Positioning Problem-Solving for Mammographers

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The MLO

- Inclusion of all breast tissue within perimeter
- Pectoral muscle fully visualized
- Tissue well separated
- Tissue visualized back to retromammary fat space
- IMF

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The MLO

Visualization of the pectoral muscle:

- The pectoralis muscle is not really part of the breast
- However, it serves as an important anatomical landmark for positioning and film evaluation

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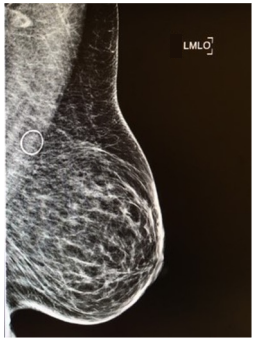
The MLO

- Visualized down to the PNL
- Wide margin at the axilla
- Convex/straight
- Radiolucent



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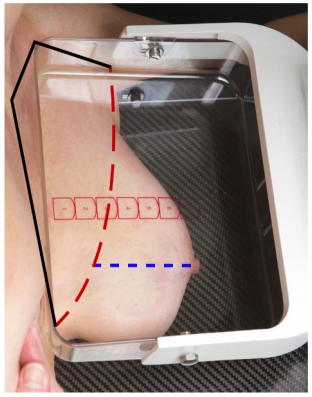

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The absence or presence of these characteristics will tell you exactly what you did right or wrong when positioning and therefore, whether you included or excluded breast tissue!

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Remember

There are only two margins for error:

- The way the machine is set up (i.e. height, angle, compression paddle size, etc.)
- The way the patient is "set up": both feet, hips and shoulders facing forward

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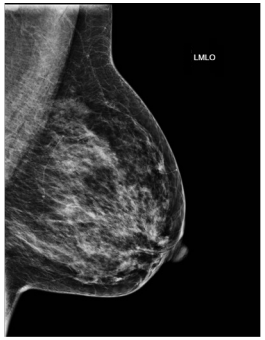
LENGTH OF MUSCLE

Should be visualized down to the level of the PNL



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PATIENT: Length of muscle is related to the position of the patient

The patient must be turned into the machine with both feet, hips and shoulders as far forward as possible as not to impede progress of the compression paddle.

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Angle for the MLO

- Angle to the free margin of the pectoralis muscle
- Keep angulation consistent
- Steeper angle for patients with longer thoraxes and small breasts
- Lesser angles for shorter thoraxes and larger breasts

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Recommended Angulation for MLO

- Depends on body habitus
- Maintain consistency from year-to-year

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I am going to say something that is shocking!

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Keep Angles Consistent

- 40 for shorter, heavier patients with large breasts
- 45 for average patients
- 50 for tall, thinner patients with smaller breasts

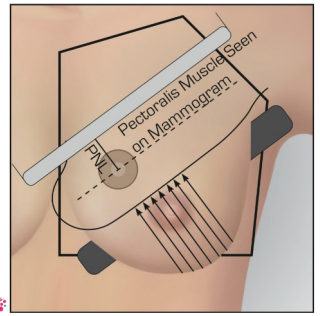
Keep Angles Consistent

- Use variations at 5-degree increments
- No more 47, 42, 48, 53, etc.

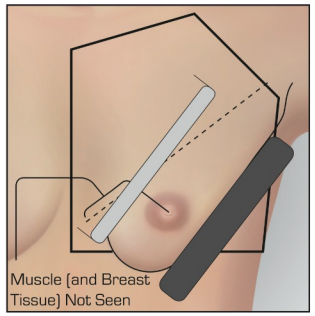
Keep Angles Consistent

- I am **not** saying NEVER use 35 or 55, but try to keep it consistent, so comparison is easier from year to year
- An MLO angled at 56 degrees one year will look markedly different than an MLO angled at 42 degrees the next year

Proper degree of angulation

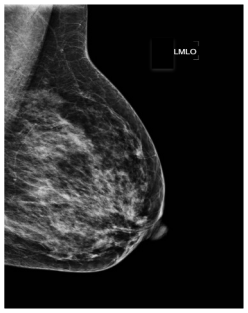


Angle too steep

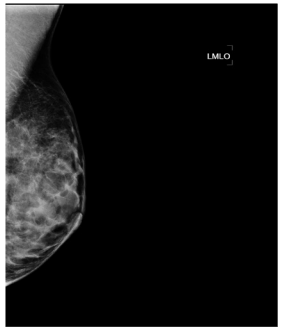


Proper degree of angulation

Angle too steep

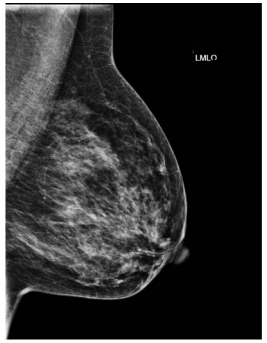


Is it the angle or the patient?



WIDTH OF MUSCLE

There should be a wide margin of the pectoralis muscle at the top of the image (in the axilla).



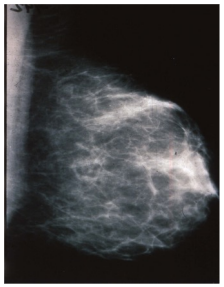
EQUIPMENT: Width of the muscle is related to placement of the IR in the axilla

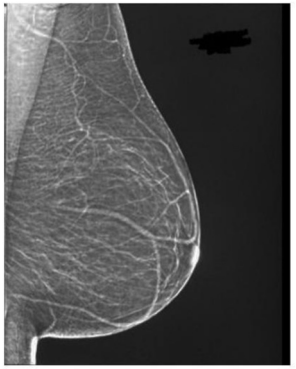
The back corner of the IR should be placed just anterior to the latissimus dorsi.

PATIENT: Width of the muscle is related to the position of the patient

The patient must be turned into the machine with both feet, hips and shoulder as far forward as possible, with the shoulder down, relaxed and pulled forward.

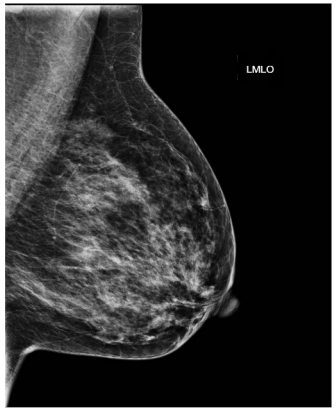
Is it the placement of the IR in the axilla or the patient?





SHAPE AND OPACITY OF THE MUSCLE

The muscle should be convex or straight.



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EQUIPMENT: The shape and opacity of the muscle is related to the height of the IR

The top of the IR should be positioned at height of the sternoclavicular joint, or halfway between the top of the shoulder and the axillary crease.

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PATIENT: The shape and opacity of the muscle is related to relaxation of the pectoralis muscle

- Patient's shoulder, arm and hand muscle
- Be relaxed

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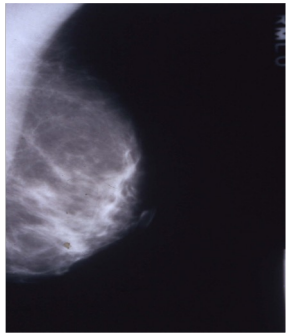
Is it the height of the IR or the patient?



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Problems with the MLO

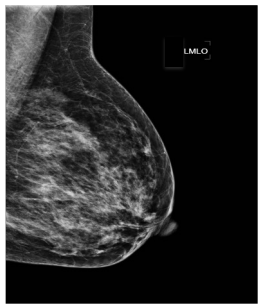
- No visualization of the IMF
- Folds in the IMF
- Breast drooping

Visualization of the IMF

Equipment challenges:
Change of the angle will not compensate for the increased length and the width of IR for FFDM and DBT (compared to the bucky)

Change should be made in the patient position.

No IMF

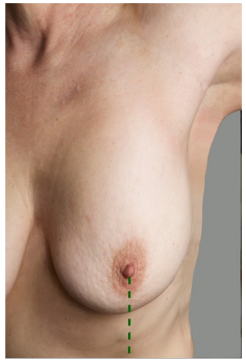


IMF

The position of the patient related to the bottom, front corner of the IR is critical:

- Patient must be facing forward with both feet
- The lower front corner of the IR should be directly below the patient's nipple (on VNL) or halfway between her ASIS and umbilicus
- This requires the patient taking a "side step" towards you

Inferior Nipple Line



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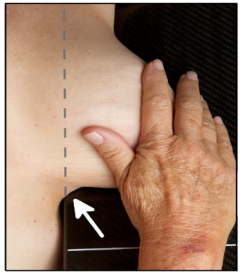
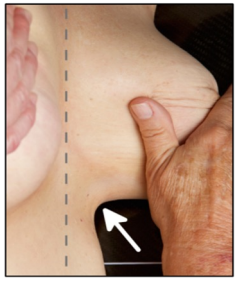
Improper
Edge of IR in front of IMF



Proper
Edge of IR behind IMF



Top edge of IR indicated by vertical dotted line.

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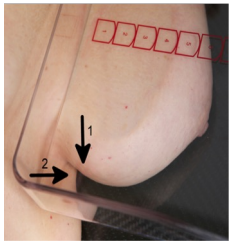
Folds in the IMF



1. Horizontal fold is in the medial breast
2. Vertical fold is in the lateral breast

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Breast Sagging

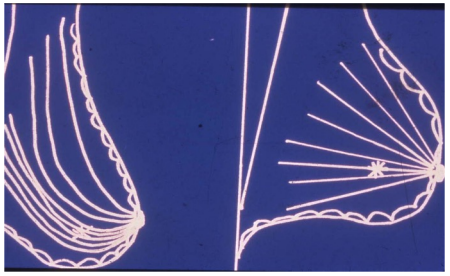
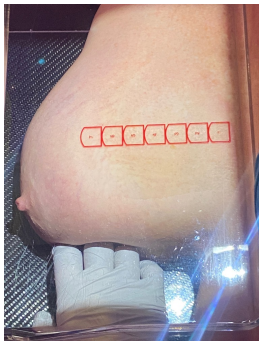
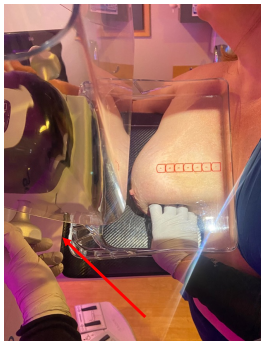


Image Courtesy of Stephen Feig, MD

Position of the Breast

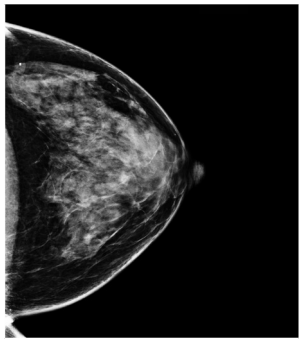
- Breast held in "up and out" position to bring the breast back to its "normal" position (nipple perpendicular to the chest wall)
- Maintained by adequate compression – DON'T LET GO!
- If necessary, use your knuckles to hold the breast up with manual compression.

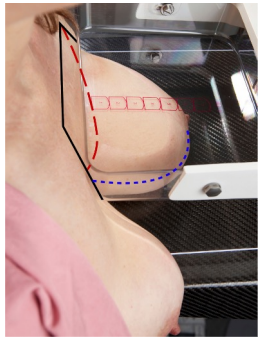


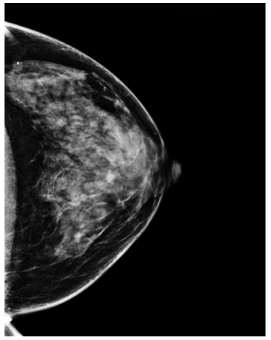


The CC

- Include maximum amount of breast tissue in the axial/transvers plane
- Visualization of medial breast tissue (cleavage) if possible
- Visualization of pectoralis muscle on approximately 30% of all CCs







Is it the Equipment or the Patient?

The Equipment:

- IR too high or too low
- Compression paddle size

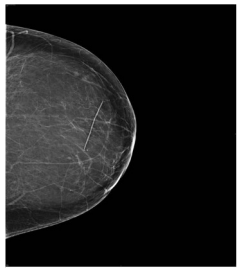
The Patient:

- Facing towards the machine with both feet, hips and shoulders forward

Due to lack of anatomical landmarks, positioning techniques are extremely important!!

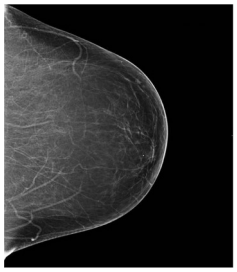
Elevate the breast so the PNL is perpendicular to the chest wall and *pull* the breast on with both hands.

1 handed "plop"



12.5 CM

2 handed pull



14.8 CM

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Common Positioning Problems

- Caused by lack of understanding of physics
- Cause by the lack of the use of standardized positioning techniques
- Too much futzing around

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Common Positioning Problems

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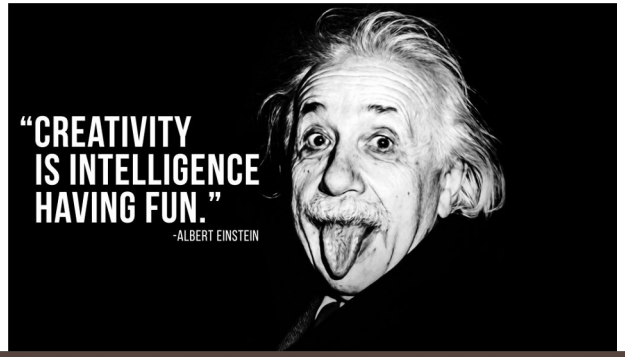
Mammography Physics



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Newton's Laws

- Law of Gravity
- Newton's Third Law: For every action, there is a reaction

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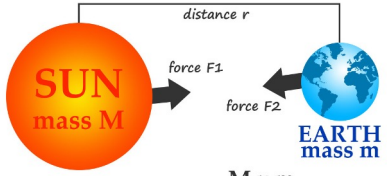
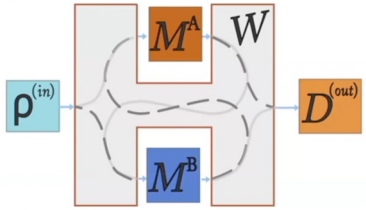
LAW OF GRAVITY



$$F1 = F2 = G\frac{M \times m}{r^2}$$

NEWTON'S THIRD LAW



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Cause and Effect

Cause and Effect Diagram	Scatter Plot	Causal Graph	Cause and Effect Flowchart	Granger-Causality Time Series

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In Mammography

- The way you "set up" the machine
  - Angle
  - Height
  - Paddle size
- The way you "set up" the patient
  - Facing forward
  - Step towards you on the MLO

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Common Positioning Problems

- Caused by lack of understanding of physics
- **Cause by the lack of the use of standardized positioning techniques**
- Too much futzing around

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Quick Steps for the CC (Right)

___ 1. Elevate breast/IMF (until the PNL is perpendicular to the chest wall)
___ 2. Adjust IR height (so top edge is parallel with elevated IMF)
___ 3. Pull breast onto IR with both hands (right hand on top; left hand on bottom) At the same time ask the patient to step forward into the machine (not to lean in) and have her turn her face towards you.
___ 4. Switch hands so now left hand is on the top (palm down) and anchor the breast with the base of your left thumb.
___ 5. With your right hand lift the other breast onto IR with your right index finger in the IMF against the rib cage and your right thumb on the top of the breast. At the same time ask the patient to turn her left hip forward towards the IR.
___ 6. Guide the patient's head towards the left, forward and around the face shield if possible.
___ 7. Place your right elbow and forearm at the mid thoracic region (where her bra clasp would be) and gently push the patient forward.
___ 8. Relax her right shoulder with your right hand.
___ 9. Pull superior breast tissue forward (if possible) by "climbing" up the breast with the outer edge of your thumb and then apply compression while continuing to "push" the patient forward with your right elbow.

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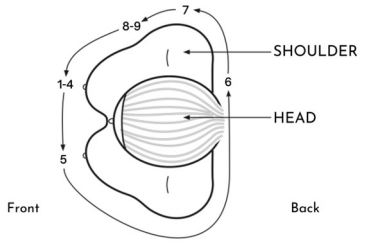
Source: Mammography Educators

Quick Steps for the CC (Right)

OVERHEAD VIEW



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Source: Mammography Educators

RCC: Steps 1-9 (Front)

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Must Follow Each Step

- Leave out a step, leave off breast tissue
- Do more steps than necessary, waste of time and increases possibility of errors
- The more variables, the more chance for errors!

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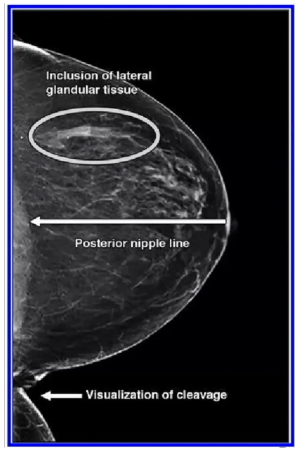

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Cause	**CC**	Effect
• Patient facing forward		↑Visualization of all breast tissue
• Elevating the IR properly		↑Superior breast tissue
• Pulling the breast on with both hands		↑Posterior breast tissue (short PNL)
• Anchoring the breast		↑Posterior, superior breast tissue
• Lifting the other breast up and over		↑Posterior, medial breast tissue (cleavage)

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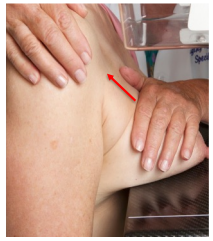
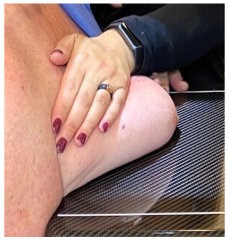
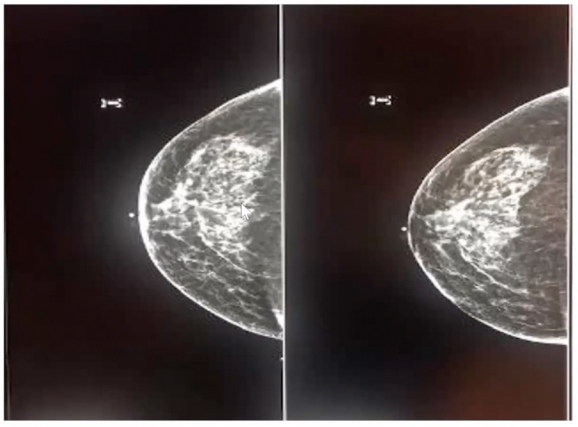
Cause	CC	Effect
• Patient turns hip towards IR		↑Posterior, medial breast tissue
• Push patient forward		↑Posterior, superior breast tissue
• "Crawl" up the breast		↑Posterior, superior breast tissue

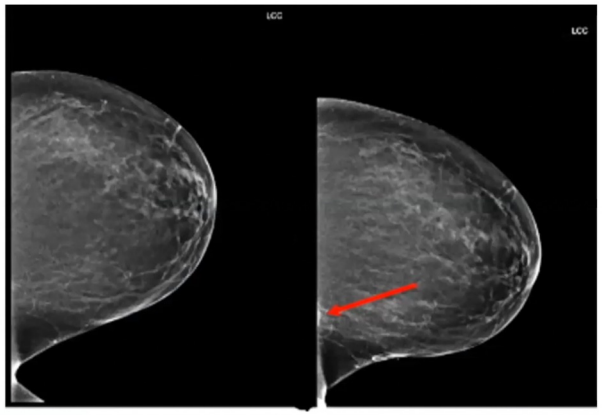
Before

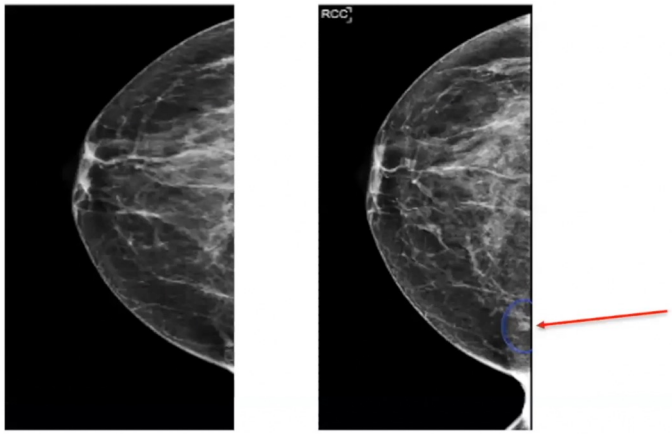


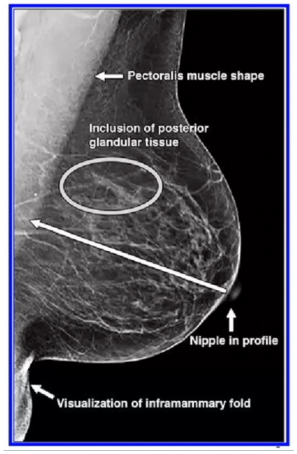
After









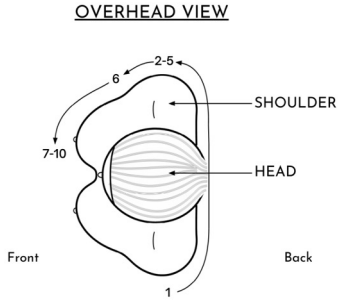


Quick Steps for the MLO (Right)

___ 1. Stand perpendicular to the patient
___ 2. Lift patient's right shoulder/arm up over the corner of the IR with your right hand in the patient's axilla. At the same time, your left hand should "meet" your left hand in the axilla and help to lift the patient's right shoulder up and over the IR
___ 3. IR is placed in back of axilla (just interior to latissimus dorsi)
___ 4. Your left hand slides down lateral side of breast to pull on lateral breast tissue and smooth out any skin folds
___ 5. Patient's right hand should be resting on bar, with their elbow bent behind the IR
___ 6. Place your right hand on patient's left shoulder
___ 7. Once your left hand is at the bottom of the breast, turn your hand over so that your hand is now palm down on the breast with the base of your thumb just anterior to the IMF
___ 8. Push the breast up and out with the base of your thumb
___ 9. At the same, ask the patient to lift and flatten their other breast. Caution: Do not ask the patient to pull their breast back
___ 10. Continue to hold the breast in the up and out position until compression is complete

Source: Mammography Educators

Quick Steps for the MLO (Right)



Source: Mammography Educators

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RMLO: Steps 1-10 (Front)

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Common Problems – MLO

1) Not choosing the correct angle
2) Not lowering the height or changing the paddle size
3) Not having the patient stand in the frontal position
4) Not moving the patient towards you
5) Not lifting the arm up and over placing the IR in the back of the axilla
6) Not sliding your hand down lateral side of breast
7) Not holding the breast up and out until compression is complete
8) Not having the patient hold their other breast up and out

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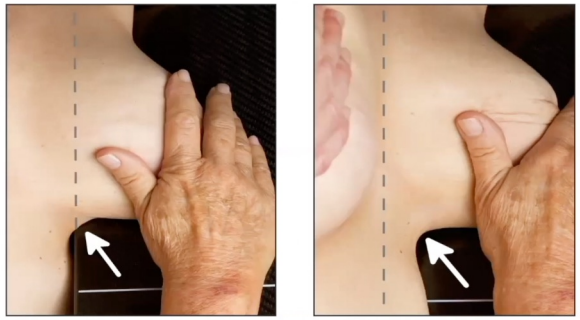
Move the Patient Towards You **Before** You Start Positioning!



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Cause **MLO** Effect

Cause	Effect
• Patient facing forward	↑Visualization of all breast tissue
• Choosing the correct angle	↑Medial breast tissue/longer pec
• Lowering the height of the IR	↑Relaxed muscle/straight/convex
• Move patient towards you	↑Visualization of IMF
• Lifting the shoulder up and over IR	↑Posterior, superior breast tissue
• Corner of the IR placed just in front of latissimus dorsi	↑Posterior, superior breast tissue wider muscle at top of image

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Cause **MLO** Effect

Cause	Effect
• Elbow relaxed behind IR/hand relaxed	↑Relaxed muscle, ↓ compression
• Smooth lateral, posterior breast tissue	↑Lateral breast tissue, ↓ folds
• Have patient lift and flatten other breast	↓Folds in IMF
	↑Visualization of anterior breast
• Hold breast up and out	↑Sagging breast/superimposition
• Maintain up and out until compression is complete	of structures

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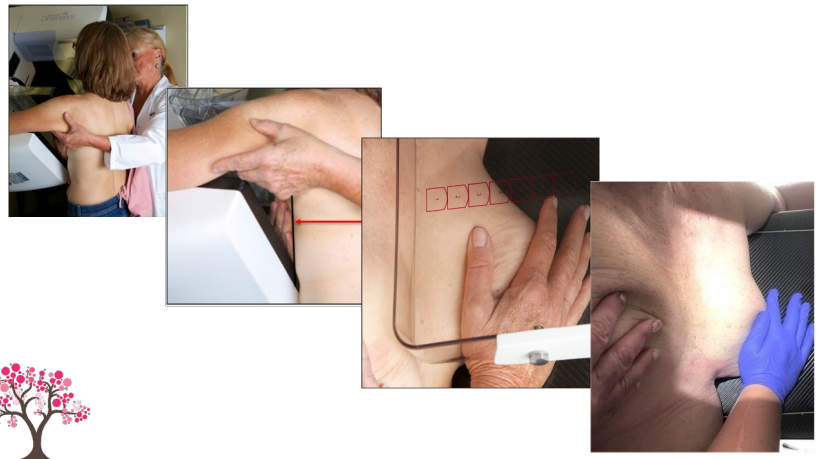

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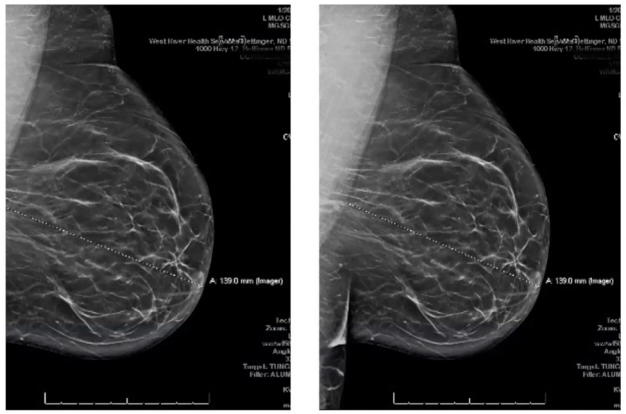

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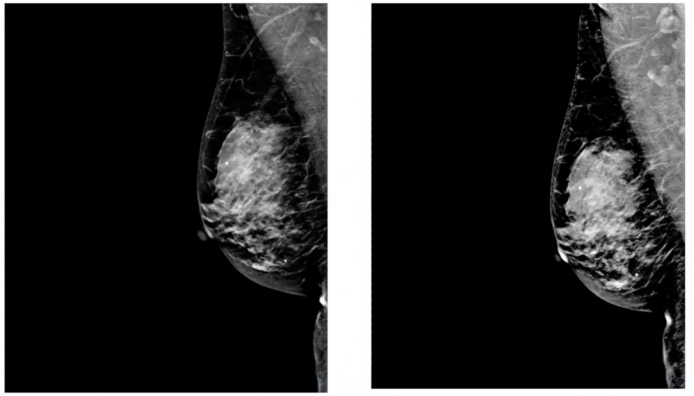

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Before

After

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We are a Worldwide Sisterhood

Quality Breast Imagers

A POSITIVE AND PROFESSIONAL FORMAT FOR MAMMOGRAPHY TECHNOLOGISTS AND OTHER BREAST IMAGERS

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