procedure with beam alignment test tool:**
- Tape the beam perpendicularity test tool to the collimation tool with the metal ball centered to center of tool.
- Make exposure and process the film





# Collimator Accuracy and Beam Alignment

- Viewing of test film
- The both small balls must be within the first circle to be in proper alignment.
- Collimation should match borders of test tool.
- **Frequency : semiannual or after tube or Bucky replacement or repair**





## 22.3 Grid Cut Off and Perpendicularity Testing

- If the tube is not perpendicular to the Bucky, Grid Cut-Off will result.
- If the grid focus is not correct, grid cut off will also result.
- The left knee is under exposed compared to the right. This is grid cut off.



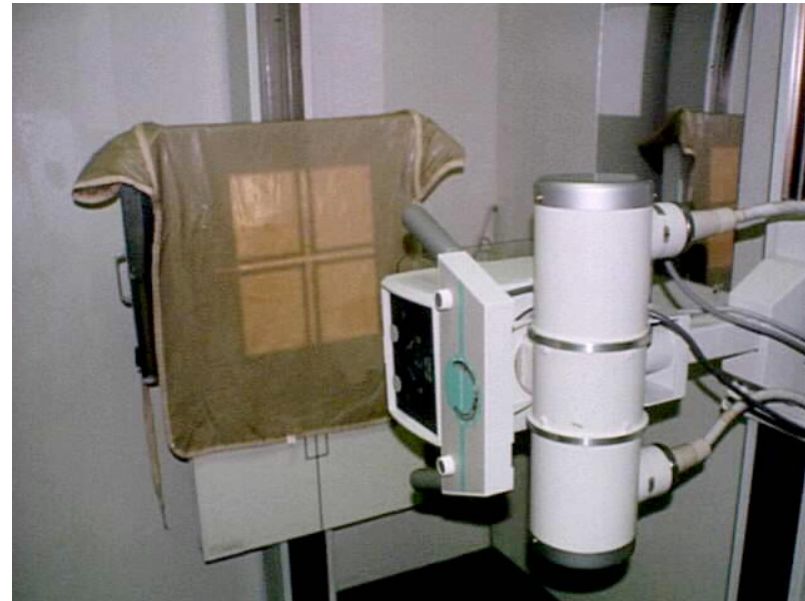
# Grid Cut Off and Perpendicularity Testing

- Tools Needed:
  - A homogenous phantom that will produce some density on the film. This can be : A lead apron or piece of Lucite 14"x17"x2"
  - Densitometer
  - 14" x 17" Cassette



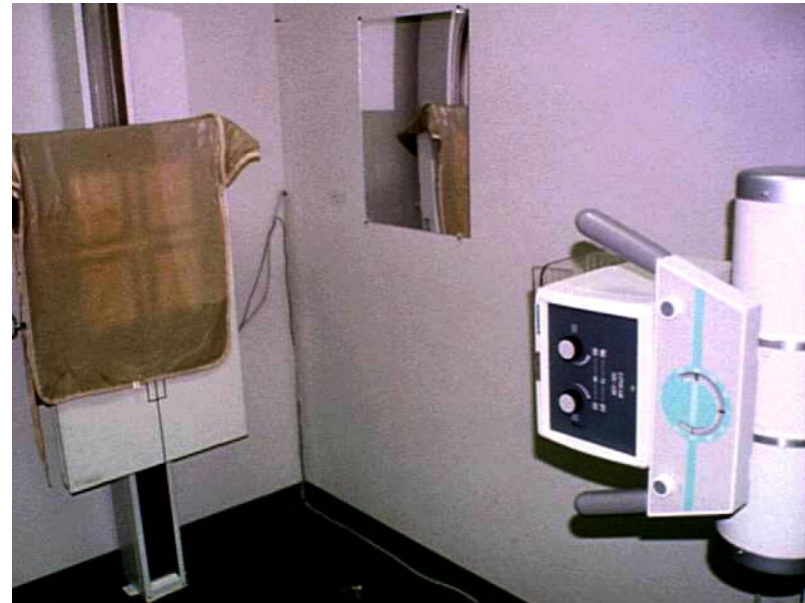
# Grid Cut Off and Perpendicularity Testing

- Procedure:
- Set the SID at 40" Bucky
- Drape Apron over Bucky or
- Place Lucite in stool in front of Bucky
- Place cassette in Bucky Tray and center tube to film.



# Grid Cut Off and Perpendicularity Testing

- Procedure:
- Collimate to film size and make exposure.
- Process film
- Repeat test at 72" SID.
- Process Film



# Grid Cut Off and Perpendicularity Testing

- Standard: There should be not more than  $\pm 0.10$  OD change from center of image to sides of image.
- If 40" or 72" test passes and the other fails, the focal range of the grid may be wrong.
- If both fail, the grid is misaligned.



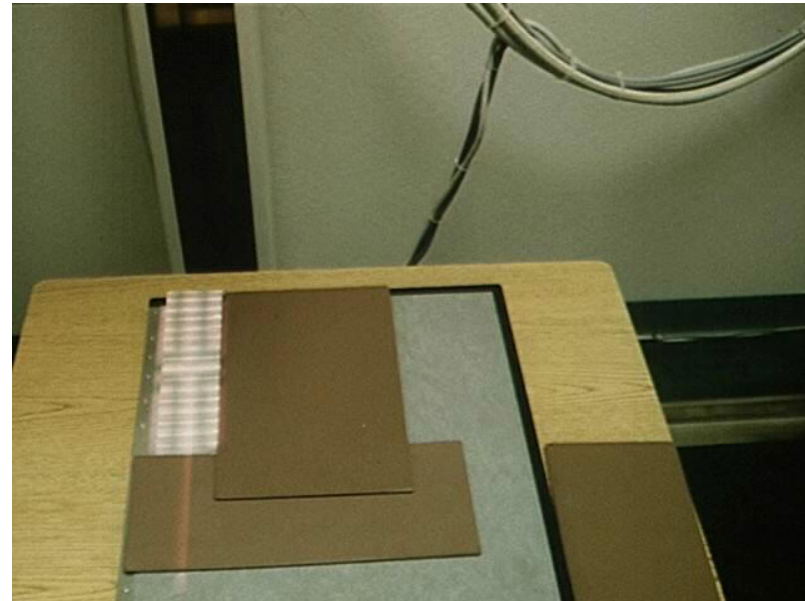
# Grid Cut Off and Perpendicularity Testing

- Grid misalignment can be common with new installations.
- If the Bucky crashes to the floor, the grid can be knocked out of alignment.
- **Frequency of test:**  
Semiannual



## 22.4 Linearity Of Exposure

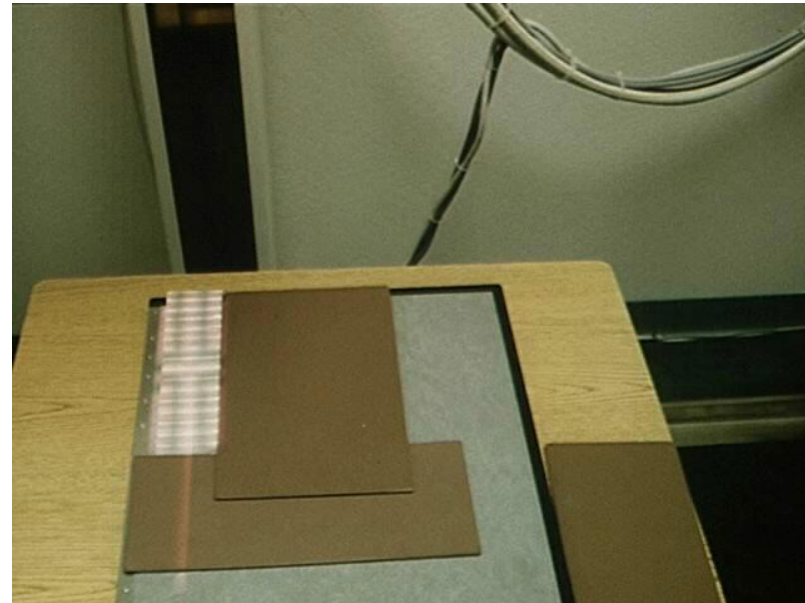
- “*The same mAs should produce the same exposure each time.*”
- This will be true if the mA and Timer are accurately calibrated.
- The kVp must be the same.





# Linearity Of Exposure

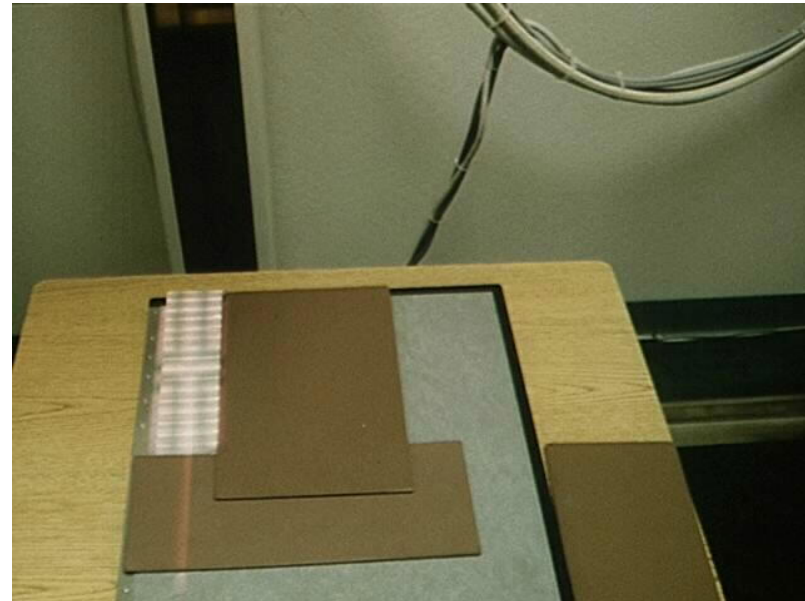
- **Tools needed:**
  - Aluminum Step wedge
  - Lead Blockers
  - 14" x17" Cassette
  - Densitometer
- **Standard:** Exposure should be within  $\pm 5\%$  across the mA, Time and mAs settings





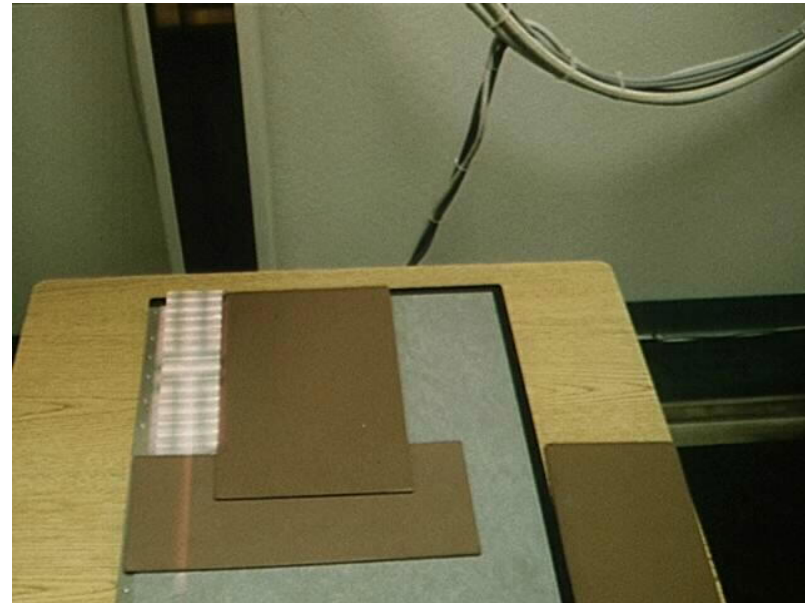
## 22.4 Linearity Of Exposure

- Procedure:
- Set SID to 40" table top
- Place cassette on table
- Step wedge is placed on cassette.
- Collimation set to size of step wedge.
- Lead blockers cover the area around exposure.



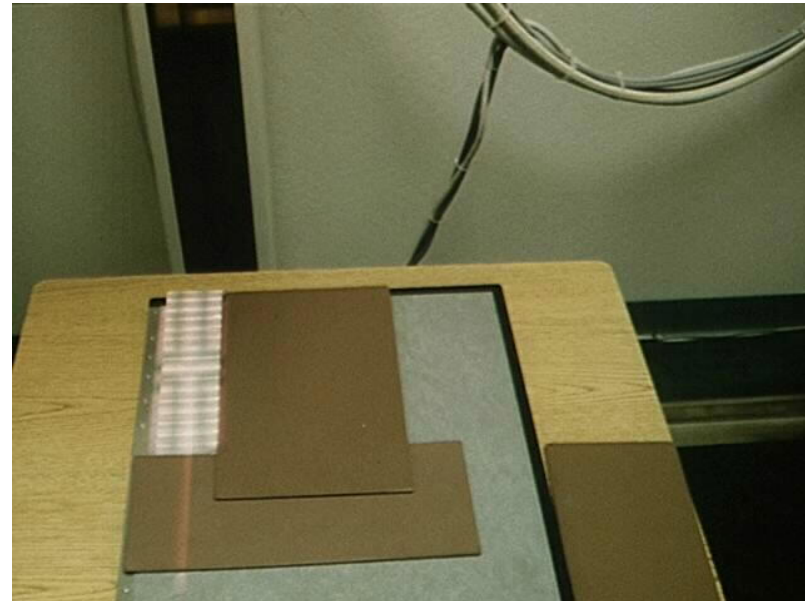
# Linearity Of Exposure

- Procedure:
- Set a baseline technique and initiate first exposure
- Cover exposed section of film and prepare for second exposure.
- Change control setting and the put back to original setting.
- Make exposure.



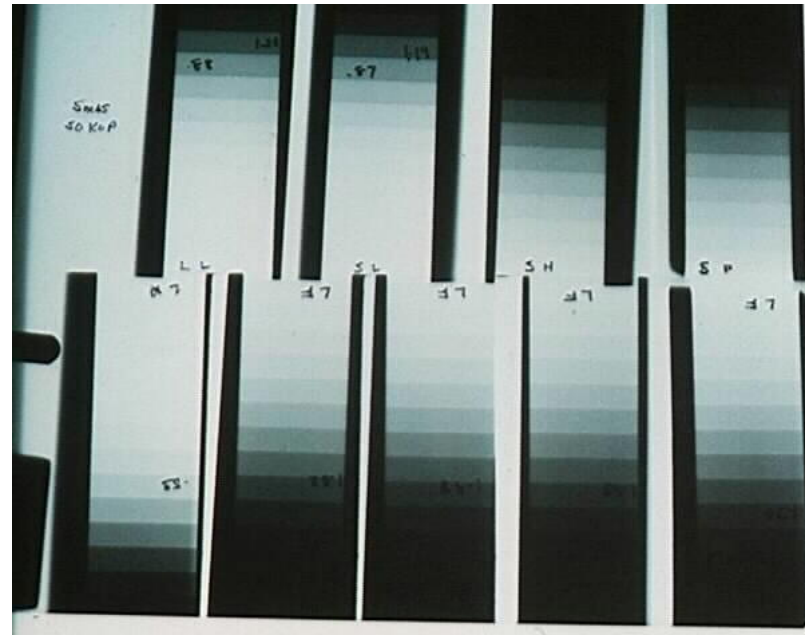
# Linearity Of Exposure

- Procedure:
- Continue process with changes in power level or mA setting, Focal Spot settings and time settings.
- Make sure that the exposed areas of the cassette are covered by the lead blockers.
- Process the film.



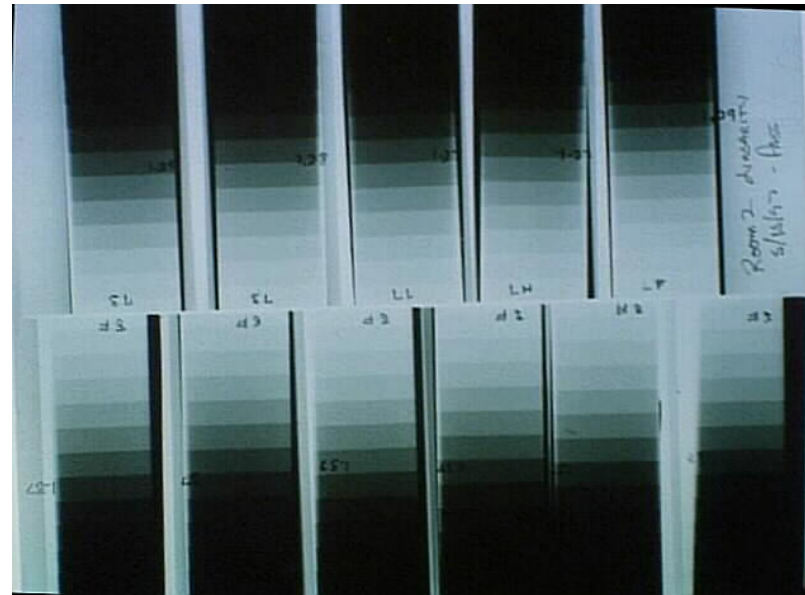
# Linearity Of Exposure

- This is an example of poor calibration of the x-ray generator.
- The small and large focal spot mA setting are not calibrated.
- This was a new unit that the service engineer failed to calibrate.



# Linearity Of Exposure

- This is an example of proper calibration of the machine.
- Each exposure is virtually identical. If you need to adjust a technique on this machine, you can do it reliably.



## 22.5 Focal Spot Testing

- **Test Tools:**
  - RMI Focal Spot Test Tool or
  - Pin Hole Camera or
  - NEMA Star Pattern Test Tool
  - Extremity Cassette
  - Lead Blocker



# Focal Spot Testing

- **Procedure:**
- Place Extremity Cassette or Card Board Film Holder on Table.
- Cover half of cassette with Lead Blocker
- Set SID to 40" Table Top
- Place test tool on cassette with rivets aligned with the anode and cathode.



# Focal Spot Testing

- **Procedure:**
- Collimate to size of test tool.
- Set technique and make exposure on small focal spot.
- Cover exposed section of cassette.
- Set tool on unexposed section of cassette.





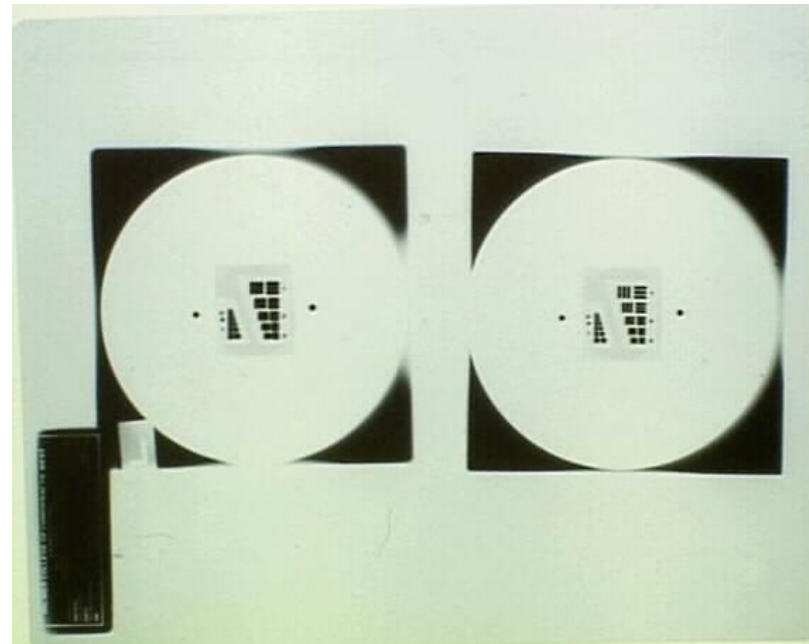
# Focal Spot Testing

- **Procedure:**
- Place “L” on film and make exposure with large focal spot.
- Process the film.

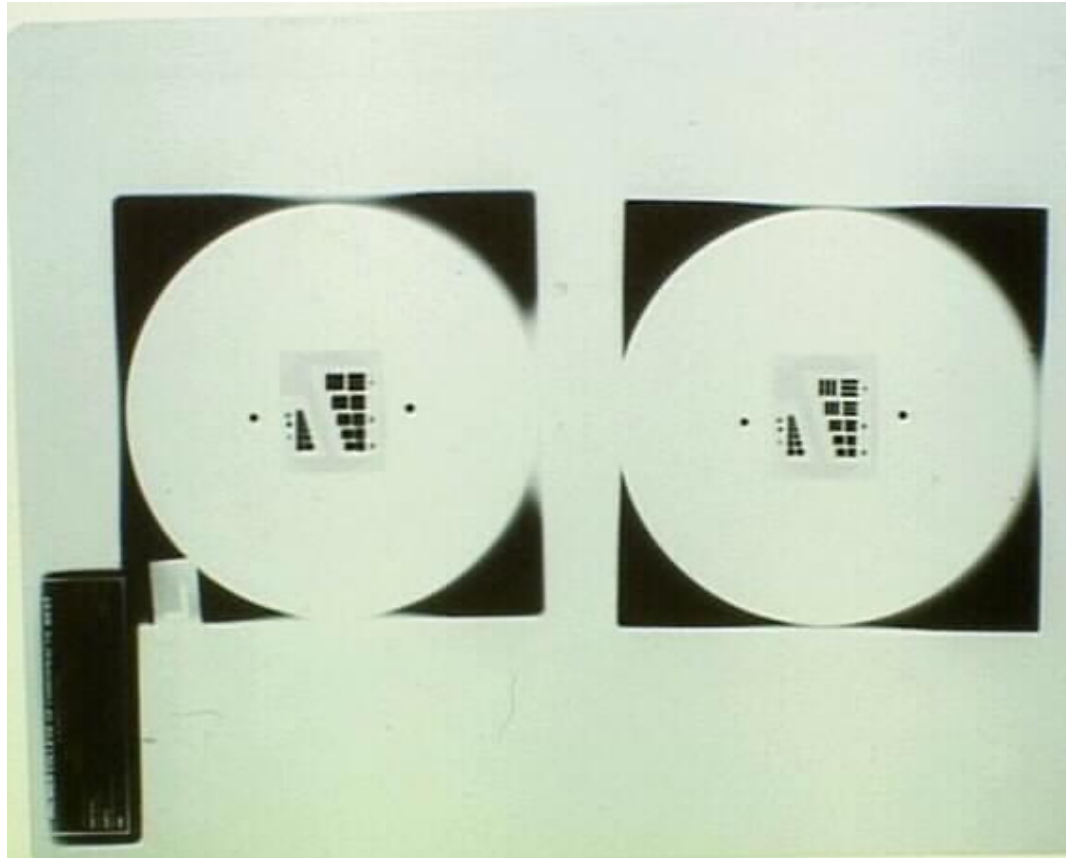


# Focal Spot Testing

- Interpretation of film:
- Compare vertical and horizontal three bars.
- 1.0mm Focal spot will resolve 11 line pairs/mm.
- 2.0mm focal spot will resolve 5 to 6 line pairs/mm.
- If you cannot see this far, the tube may be bad.

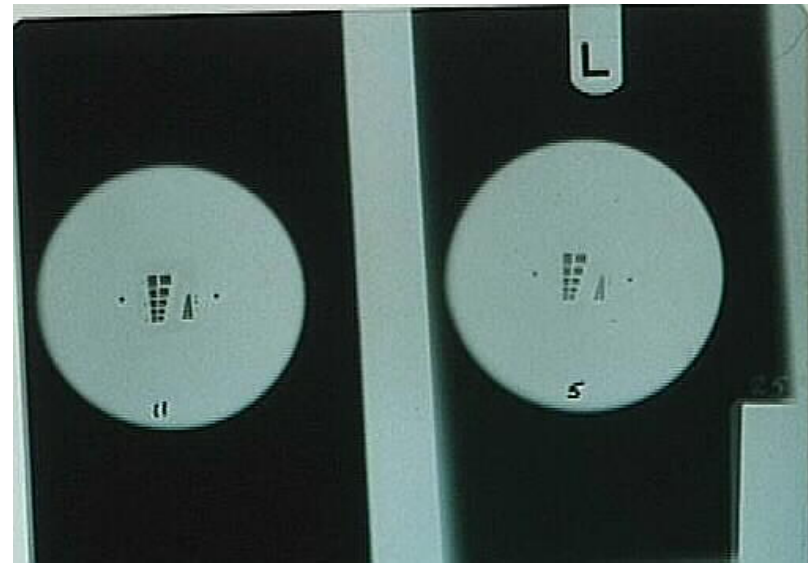


# Focal Spot Test Film Passed



# Focal Spot Testing

- While the focal spot passes the test, the exposure is different between the large and small focal spots.
- This was the first clue that the calibration of the machine was wrong.



# Focal Spot Test Film

- Both exposures are at the same mAs and kVp
- Resolution: Passed
- Exposure: Fail

