Mammography

Positioning

MRT Program

Routine Projections

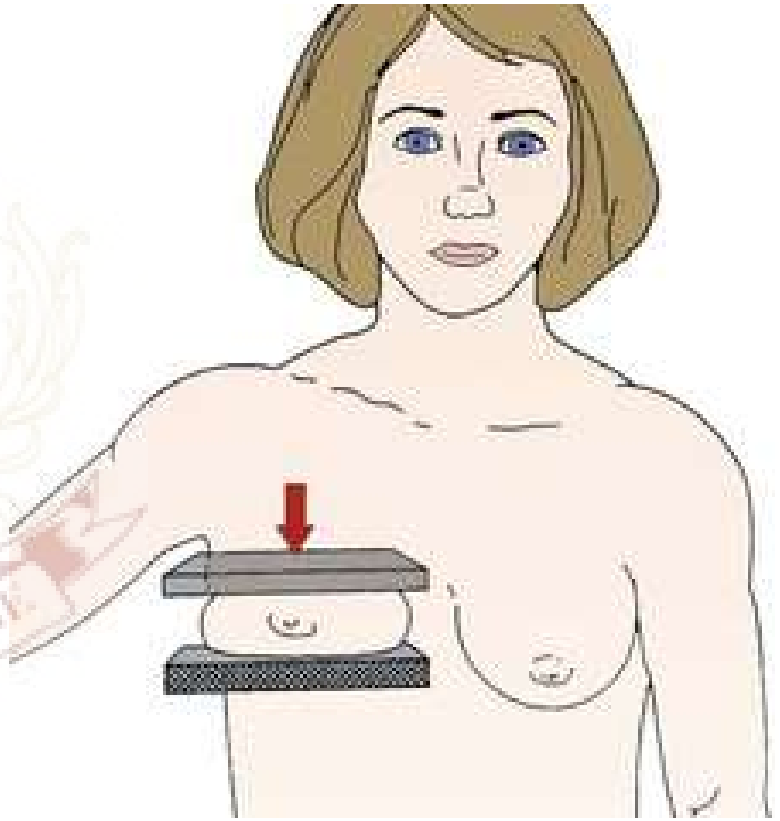
- Routine screening exams include the Craniocaudal (CC) and Mediolateral Oblique Projections (MLO)
- These two views best visualize greatest amount of breast tissue
- Diagnostic exams are performed for specific areas of concern additional views may be indicated as desired by the radiologist

Craniocaudal Projection Clinical Indications

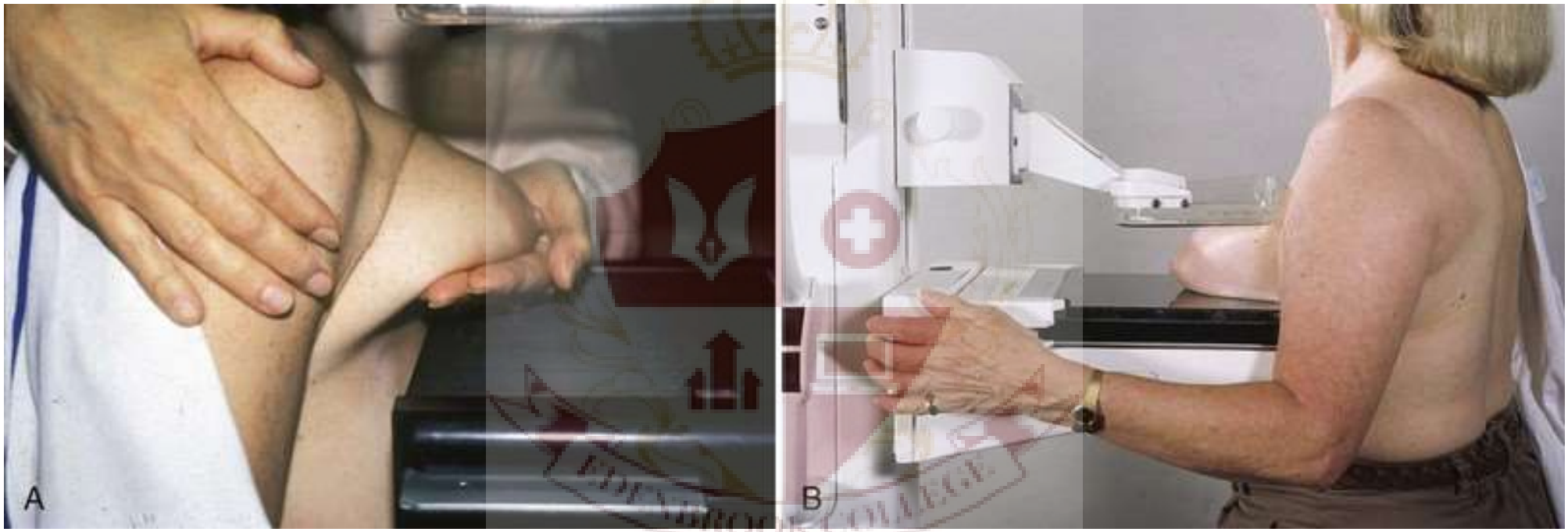
- Detection or evaluation of calcifications, cysts, cancer, or other abnormalities or changes in breast tissue
- SID-fixed varies with manufacturer, about 60 cm
- Grid is used
- kV ranges: 25-35 kV
- Shielding waist apron
- IR height is determined by lifting the breast 90 degrees to chest wall at level of IMF
- Position from medial side to ensure breast tissue is parallel to IR

Craniocaudal (CC) Projection

- IR tray to height of inframammary crease level
- Nipple in profile
- Wrinkles and folds smoothed out
- Compression applied
- Markers on axillary side
- CR perpendicular to the base of the breast

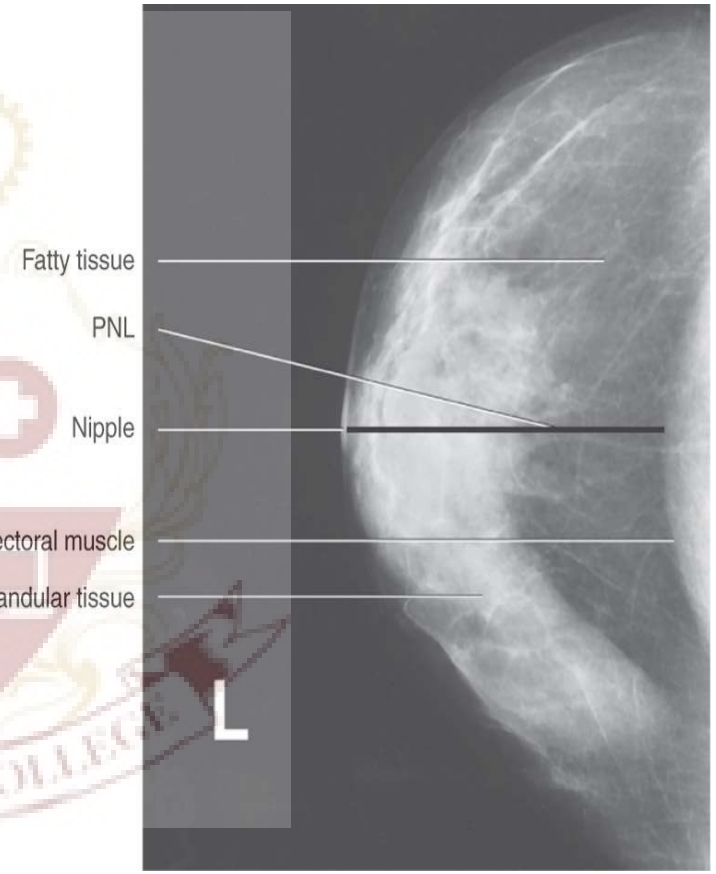


CC Positioning

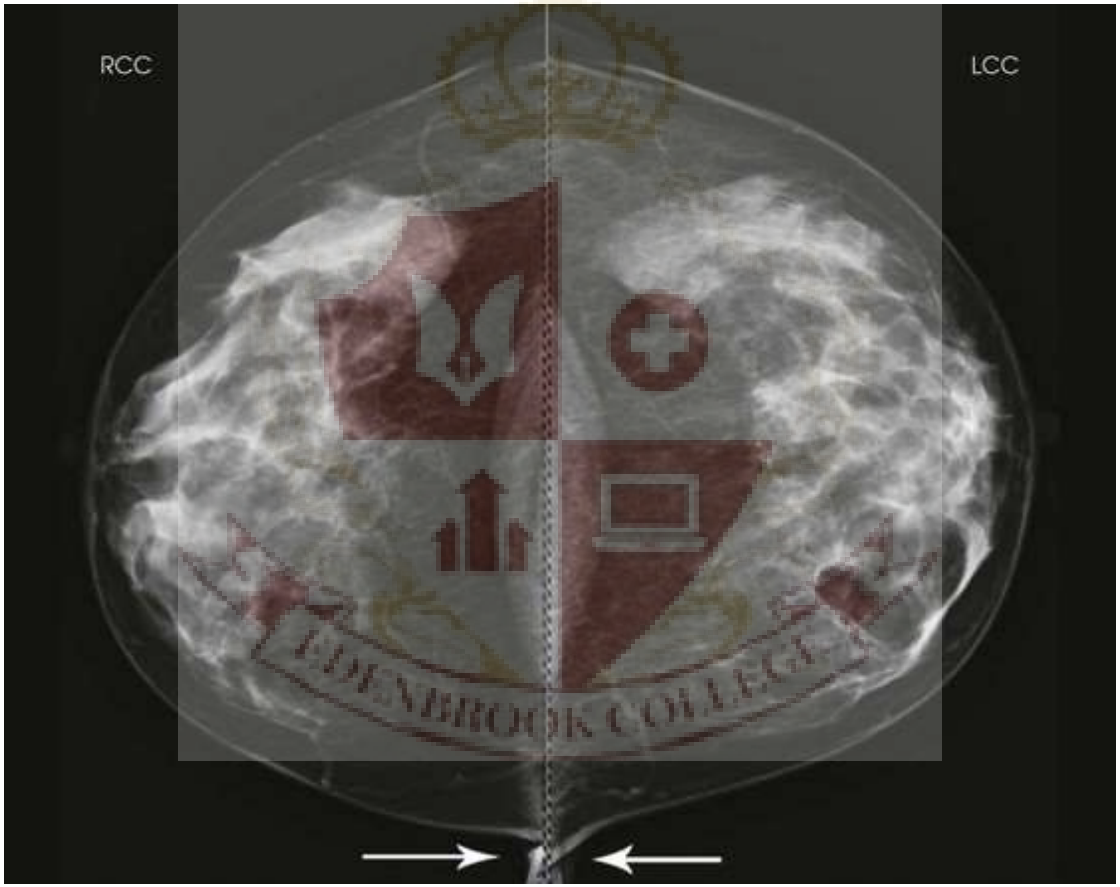


CC Image Criteria

- No motion
- Nipple in profile
- All pertinent anatomy demonstrated
- Tissue thickness distributed evenly
- Dense areas penetrated
- High contrast and optimal resolution
- Absence of artifacts
- Marker and patient ID visible



CC Image

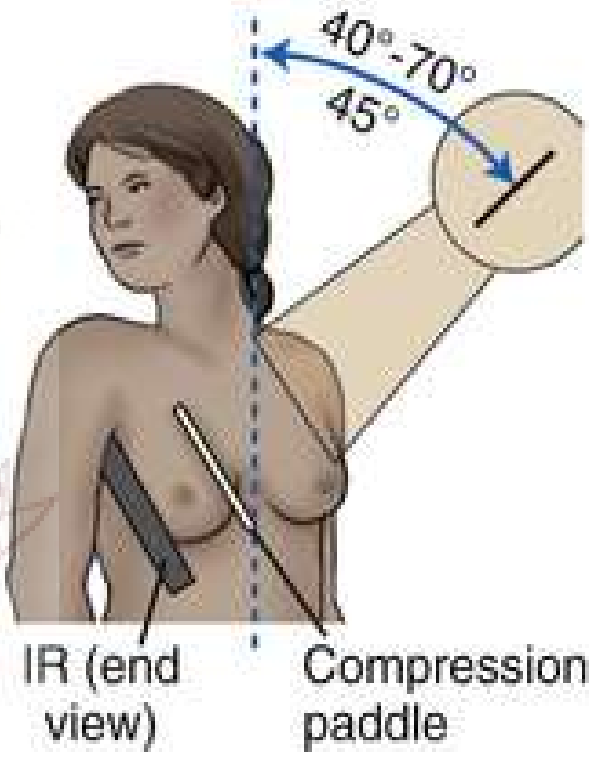


MLO Projection Clinical Indications

- Detection or evaluation of calcifications, cysts, cancer, or other abnormalities or changes in the deep lateral aspect of breast tissue
- SID-fixed varies with manufacturer, about 60 cm
- Grid is used
- kV ranges: 25-35 kV
- Shielding waist apron

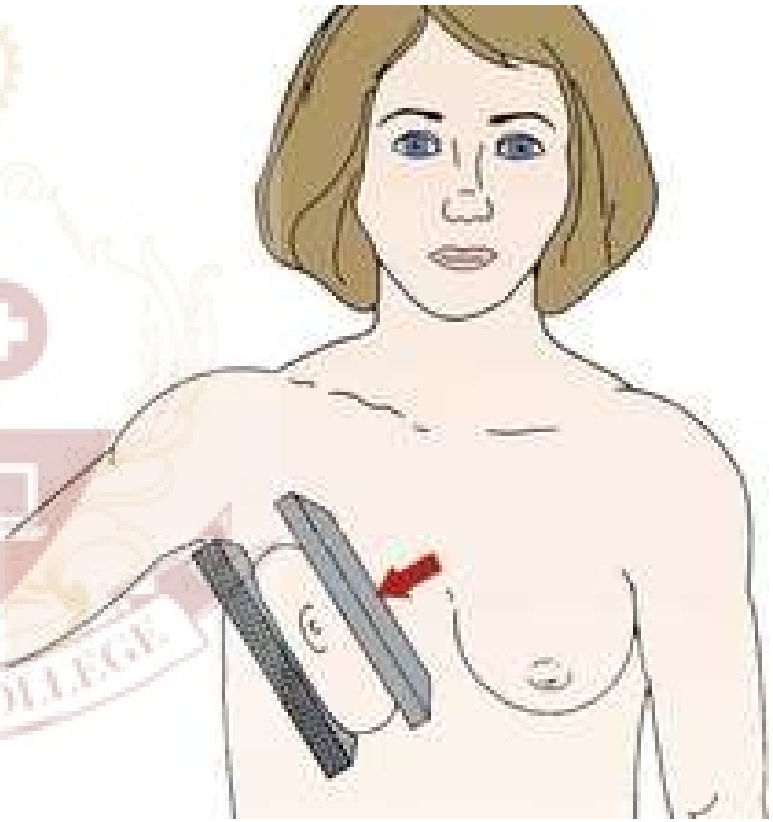
Tube and IR angles

- Patient stand feet pointed forward
- Tube and IR remain at 90 degrees to each other
- CR enters breast medially perpendicular to pectoralis muscle
- Angle determined by technologist but generally 45 degrees



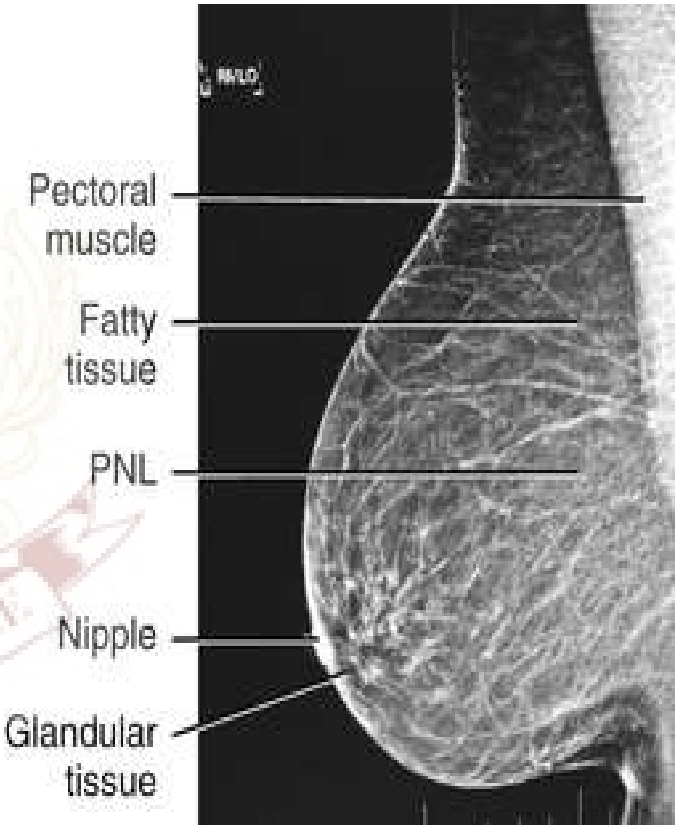
Mediolateral Oblique (MLO) Positioning

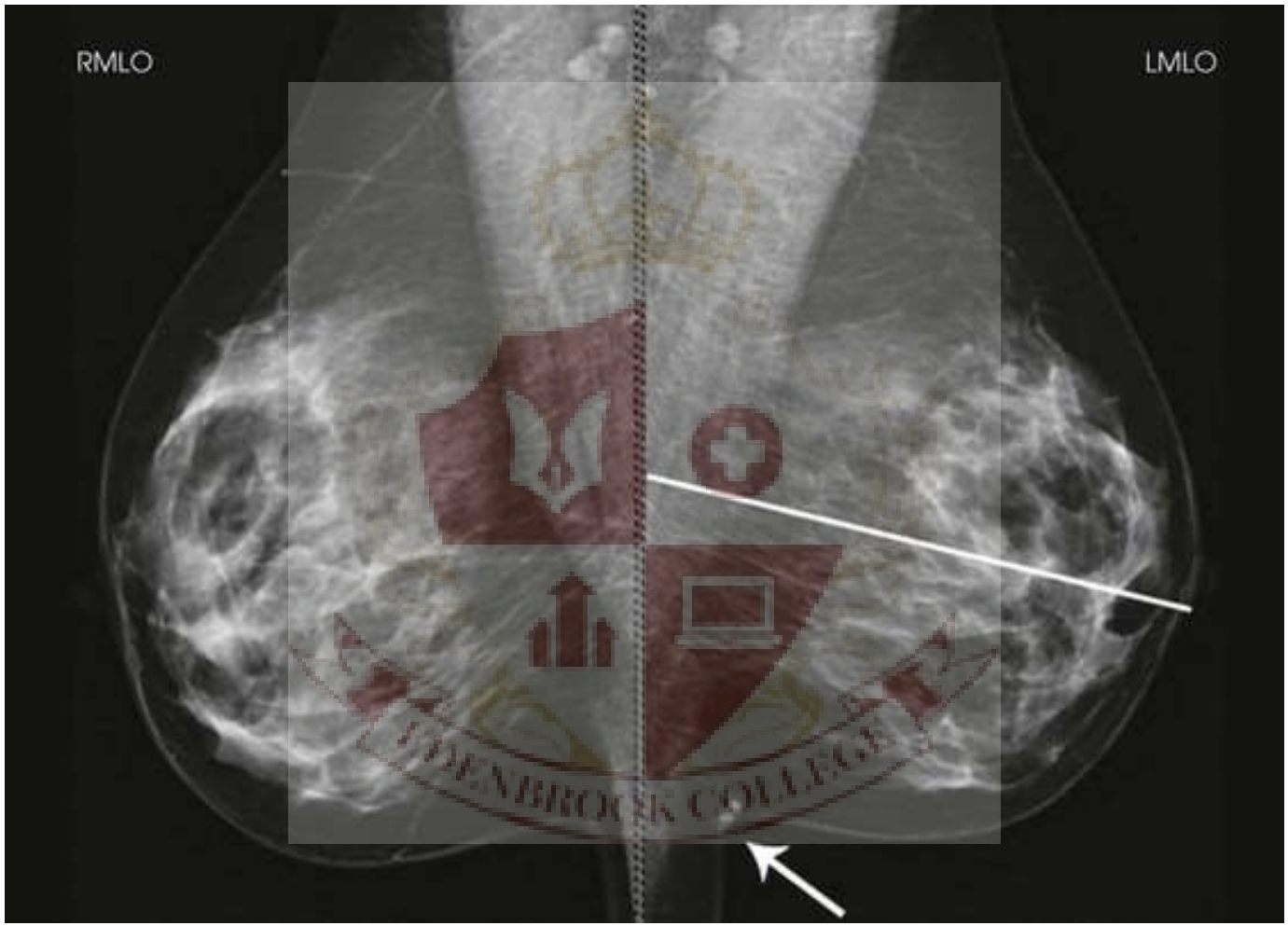
- CR and IR angled ~45°
- Top of IR at axilla
- Compression applied
- Nipple in profile
- Marker at axilla



MLO Image Evaluation Criteria

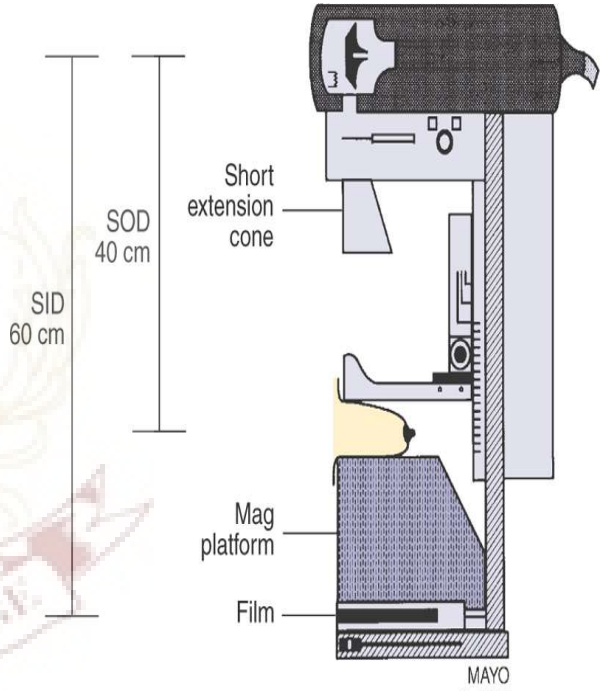
- No motion
- Pectoral muscle to level of nipple visualized
- Breast pulled away from chest wall
- Nipple in profile
- Dense areas penetrated
- High contrast and optimal resolution
- Absence of artifacts
- Marker and patient ID visible




RMLO
LMLO

Magnification Technique (M)

- Used to enlarge specific areas of interest using increase OID
- 0.1-mm focal spot
- 1.5 to 2 times enlargement
- Visualize better or rule out potential breast pathologies



$$\text{Magnification} = \frac{\text{SID (60 cm)}}{\text{SOD (40 cm)}} = 1.5\times$$

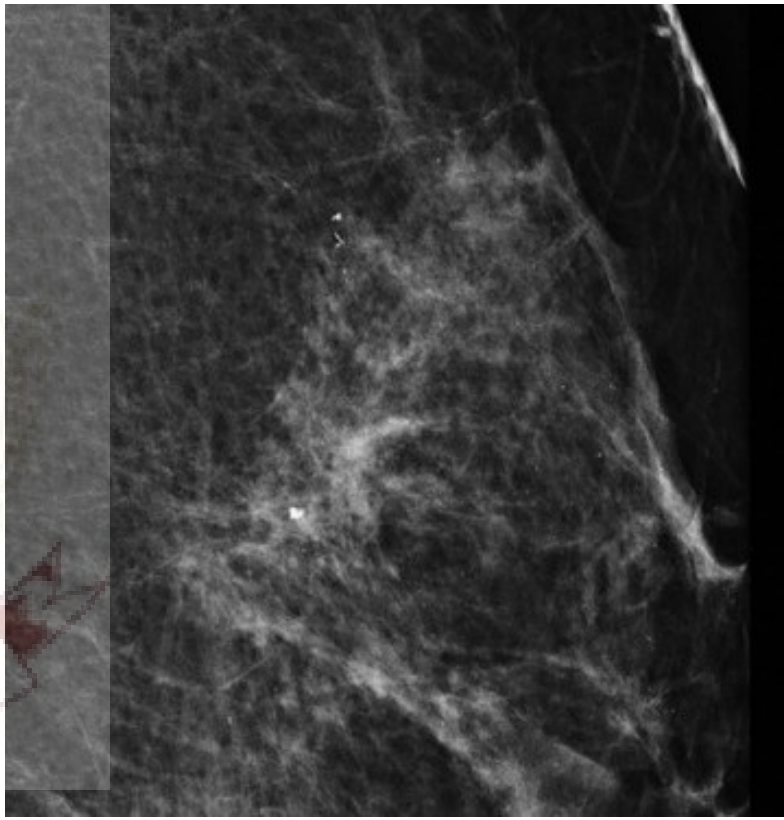
Magnification Technique (M)

- Patient standing or seated
- Attach firm radiolucent mag platform
- Position breast on it between compression device and non grid
- Select smallest focal spot 0.1 mm preferred
- Select appropriate FSS
- Collimate to size of paddle
- Position to show area of interest
- Full compression move AEC
- Suspend respiration



Magnification View- MLO Projection

- Magnifies the compressed area of interest with improved detail to determine characteristics of micro calcifications and margins of suspected lesions



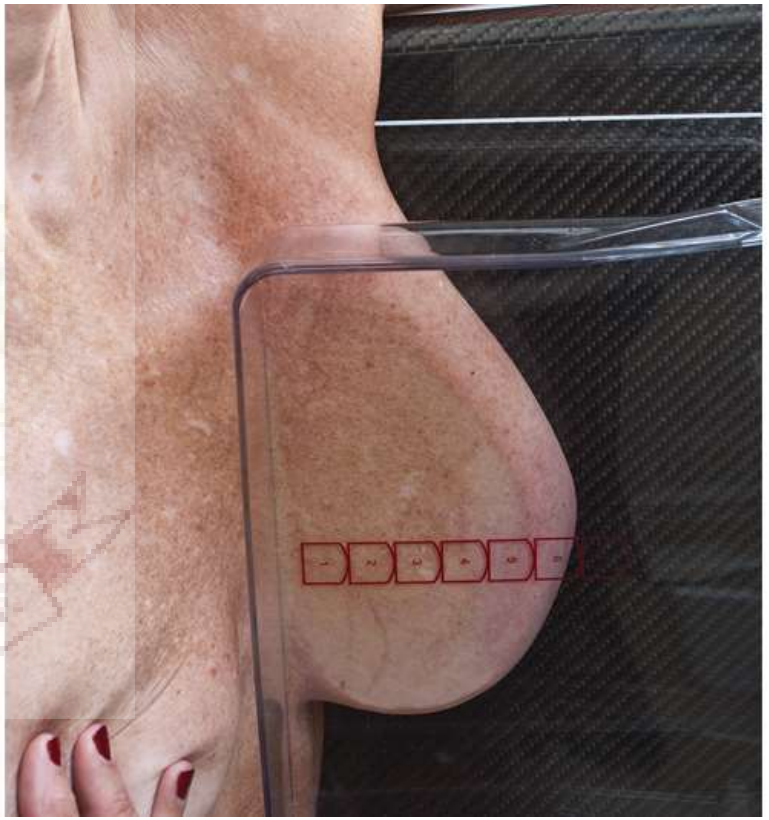
Diagnostic Views

- Routine
  - Craniocaudal (CC)
  - Mediolateral oblique (MLO)

- Special (Diagnostic exam)
  - Mediolateral (ML)
  - Exaggerated craniocaudal (lateral)—XCCL
  - Implant displaced, Eklund technique (ID-CC)

Mediolateral (ML) Projection

- CR and IR 90° from vertical
- True lateral
- Compression applied
- Nipple in profile
- Marker at axilla

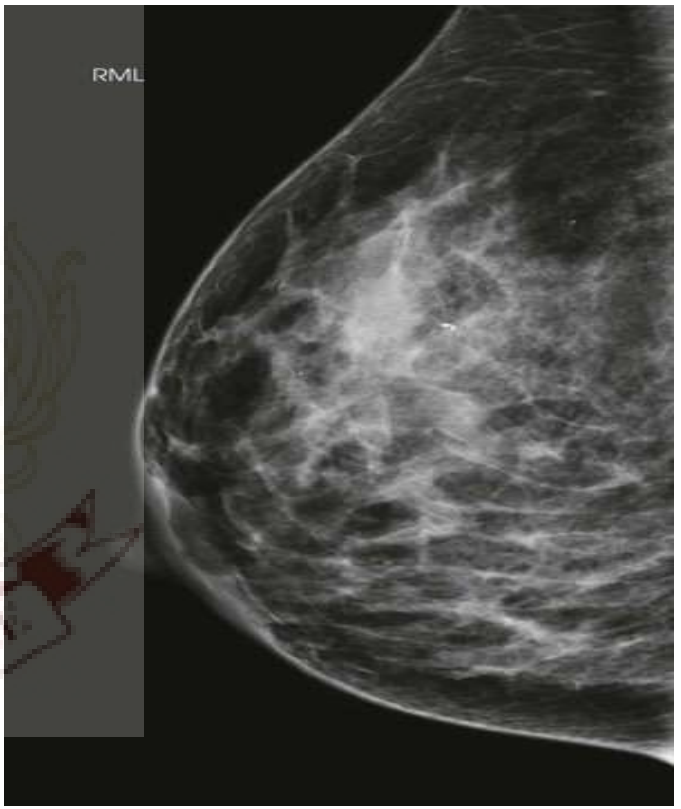


ML Structures Shown

- Shows lesions on the lateral aspect pf the breast in superior and inferior aspects
- Resolves superimposed structures seen on MLO projection, localizes a lesion seen in one or both initial projections and air fluid level
- This view is at 90 degrees to the CC view
- Used to localize depth of breast lesions

ML Evaluation Criteria

- Dense areas adequately penetrated
- Nipple in profile
- May see pectoral muscle
- No artifacts
- No motion
- Marker and patient ID visible



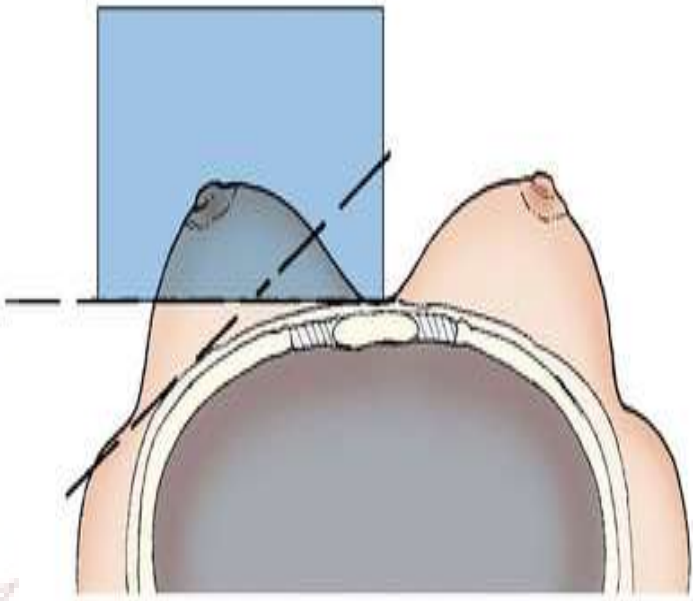
Exaggerated Craniocaudal (XCCL) Projection

- CR perpendicular or 5° mediolateral
- CC projection with some body rotation
- Includes axillary aspect
- Compression applied
- Nipple in profile
- Marker at axilla



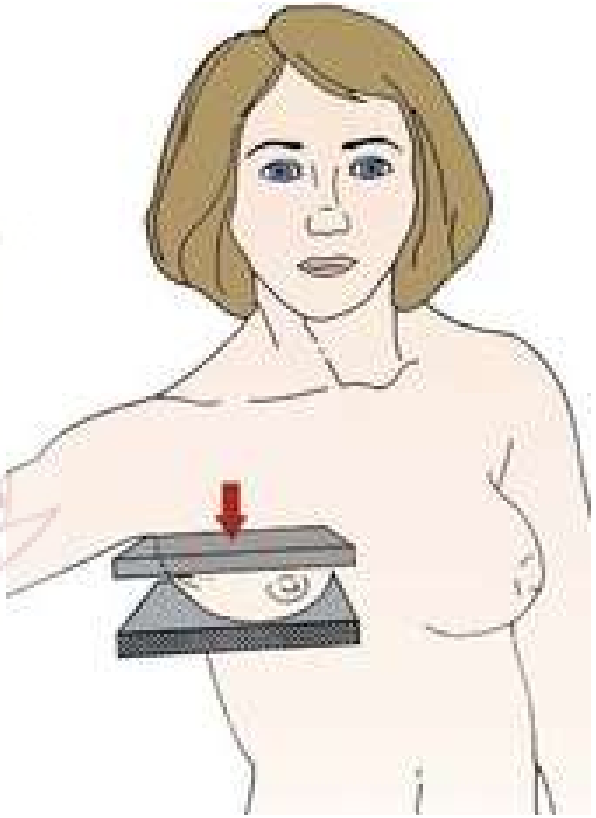
XCCL Projection

- Superior profile shows how placement of flat edge of IR against curved chest wall excludes a portion of breast tissue (shaded area)



XCCL Projection

- Demonstrates a super inferior projection of the lateral fibroglandular breast tissue and posterior aspect of the pectoral muscle
- Shows a sagittal orientation of a lateral lesion located in the axillary tail of the breast



XCCL Evaluation Criteria

- Retroglandular fat well visualized to ensure inclusion of deep fibroglandular breast tissue on lateral aspect and lower axillary region
- Pectoral muscle visualized over lateral chest wall
- Humeral head projected clear (5 degree angle)
- Uniform tissue exposure of compression adequate



Breast Augmentation

- Mammography has 80-90 % true-positive rate for detecting cancer that do not contain implants
- Cancer detection rates decrease to 60 % because implants obscure 85 % of breasts structures
- Precautions must be taken to avoid rupturing augmentation device during exam
- Eight radiograph exam (4 views of each breast) is preferred
- Posterior and superior aspects of segmented breast can be evaluated using standard CC and MLO projections but not the surrounding breast parenchyma

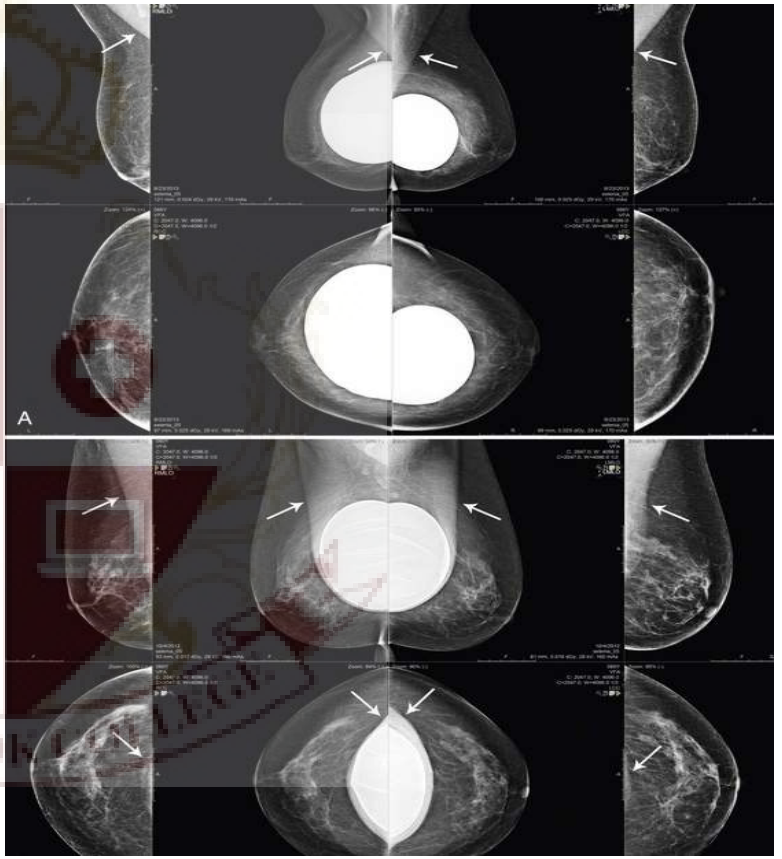
Eklund Method

- The addition of a second set of images utilizing the implant displacement method also known as the Eklund method
- Improves compression of the breast tissue and visualization of breast structures
- The implant is pushed posteriorly against the chest wall so it is excluded from the image and the surrounding breast tissue is pulled anteriorly and compressed
- This technique is most effective when used on patients with implants placed posterior to the pectoral wall

Eight iew Mammogram

- A- 8 view anterior to pectoral muscle

- B- 8 view posterior to pectoral muscle



Complications

- Complication frequently associated with breast augmentation include fibrous tissue surrounding the implant, shrinking, hardening, leakage and pain
- Mammography cannot alone fully show all complications ultrasound and MRI are used for breast examinations in symptomatic patients

Ultrasound

- Ultrasound of the breast useful in identifying implant leakage when ruptured
- Identifies leakage migrated to axillary lymph nodes

MRI

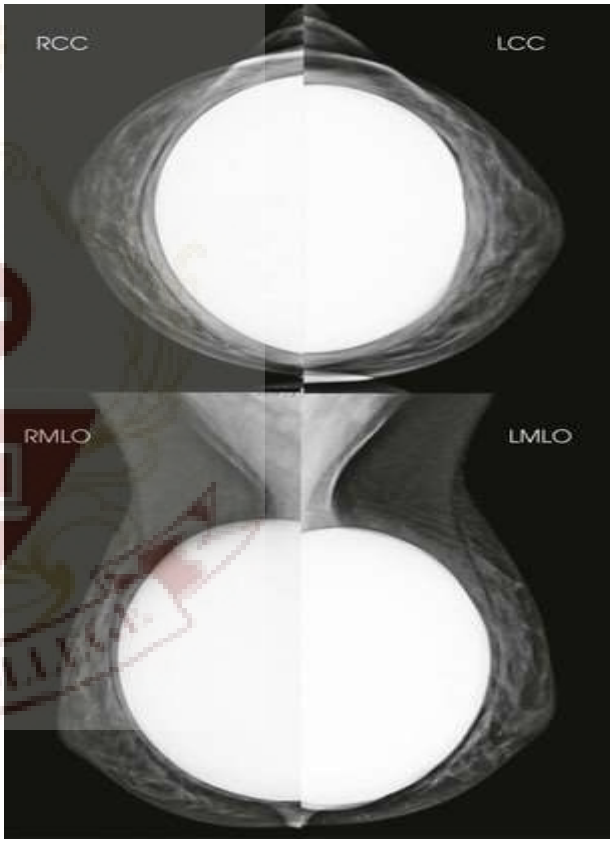
- Common used diagnostic tool of augmented breasts
- Several diagnostic advantages the cost and time consuming nature of the procedure inhibit it as a screening tool
- Used as screening tool for women who have undergone reconstruction after breast cancer
- Useful preoperative tool position of implant, identifying contour of deformity and confirming rupture/ leakage migration patterns

CC Projection with Full Implant

- Turn off AEC and preselect a manual technique- AEC will overexpose due to implant
- Follow same positioning of standard CC projection
- Minimal breast compression used –anterior breast should feel soft

CC Full Implants Structures Shown)

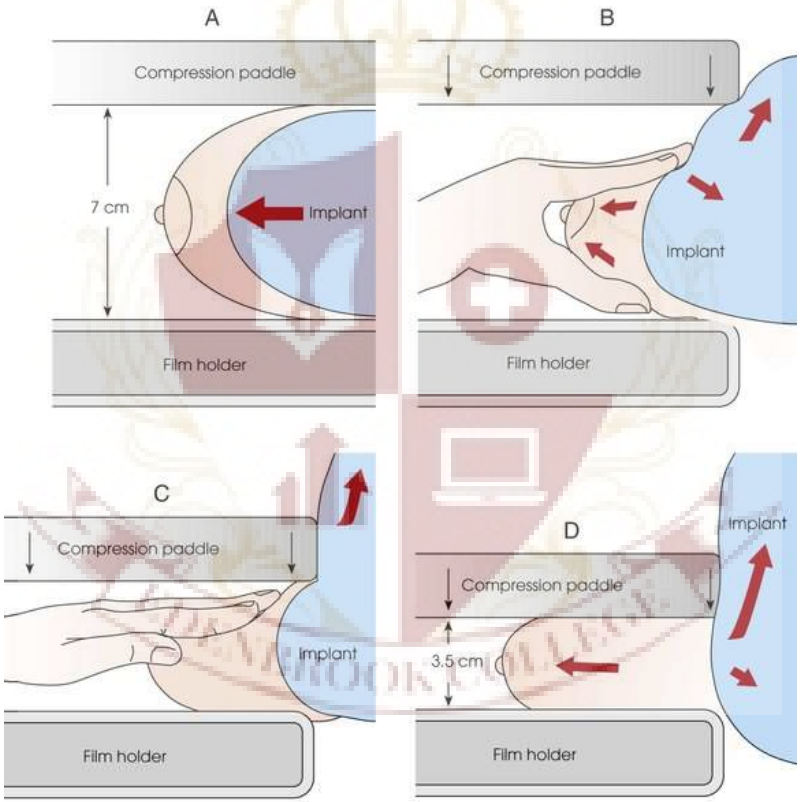
- Should show the entire implant and surrounding tissue with suboptimal compression of anterior fibroglandular tissue



CC Full Implants Evaluation Criteria

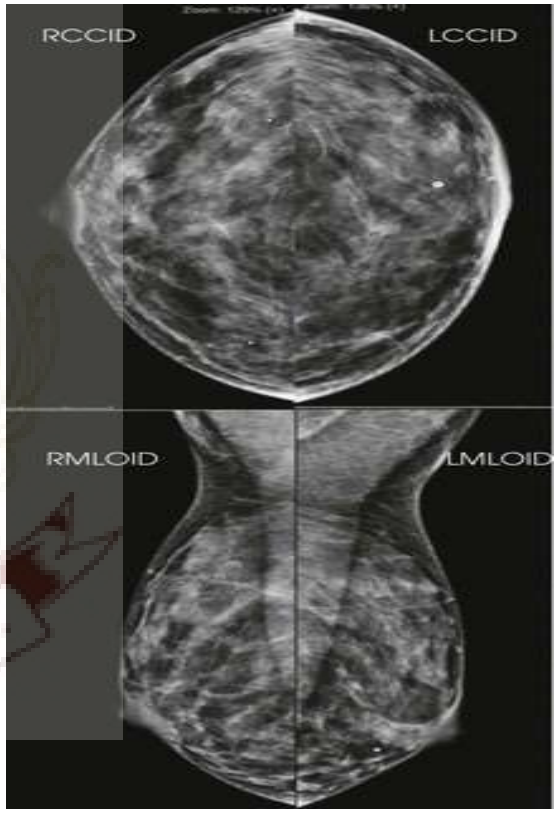
- Implant projected over fibroglandular tissue extending to posterior edge of image
- Posterior breast tissue on medial and lateral aspects extending to chest wall
- Nipple in profile if possible and at midline
- Non uniform compression of anterior breast tissue

Normal Technique vs Eklund



Eklund Method CC Projection

- Shows anterior and central breast tissue free of superimposition with uniform compression and improved tissue differentiation
- Implant displaced posteriorly and shouldn't be visualized on image



Eklund CC Projection Evaluation Criteria

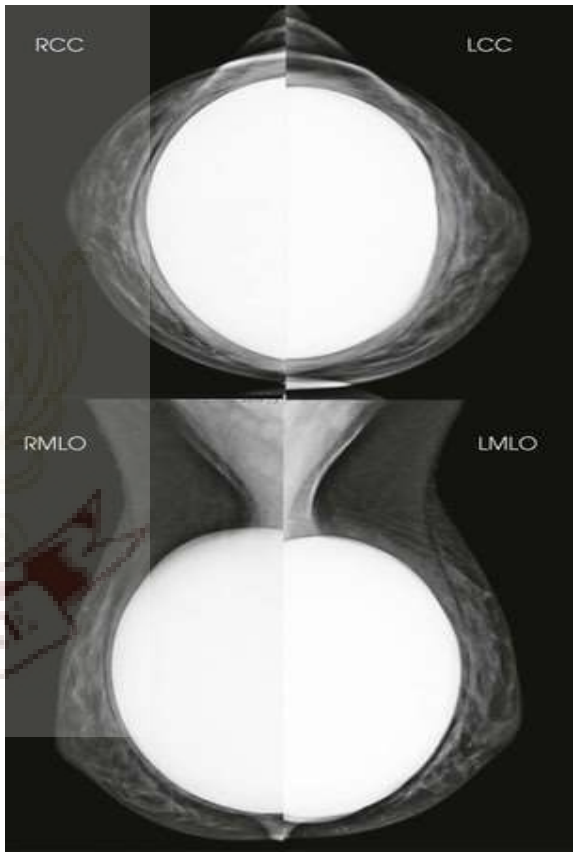
- Breast tissue superior and inferior to implant pulled forward with anterior breast tissue projected free of implant
- PNL extending posteriorly to edge of implant within 1 cm depth PNL on MLO with implant displaced
- Implant along posterior edge if image flattened against chest wall-should not be seen but often remnants
- Image sharpness enhanced by increased compression and reduced scatter removal of implant from beam

MLO with Full Implant

- Turn off AEC
- Follow same positioning as standard MLO
- Minimal compression used
- Anterior breast still feels soft
- Angle the C-arm to match the slope of the patient's pectoral muscle (approx. 45 %)

MLO Full Implant Structures Shown

- Image shows entire implant and surrounding posterior breast tissue as well as axillary tissue and pectoral muscle with sub optimal compression of anterior fibroglandular breast tissue



Evaluation Criteria MLO Full Implant

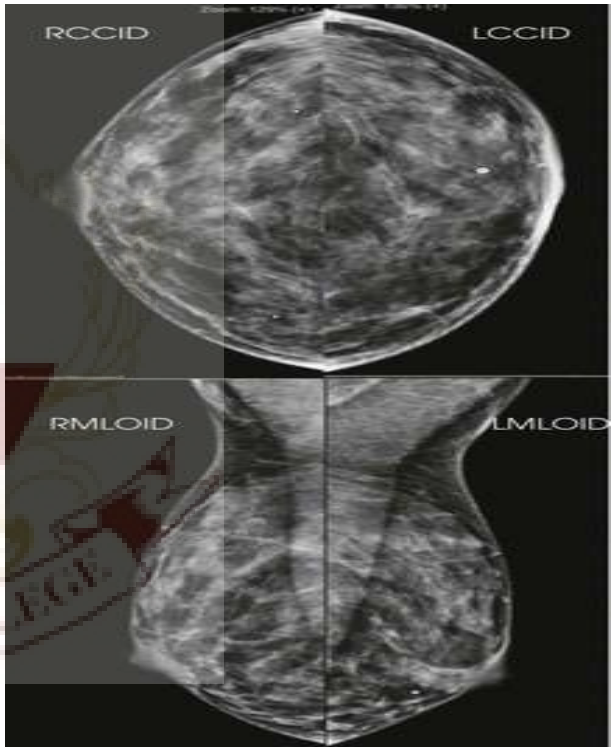
- Implant projected over fibroglandular tissue towards the posterior edge of image
- Posterior breast tissue on inferior aspect towards chest wall
- Nipple in profile if possible
- Open inframammary fold
- Breast adequately maneuvered up and out from chest wall
- Non uniform compression of anterior breast tissue

MLO with Displaced Implant

- Select AEC technique
- Position for MLO projection
- Use the Eklund method to displace implant posteriorly
- Apply compression as with CC displace implant

MLO with Implant Displaced Structures Shown

- Shows anterior and central breast tissue projected free of superimposition with uniform compression and improved tissue differentiation
- Implant displaced posteriorly and should not be seen



Evaluation Criteria MLO Implant Displaced

- Breast tissue superomedial and inferolateral to the implant with anterior breast tissue free of implant
- Pectoral muscle showing anterior convexity to ensure relaxed shoulder
- PNL extending obliquely to edge if implant and within 1 cm depth of PNL on CC with implant displaced
- Posterior breast tissue on inferior aspect of breast
- Nipple in profile
- Pen Inframammary fold
- Breast maneuvered up and out form chest wall
- Image sharpness enhanced by increased compression, reduced scatter