The Importance of Standardized Positioning, Anatomy, Physiology and Physics

Louise Miller, R.T.(R)(M)(ARRT), CRT(M), FSBI, FNCBC
Director of Education, Mammography Educators

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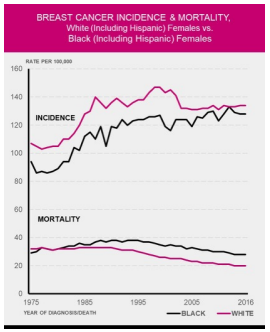
United States



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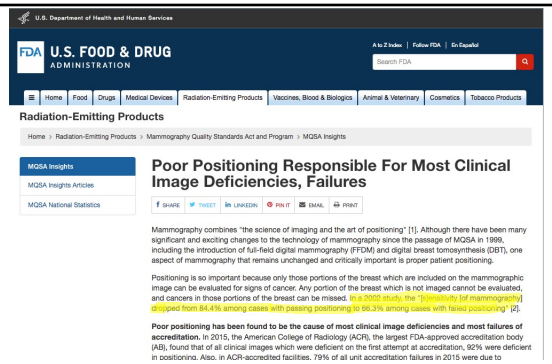

Source: https://www.fda.gov/Radiation-EmittingProducts/MammographyQualityStandardsActandProgram/FacilityScorecard/ucm495378.htm

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Now is the time to make a collaborative effort to establish, improve and maintain quality in mammography positioning.

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Quality

ALL industries have established standardized methods performance of tasks to:

- Establish and maintain quality
- Reduce errors
- Increase consumer satisfaction
- Increase profit
- Reduce possibility of litigation

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400,000 deaths per year due to medical errors… How many mistakes were made??

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Source: Journal of Patient Safety

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How do we reduce medical errors?

- Standardization
- Consistency
- Reproducibility

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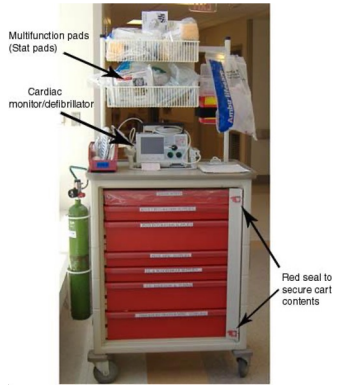

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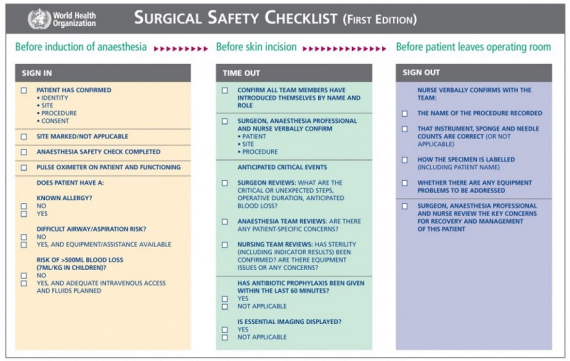

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Standardized Technologist Training for General Radiology

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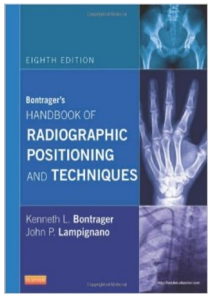
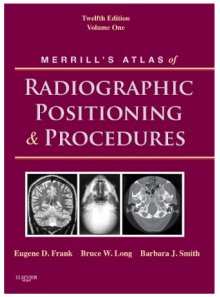
Bontrager's and Merrill's





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Standardization

- We all position the same way for every body part.
- We all do it in the same sequence.
- We all set up the machine before we bring the patient in.
- We all position the whole patient, not just the body part.

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In General Radiology

All training is competency based and a technologist's skills will be evaluated for *positioning techniques*, as well as *clinical image evaluation*.

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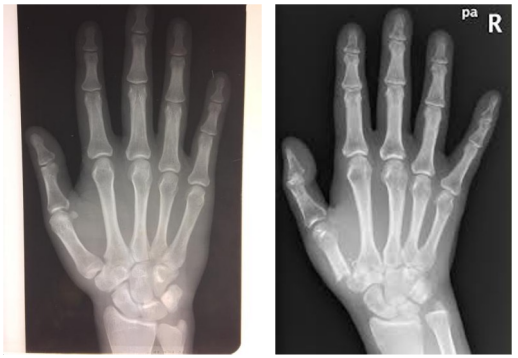

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Consistency and Ergonomics

- **M**achine
- **P**atient
- **B**ody Part (Breast)

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Consistency and Ergonomics

- **M**aking
- **P**ositioning
- **B**etter

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We position the **whole patient**, not just the body part!

In General Radiology…

We use anatomical landmarks that are visible and palpable:

- Radial head
- Humeral head
- Sternal-clavicular notch
- CML
- OML
- ASIS
- Umbilicus

In Mammography…

We *should also use* anatomical landmarks that are visible and palpable:

- Perimeter of the breast
- Humeral head
- Sternal-clavicular notch
- IMF
- PNL

All exams are done using the *same* positioning technique, in the *same* sequence.

WHY???

- Consistency
- Reproducibility
- Efficiency
- Proficiency
- Use of proper body mechanics

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But in mammography…
We are "all over the map"

- LCC, LMLO, RMLO, RCC
- RCC, LCC, RMLO, LMLO
- RMLO, RCC, LMLO, LCC
- LCC, RCC, LMLO, RMLO
- RCC, RMLO, LMLO, LCC
- LCC, LMLO, RCC, RMLO
- LMLO, LCC, RCC, RMLO

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My Suggestion:

- Do CC's first
- Then, do the MLO on the side you just finished the CC
- Then, do the other MLO

Example: RCC, LCC, LMLO, RMLO

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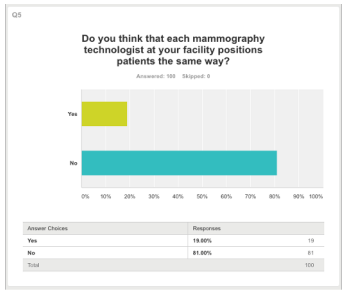
Most technologists *do not* practice a standardized method of positioning.



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In Mammography, Most Technologists…

- Have not been taught correlative anatomy, so they do not understand how positioning techniques effect image quality
- Know what they need to see on the images, but have not been taught how to correct positioning problems
- Havenot been taught a standardized method of positioning
- Have not been trained by a qualified trainer

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How did this happen?

- No current standardization for positioning for FFDM and DBT
- CEUs for hands-on positioning not required
- Initial 25 mammograms required but under whose supervision?

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How did this happen?

- Technologists are getting most CEUs online (no actual education for positioning)
- Radiologists are passing inadequate images and/or can only give feedback regarding positioning criteria

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How did this happen?

- Updated positioning trainings are not provided by employers
- There is no current published data available to establish parameters for positioning criteria

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How did this happen?

- No updates for positioning with FFDM or DBT (and the new equipment design requires a modification of positioning techniques used for FS)

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FS/FFDM/DBT

- Increased length of the IR by up to 40%
- Increased thickness of the IR by up to 80%
- Increased width of face shield up to 50%

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So, the problem is…

No standardization or follow-through, which means:

- Less consistency and reproducibility
- More repeats and rejects
- More accreditation failures
- Increased exposure
- MISSED BREAST CANCERS???

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How can we make things better?

Consistency and Reproducibility

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Common Work-Related Injuries

- Wrist problems
- Shoulder problems
- Back
- Knees
- Hips

No Standards for Mammography Positioning

There are standards for WHAT images should look like, but not HOW you get to that point!

Mammography Positioning Techniques Should Be:

- Based on ergonomic principles
- Efficient
- Proficient
- Consistent
- Reproducible

Do standardized positioning techniques work?

- Used consistently for 50+ years in Sweden
- Was taught by ACR in the 1990s
- Results published by Bassett et al in 1993 showed an improvement of 68% in image quality after ACR standardized positioning training
- Current preliminary data regarding standardized positioning techniques is impressive

Standardized Training

Northwestern University 2012*

- After standardized training, they showed a **50%** reduction in technical call backs (for positioning, blur, etc.)

*Not a published study.

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Metropolitan Chicago Breast Cancer Task Force

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What They Did to Affect Change

- Developed a Train-the-Trainer* (T3) Program
- Technologists applied to participate in the program and were chosen by specific criteria
- Received specialized training so they can provide effective and proven positioning techniques to other technologists in underserved areas
- Train-the-Trainer program successfully in place for 4+ years
- Plans for expansion to other major urban areas in US

*Program designed and presented by Louise C. Miller, RTRM

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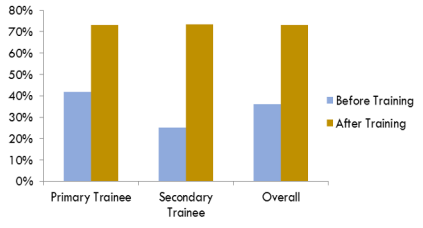
Does T3 Program help improve the quality of images taken by participating mammography technologists?



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USE DATA!!!

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Mammography Positioning Standards in the Digital Era: Is the Status Quo Acceptable?

Positioning criteria *following training for updated standardized positioning techniques* for FFDM and DBT far exceeds data on Bassett study.*

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*Approved for publication by AJR, December 2017

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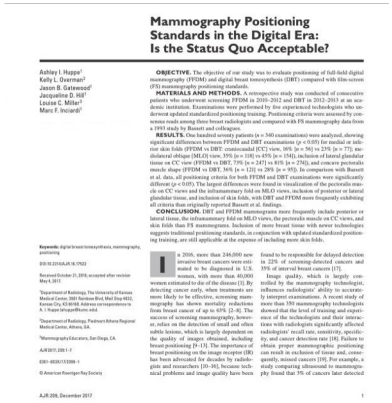

Mammography Positioning Standards in the Digital Era: Is the Status Quo Acceptable?

Ashley I. Hupp[1]
Kelly L. Overman[2]
Jason B. Gatewood[2]
Jacqueline D. Hill[2]
Louise C. Miller[2]
Marc F. Inciardi[3]

OBJECTIVE. The objective of our study was to evaluate positioning of full-field digital mammography (FFDM) and digital breast tomosynthesis (DBT) compared with film-screen (FS) mammography positioning standards.

MATERIALS AND METHODS. A retrospective study was conducted of consecutive patients who underwent screening FFDM in 2010–2012 and DBT in 2012–2013 at an academic institution. Examinations were performed by five experienced technologists who underwent updated standardized positioning training. Positioning criteria were assessed by consensus reads among three breast radiologists and compared with FS mammography data from a 1993 study by Bassett and colleagues.

RESULTS. One hundred seventy patients (*n* = 340 examinations) were analyzed, showing significant differences between FFDM and DBT examinations ($p < 0.05$) for medial or inferior skin folds (FFDM vs DBT: craniocaudal [CC] view, 36% [*n* = 56] vs 23% [*n* = 77]; mediolateral oblique [MLO] view, 35% [*n* = 118] vs 45% [*n* = 154]), inclusion of lateral glandular tissue on CC view (FFDM vs DBT, 73% [*n* = 247] vs 81% [*n* = 276]), and concave pectoralis muscle shape (FFDM vs DBT, 36% [*n* = 123] vs 28% [*n* = 95]). In comparison with Bassett et al. data, all positioning criteria for both FFDM and DBT examinations were significantly different ($p < 0.05$). The largest differences were found in visualization of the pectoralis muscle on CC views and the inframammary fold on MLO views, inclusion of posterior or lateral glandular tissue, and inclusion of skin folds, with DBT and FFDM more frequently exhibiting all criteria than originally reported Bassett et al. findings.

CONCLUSION. DBT and FFDM mammograms more frequently include posterior or lateral tissue, the inframammary fold on MLO views, the pectoralis muscle on CC views, and skin folds than FS mammograms. Inclusion of more breast tissue with newer technologies suggests traditional positioning standards, in conjunction with updated standardized positioning training, are still applicable at the expense of including more skin folds.

In 2016, more than 246,000 new invasive breast cancers were estimated to be diagnosed in U.S. women, with more than 40,000 women estimated to die of the disease [1]. By detecting cancer early, when treatments are more likely to be effective, screening mammography has shown mortality reductions from breast cancer of up to 63% [2–8]. The success of screening mammography, however, relies on the detection of small and often subtle lesions, which is largely dependent on the quality of images obtained, including breast positioning [9–13]. The importance of breast positioning on the image receptor (IR) has been advocated for decades by radiologists and researchers [10–16], because technical problems and image quality have been found to be responsible for delayed detection in 22% of screening-detected cancers and 39% of interval breast cancers [17].

Image quality, which is largely controlled by the mammography technologist, influences radiologists' ability to accurately interpret examinations. A recent study of more than 350 mammography technologists showed that the level of training and experience of the technologists and their interactions with radiologists significantly affected radiologists' recall rate, sensitivity, specificity, and cancer detection rate [18]. Failure to obtain proper mammographic positioning can result in exclusion of tissue and, consequently, missed cancers [19]. For example, a study comparing ultrasound to mammography found that 3% of cancers later detected

Keywords: digital breast tomosynthesis, mammography, positioning

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[1]Department of Radiology, The University of Kansas Medical Center, 3901 Rainbow Blvd, Mail Stop 4033, Kansas City, KS 66160. Address correspondence to A. I. Hupp (ahupp@kumc.edu).

[2]Department of Radiology, Piedmont Athens Regional Medical Center, Athens, GA.

[3]Mammography Educators, San Diego, CA.

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Source: American Journal of Roentgenology: 209, December 2017

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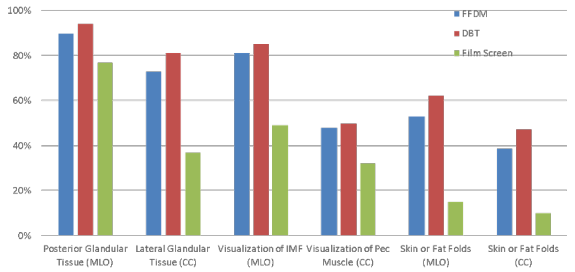
Criteria met after Standardized Training*



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Source: American Journal of Roentgenology: 209, December 2017

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Reasonable Expectations

	Positioning Criteria	FFDM	DBT	Bassett
MLO View	Visualization of Pec Muscle to PNL	86%	87%	81%
	Concave Pec	36%	28%	-
	Straight Pec	41%	46%	-
	Convex Pec	23%	26%	-
	Wide Margin at Top of Pec	95%	93%	-
	No Motion	98%	97%	99%
	Posterior Glandular Tissue Included	90%	94%	77%
	Nipple in Profile	89%	92%	88%
	Skin or fat folds	53%	62%	15%
	Upper Location	25%	27%	-
	Lower Location	35%	45%	-
	Visualization of Inframammary Fold	81%	85%	49%
	Requires More Than One View	13%	17%	-
CC View	Pec Muscle Visualized	48%	50%	32%
	No Motion	100%	98%	-
	Lateral Glandular Tissue Included	73%	81%	37%
	Nipple in Profile	83%	85%	89%
	Skin or fat folds	39%	47%	10%
	Medial Location	16%	23%	-
	Lateral Location	29%	32%	-
	Visualization of Cleavage	41%	34%	-
	Requires More Than One View	5%	7%	-

Source: American Journal of Roentgenology: 209, December 2017

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Reasonable Expectations

- Our patients have different and often challenging body habitus
- Their breast size, shape, mobility and tenderness are hugely variable

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Reasonable Expectations

Even the "perfect" patient, in terms of body habitus, breast mobility, etc. may provide a challenge that inhibits the technologist's ability to position and compress properly.

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But we CAN improve image quality by using standardized positioning techniques that are applicable for FFDM and DBT *and* developing a strong knowledge-based foundation that depends on the technologist's understanding of correlative anatomy.

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Does it work??

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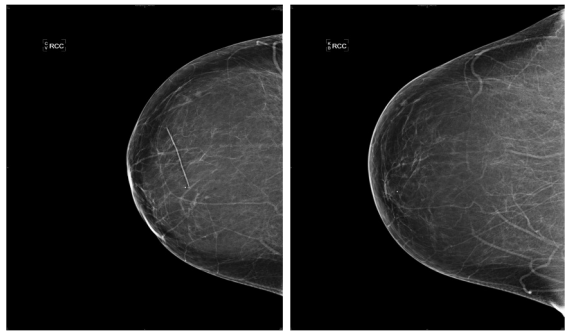
BEFORE 13.1 cm | STANDARDIZED POSITIONING + 3.0 cm | AFTER 16.6 cm



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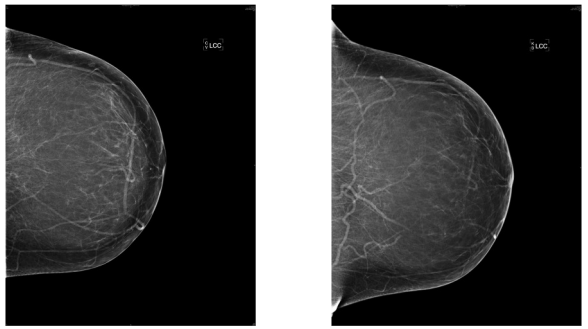
BEFORE 14.8 cm | STANDARDIZED POSITIONING + 2.0 cm | AFTER 16.8 cm



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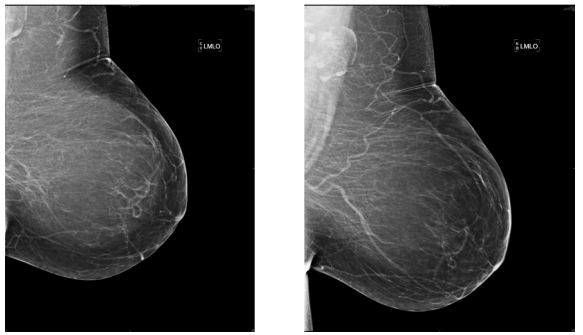
BEFORE 17.1 cm | STANDARDIZED POSITIONING + 1.0 cm | AFTER 18.1 cm



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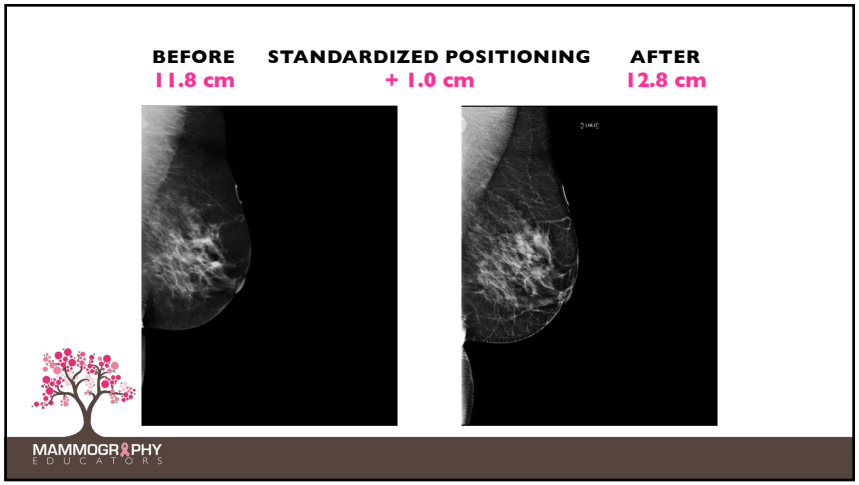

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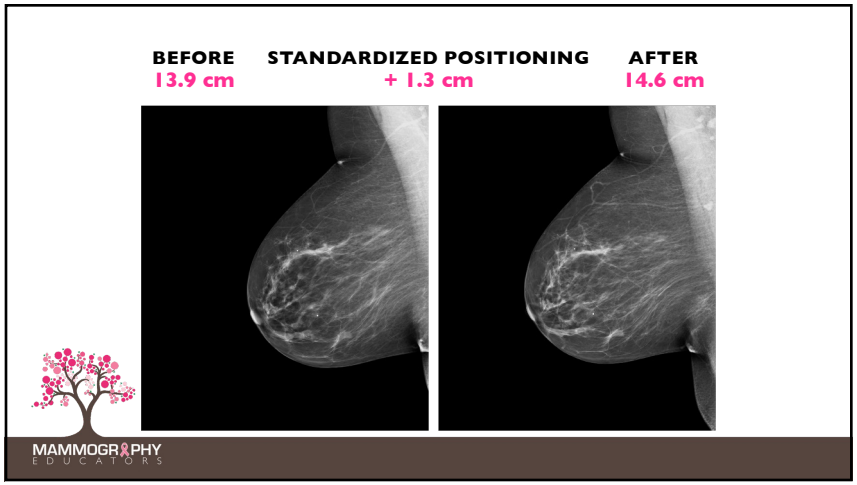

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We need:

- Accurate methods for determining the actual number of images taken
- Accurate methods for analyzing positioning standards
- The ability to provide corrective action plans for *improving* positioning errors (EQUIP)
- The establishment of standardized positioning techniques that are efficient, consistent and ergonomically sound

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It is ALL our responsibility to make sure that ALL women receive the highest quality mammogram achievable.

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Back To The Basics

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Mammography should be taught according to scientific principle, NOT ANECOTE!

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ANATOMY - PHYSIOLOGY - PHYSICS

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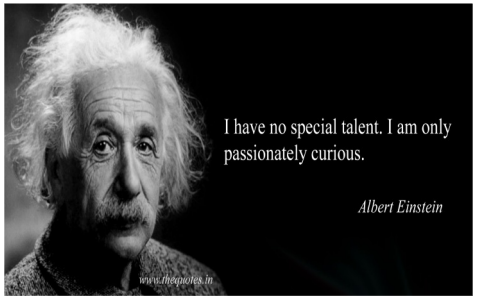

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Except…

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

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ANATOMY AND PHYSIOLOGY AS THEY RELATE TO MAMMOGRAPHY POSITIONING USING GENERAL RADIOLOGY PRINCIPLES

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Goals for **General Radiology** Positioning

- Bring the body part back to its true anatomical position OR the position that will best visualize that body part
- Use palpable and visible anatomical landmarks for positioning and clinical image evaluation
- Use consistent and reproducible methods

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Goals for **Mammography** Positioning

Bring the breast back to its natural anatomical position (*with the nipple perpendicular to the chest wall as possible*) on both screening views to maximize visualization of breast tissue and to avoid superimposition of structures.

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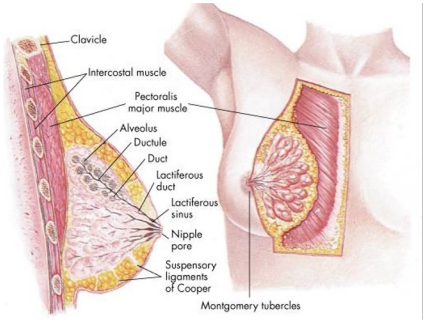
Anatomy of the Breast



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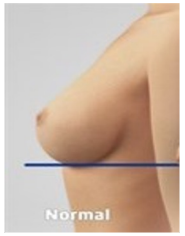
Normal or natural position of the breast is when the nipple is perpendicular to the chest wall.



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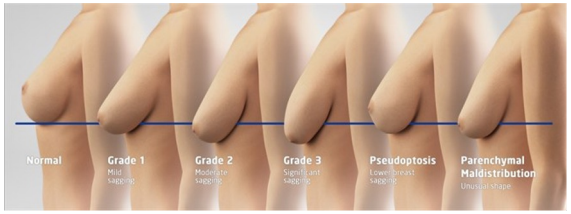
When positioning for mammography we need to bring the breast back to its 'normal' position.



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In order to accomplish this and include the maximum amount of breast tissue, we must consider the anatomical landmarks that will be used for positioning and clinical image analysis.

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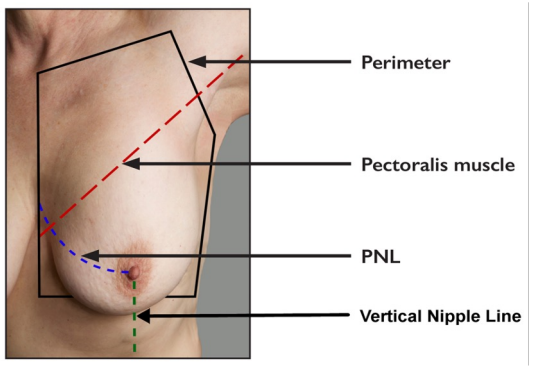

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Perimeter of the Breast

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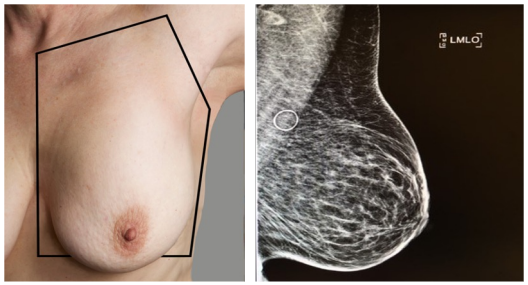
Perimeter Used for Positioning and Clinical Image Analysis



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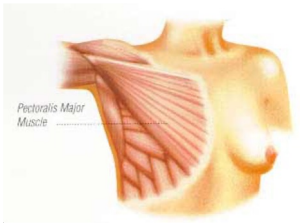
Pectoralis Major Muscle



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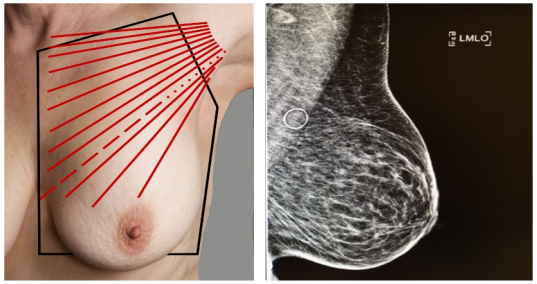
Pectoralis Used for Positioning and Clinical Image Analysis



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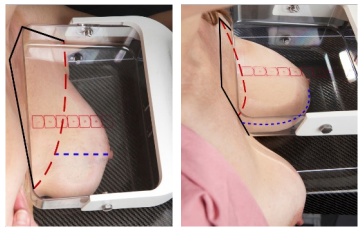
PNL Used for Positioning

Elevate the breast so that the PNL is as close as possible to perpendicular to the chest wall.



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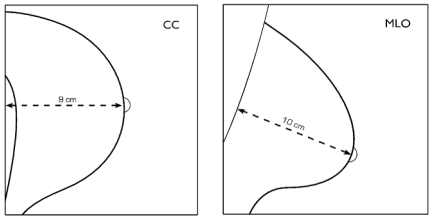
PNL Used for Clinical Image Analysis

PNL measurement of CC should be within 1cm of the PNL measurement on the MLO



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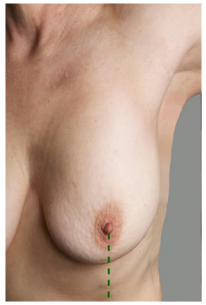
Vertical Nipple Line



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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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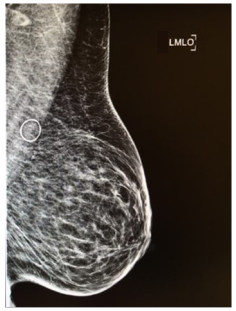
The MLO

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



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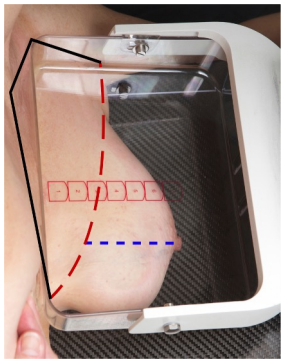

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The absence or presence of these characteristics will tell you exactly what you did right or wrong when positioning and therefore, whether you included or excluded breast tissue!

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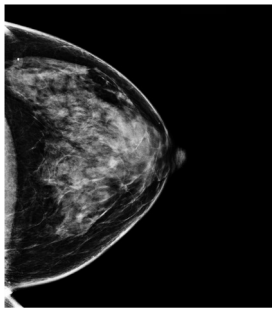
84

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



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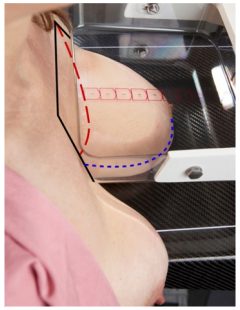

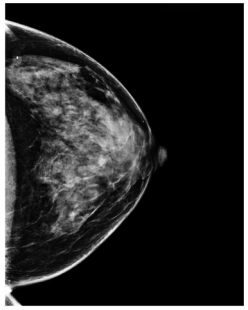

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So….I know what you're thinking

"She didn't see that patient I did yesterday!"

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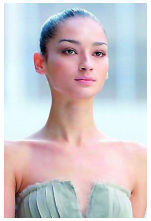
90

Well, how do you deal with different or challenging body habitus in general radiology??



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Positioning for the CC and MLO Views

Louise Miller, R.T.(R)(M)(ARRT), CRT(M), FSBI, FNCBC
Director of Education, Mammography Educators

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The MLO View

94

The MLO View

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

95

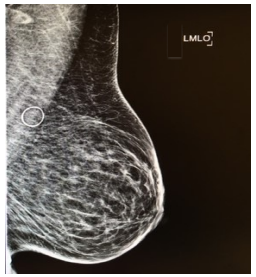
MLO: Visualization of the Pectoral Muscle

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

96

MLO: Visualization of the Pectoral Muscle

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



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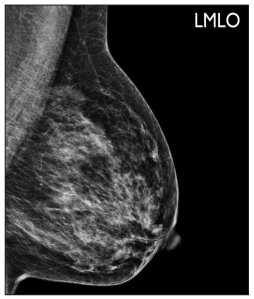
The MLO View

Remember, there are only two margins for error:

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

MLO – Length of the Muscle

Should be visualized from axilla down to the level of the PNL.



MLO – 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

MLO – Angle

- 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

MLO – Angle

Recommended angulation:
- Depends on body habitus
- Maintain consistency from year to year

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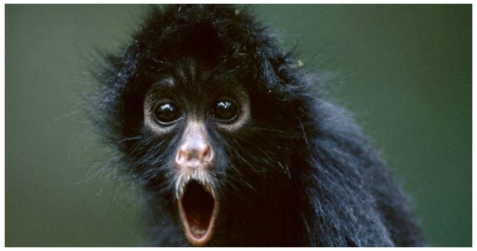
I am going to say something that is shocking!!



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Keep Angles Consistent

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

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Keep Angles Consistent

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

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105

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.

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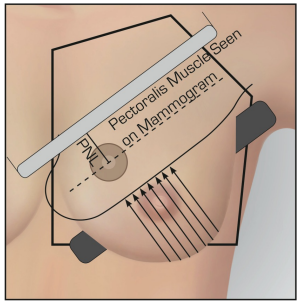
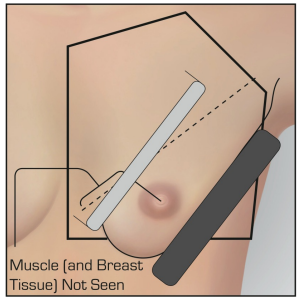
Proper Degree of Angulation



Angle Too Steep



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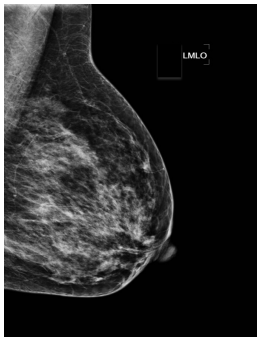
Proper Degree of Angulation

Angle Too Steep



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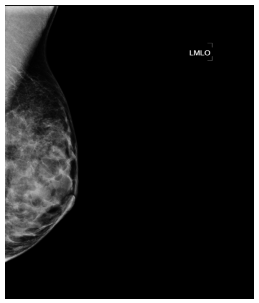
Is it the angle or the patient?



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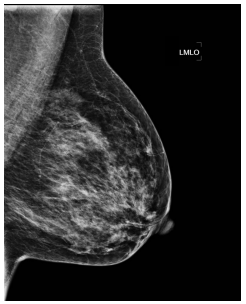
MLO – Width of the Muscle

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



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MLO – 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

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MLO – 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

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113

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

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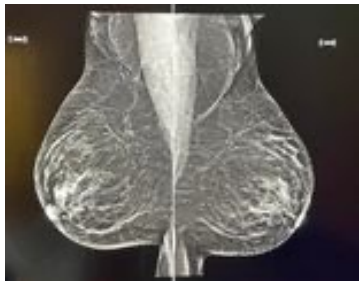
114

MLO – Width of the Muscle



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Visualization of the Lat Dorsi

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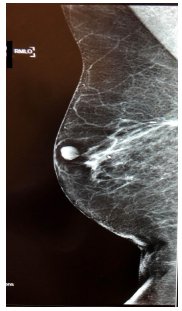
116

Patient HX – Lumpectomy RUOQ



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Normal Placement of the IR Just Anterior to the Latissimus Dorsi

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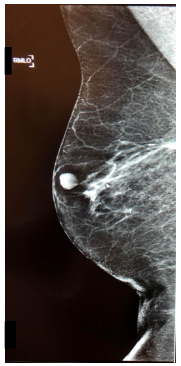

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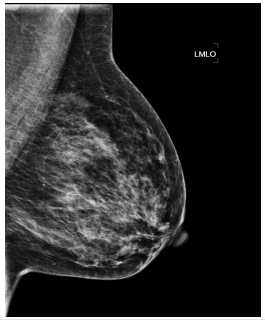
MLO – Shape and Opacity of the Muscle

The muscle should be convex or straight



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120

MLO – 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 axilla crease

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MLO – Patient

- The shape and opacity of the muscle is related to relaxation of the pectoralis muscle
- Patient's shoulder, arm and hand must be relaxed

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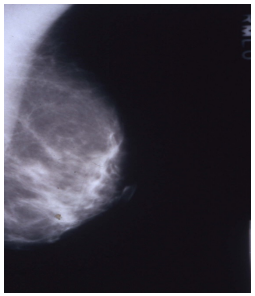
Is it the height of the IR or the patient?



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Reasonable Expectations

Positioning Criteria	FFDM	DBT	Bassett
Visualization of Pec Muscle to PNL	86%	87%	81%
Concave Pec	36%	28%	-
Straight Pec	41%	46%	-
Convex Pec	23%	26%	-

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*AJR:209, December 2017

124

Problems with the MLO

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

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125

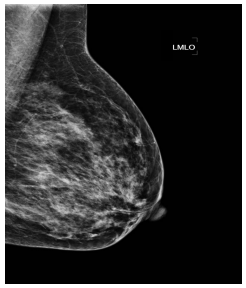
MLO – Visualization of the IMF

Equipment challenges:

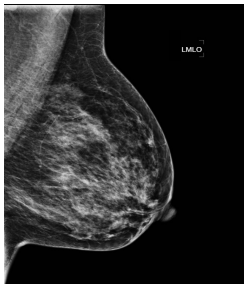
- Change of the angle will not compensate for the increased length and the width of IR for FFDM and DBT (compared to the bucky)
- Change should be made in the patient position

126

No IMF



IMF



127

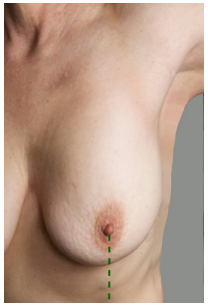
MLO – Visualization of the IMF

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 "sidestep" towards you

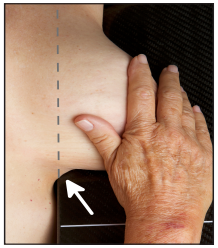
128

Inferior Nipple Line

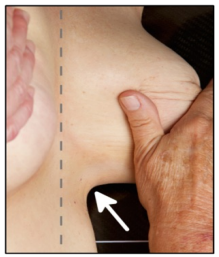


129

IMPROPER
Edge of the IR is in Front of IMF



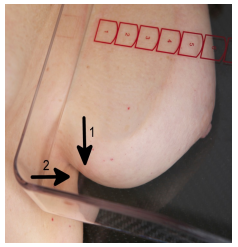
PROPER
Edge of the IR is Behind IMF

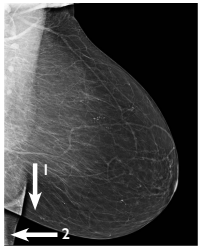


*Top edge of IR indicated by vertical dotted line

130

Folds in the IMF





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

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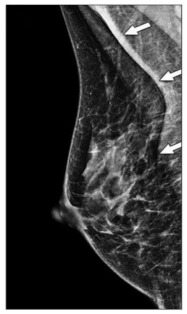
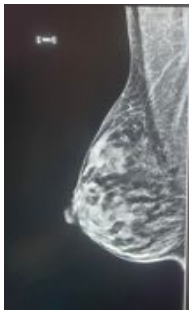
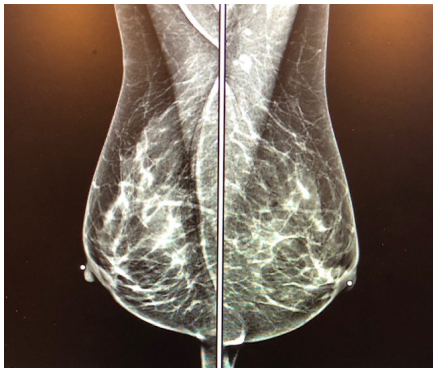
Skin and Fat Folds





132



133

Your hand slides down the lateral side of the breast.

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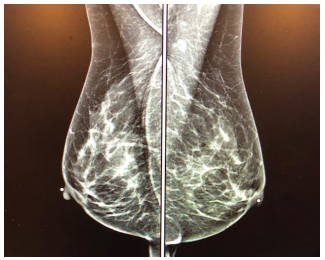

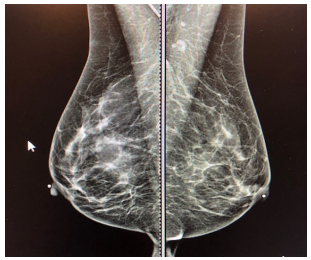

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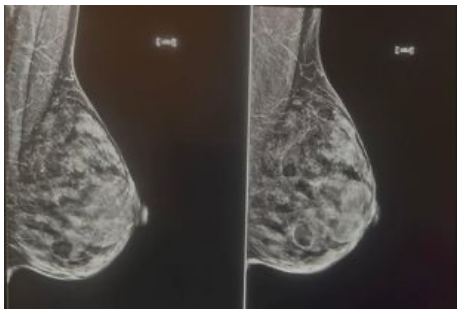

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136

Position of the Breast

- Breast held in the "up and out" position to bring the breast back to its "normal" position (nipple perpendicular to the chest wall)
- Maintained by adequate compression

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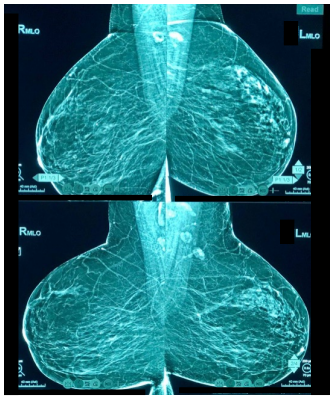

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BEFORE 11.8 cm

STANDARDIZED POSITIONING + 1.0 cm

AFTER 12.8 cm

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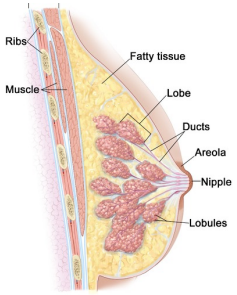
139

Glandular Breast Tissue

Ducts, lobes, and lobules



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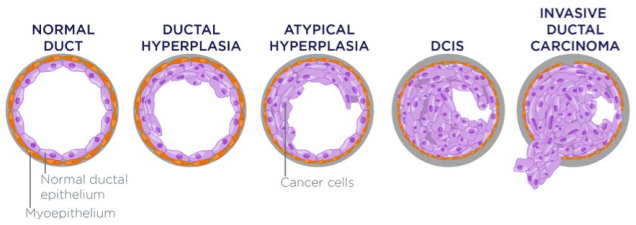

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141

Breast Sagging

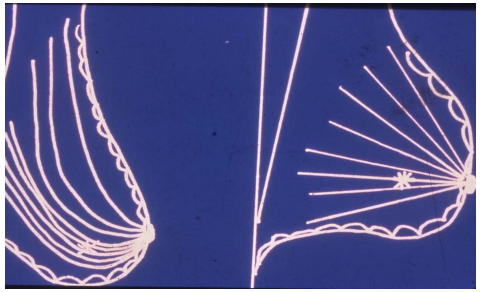

Image Courtesy Stephen Feig, MD

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142

"Up and Out" Position

Maintain the breast in the "up and out" position*

- Keep the nipple as close as possible to perpendicular to the chest wall
- Don't let go of the breast until compression **is complete**
- This will help eliminate the "sagging breast"

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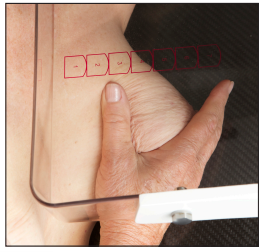
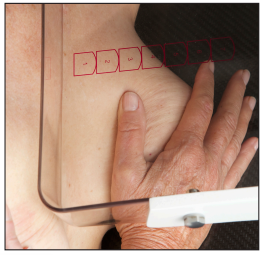
Solution for "Sagging" Breast



Hold the breast in up and out position.



Compress.

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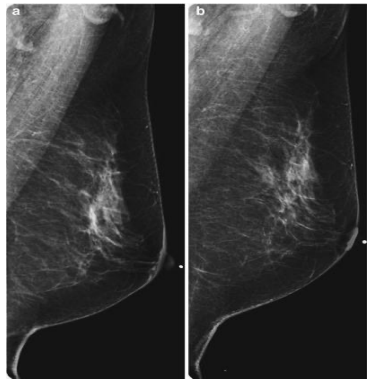

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145

Have the patient lift and flatten their opposite breast – never "pull" back.

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146

The CC View

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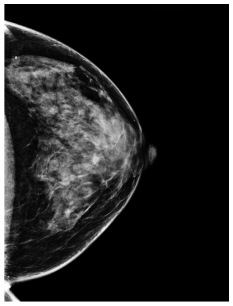
147

The CC View

- Include maximum amount of breast tissue in the axial/transverse plane
- Visualization of medial breast tissue (cleavage) if possible
- Visualization of pectoralis muscle on approximately 40-50% of all CCs



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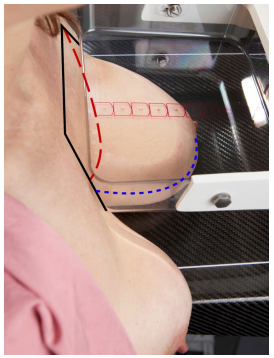

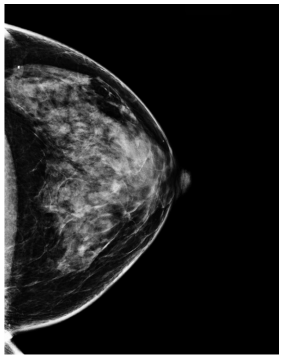

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149

The CC View – Equipment or Patient?

Equipment:
- IR too high or too low
- Compression paddle size

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

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150

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

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151

Stand on the Medial Side

- So you can see if medial breast tissue is included
- To facilitate the performance of the exam
- To keep the patient "pushed" forward
- To maintain eye contact

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152

Remember 5 Things…

1. Elevate the breast to the correct height
2. Pull the breast on with both hands
3. Anchor the breast
4. Push the patient in with your elbow/arm
5. "Crawl" up on the chest wall to include more pec muscle

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153

1) Elevate the breast/IMF and adjust the height of the IR

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2) Pull the breast onto the IR with both hands

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3) Anchor the breast

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4) Place your elbow and forearm at the mid-thoractic region of the patient's spine and gently "push" her forward

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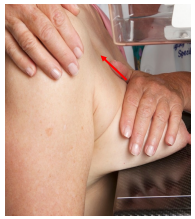
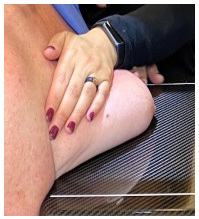
5) Use the edge of your thumb to "climb up" the chest wall to pull superior breast tissue forward and apply compression while continuing to "push" the patient forward



Before



After

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One-handed "Plop"

12.5 cm

Two-handed Pull

14.8 cm

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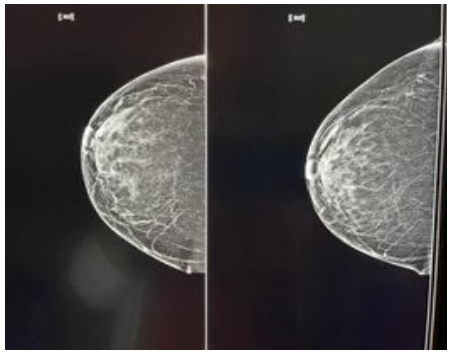

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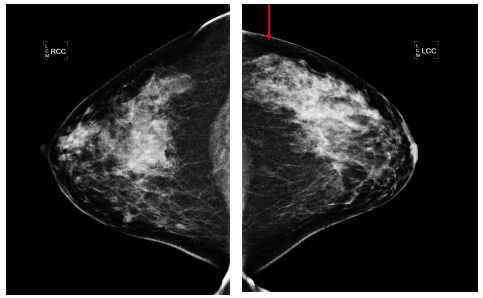
Failure to include lateral posterior breast tissue or ???



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NIPPLE IN PROFILE
NIPPLE CENTERED

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Nipple Centered

- Nipple should be centered on the CC view, if possible, and without sacrificing breast tissue
- Nipple may not be centered due to prominent medial or lateral fullness of the breast, which should be noted on the history sheet

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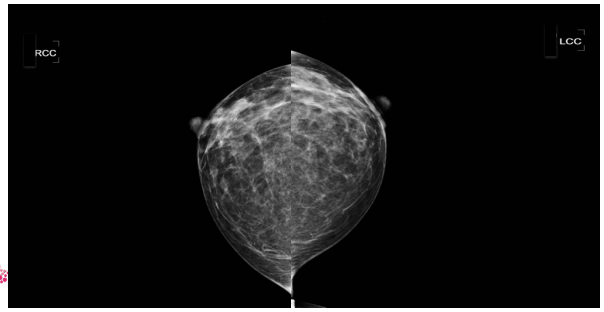
Patient with Prominent Medial Fullness



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Nipple Centered

- Breast tissue should never be sacrificed in order to center the nipple or show the nipple in profile
- An additional view should be added and labeled appropriately
- Notation should be made on history sheet

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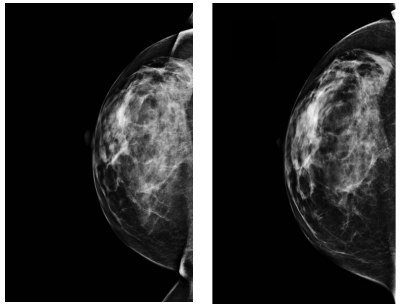
Compression



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Solutions – Compression

Criteria: Breast should be compressed until taut or less than painful and glandular tissue should be well separated

- Technologist must compress the breast until "taut" or less than painful
- Technologist must work with the patient to achieve adequate compression

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Focus On…

- Consistency
- Reproducibility
- Efficiency
- Proficiency
- Ergonomic principles

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Mammography Saves Lives!

But it is up to you… Even the best radiologist, in the best breast center cannot diagnose a cancer that is not included on the image.

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Additional Mammographic Views: A Comprehensive Guide

Louise Miller, R.T.(R)(M)(ARRT), CRT(M), FSBI, FNCBC
Director of Education, Mammography Educators

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Additional Views Lexicon – Labeling Codes

- XCCL - Exaggerated craniocaudal lateral
- CV – Cleavage
- ML - Mediolateral
- LM - Lateromedial
- AT - Axillary tail
- TAN - Tangential

171

Additional Views Lexicon

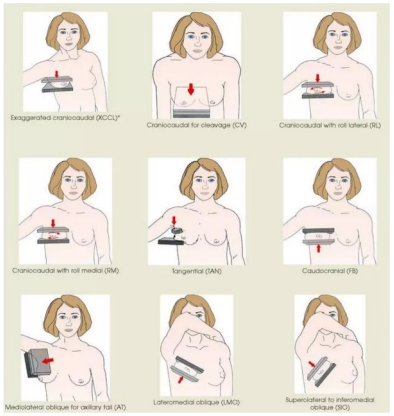
- RL - Rolled lateral
- RM - Rolled medial
- RS - Rolled superior
- RI - Rolled inferior
- FB - Caudocranial

172

Additional Views Lexicon

- SIO - Superior lateral to inferior medial oblique
- LMO - Lateromedial oblique
- M - Magnification
- ID - Implant displaced
- No label: Spot Compression

173



Source: Hologic Selenia Unit

Labeling Codes (Lexicon)

The name is view (labeling code) is always preceded by identification of laterality

- i.e., LXCCL or RXCCL

The Most Commonly Used Additional Views

- XCCL
- CV
- LM/ML

Why do we do additional views?

- To show a specific component of the anatomy not seen on standard views
- To provide localization of an area of concern medial/lateral or superior/inferior to the nipple

OR. . .

- To show an area of concern in better detail
- To counteract superimposition of structures
- To triangulate a lesion

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Commonly used additional views are done to show a specific component of the anatomy not seen on standard views.

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Ask and Answer

- Which part of the breast do I want to visualize?
- In which projection?
- Which view will accomplish this?

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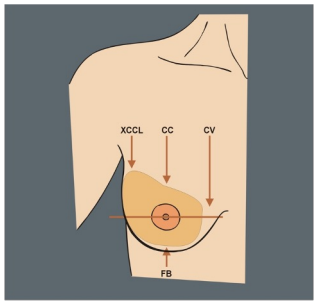
Imaging the Breast in a Transverse or Axial Plane



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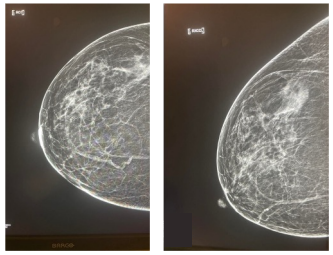
XCCL - Exaggerated CC Lateral

Visualization of lateral breast tissue in a CC projection



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Use of the XCCL

- Should be used on a *baseline* exam when lateral posterior breast tissue is missing on the CC view
- If glandular breast tissue on subsequent screening views is visualized back to the retromammary fat space on the MLO, an XCCL is not needed

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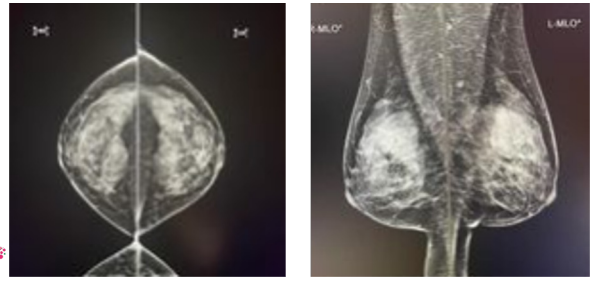
XCCL required for baseline, but not on subsequent screenings



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Use of the XCCL

- Should be performed on less than 10% of all patients
- Performed at 0 degrees angulation
- Patient's body should be at 45-degree angle to the IR
- Nipple should be pointing towards the upper corner of the image receptor

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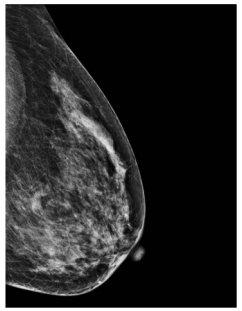
Muscle or NO muscle?
NO MUSCLE!



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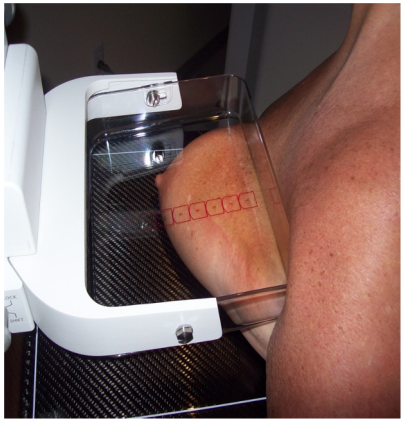
186



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Incorrect

Correct

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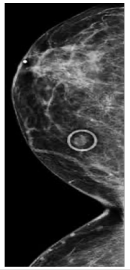
CV - Cleavage

For visualization of medial breast tissue in a CC projection



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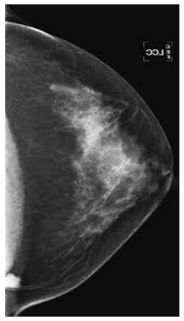
Sternalis Muscle



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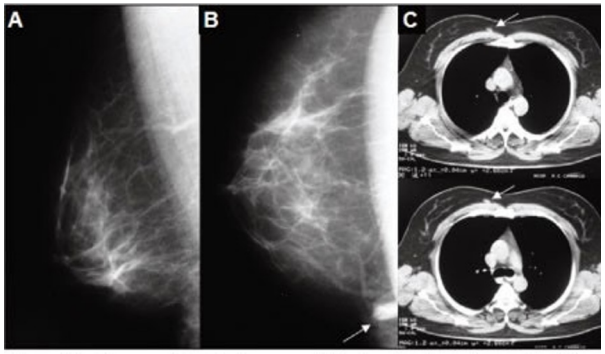

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Sternalis Muscle

- Flame-like appearance (similar to an appendix)
- Present in only 7-10% of the population
- Seen medially on a mammogram
- Often misdiagnosed as the insertion of the pectoralis muscle

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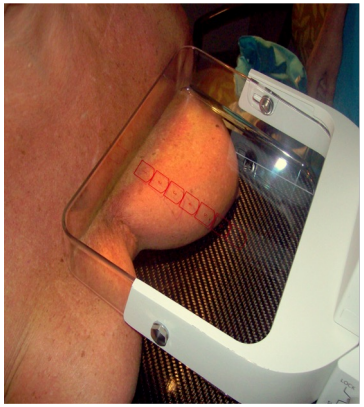
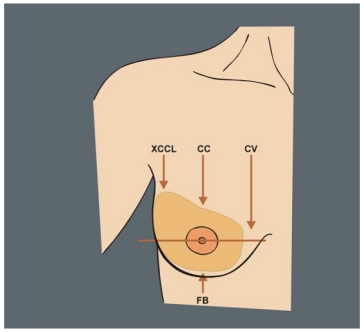


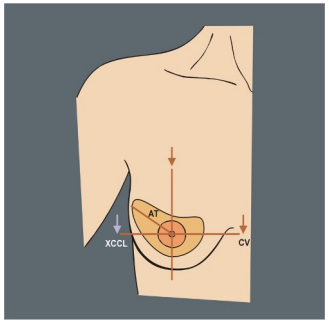
194

Medial or Lateral Orientation to the Nipple



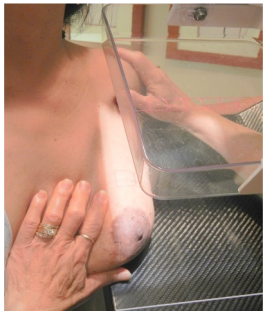
195

Axillary Tail



196

Axillary Tail



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AT – Axillary Tail

- Angle tube to axillary tail
- Approximately 30 degrees

198

AT – Axillary Tail

It is never used to localize a lesion.

199

AT – Axillary Tail

- The AT View is used only for focal compression of the axillary tail
- Anterior to posterior orientation and compression

200

AT – Axillary Tail

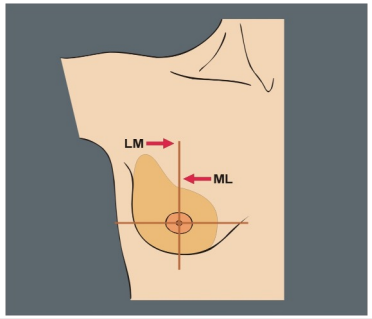
It will not give you true lateral/medial or true superior/inferior orientation to the nipple

201

90-degree (True) Lateral

- LM - Lateromedial
- ML - Mediolateral

Superior or Inferior Orientation to the Nipple (LM or ML)



Use of the Lateral

- Shows effects of gravity on air fluid levels (Milk of Calcium)
- Used as a "tie breaker" view (to overcome superimposition of structure)
- Visualizes the breast in the sagittal plane (demonstrates an area of concern superior or inferior to the nipple)

Why do the LM?

- When you did the MLO, you showed the lateral breast in better detail; The LM shows the medial breast in better detail
- The LM takes advantage of the lateral mobile border of the breast and thus facilitates positioning

Why do the LM?

- The posterior medial breast is hardest part of the breast to image and the area most often missed on the MLO
- If done properly, by off-setting the IR into the contralateral breast, you will be able to go deeper against the chest wall

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Why do the LM?

- There is no issue of the contralateral breast impeding the path of the compression paddle

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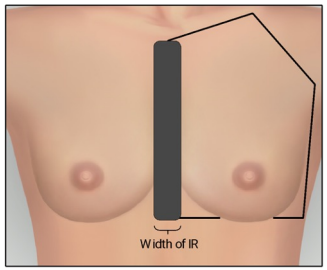
Improperly positioned LM with breasts separated, so the middle of the IR is centered on midsternal line. This excludes deep medial breast tissue on the side you are imaging.



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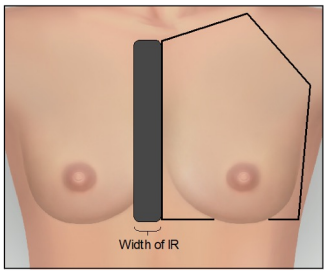
Properly positioned LM with breasts separated so the *top edge of the IR* is centered on midsternal line and the width of the IR pressing against the contralateral breast.



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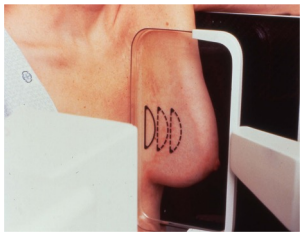
ML – Mediolateral

The opposite breast must be pulled back to allow the compression paddle to pass and may therefore eliminate visualization of deep medial breast tissue.



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Additional Views to Facilitate Imaging of Difficult Body Habitus

- LMO
- FB

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LMO – Lateromedial Oblique
FB – Caudocranial (From Below)

- Used when a standard MLO or CC is impossible
- Kyphotic patients
- Males with prominent pectoral muscles

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LMO – Lateromedial Oblique

- Degree of angulation should be 90 degrees plus or minus the standard degree of angulation.
- Average 45-degree RMLO would be 135 degrees for RLMO

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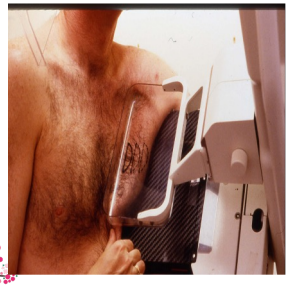
MLO LMO



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FB - Caudocranial

- Machine is turned 180 degrees opposite the CC
- Direction of the beam is Caudal to Cranial

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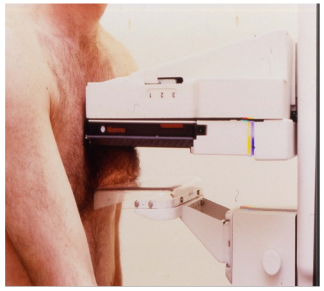
CC FB



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Additional Views for Clarification of Areas of Concern

- TAN
- Spot compression
- Spot compression with MAG
- Rolled views

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TAN – Tangential View

- To prove the existence of dermal calcifications
- Enhanced visualization of palpable masses that may otherwise be superimposed on glandular breast tissue

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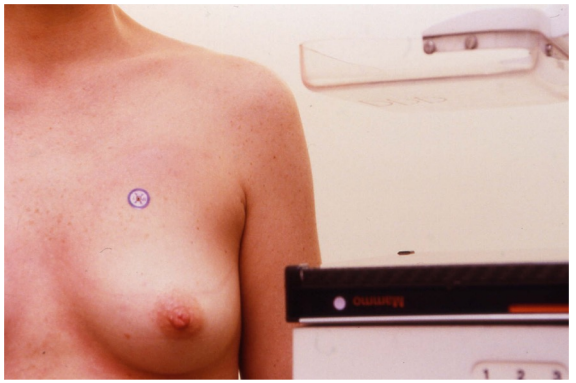

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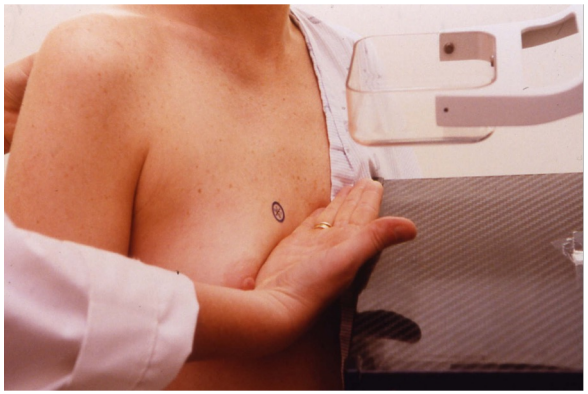

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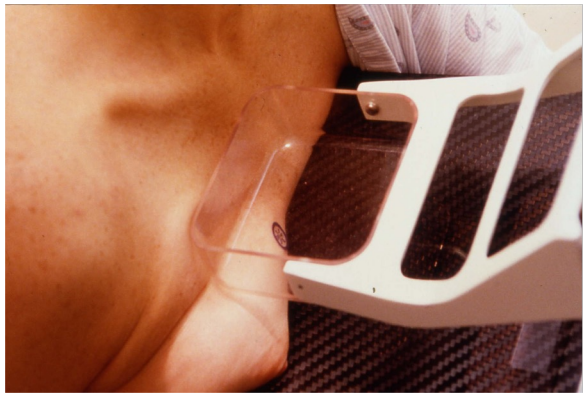


222

Localization for Verification of Skin Calcifications

- Decreased with use of DBT
- Set up as the same as a needle localization
- Determine which quadrant the calcifications are located

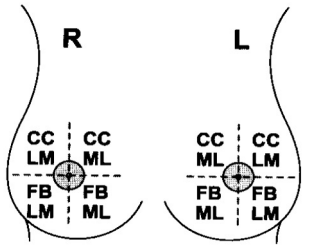
223

Localization for Verification of Skin Calcifications

- Use biopsy paddle
- Select direction of approach so that the window of biopsy paddle is closest to the area in question

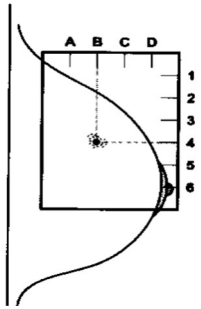
224

Tangential Views for the Verification of Skin Calcifications



225

Tangential Views for the Verification of Skin Calcifications



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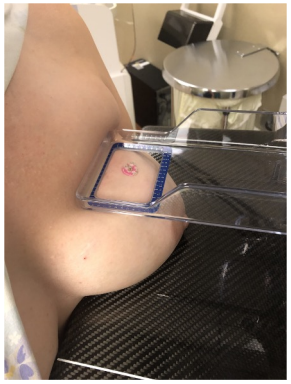

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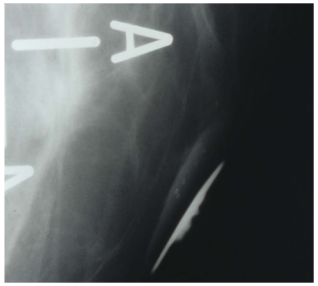
Tangential Views for the Verification of Skin Calcifications



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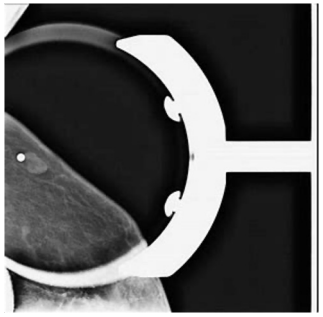
Spot Compression with/without Magnification



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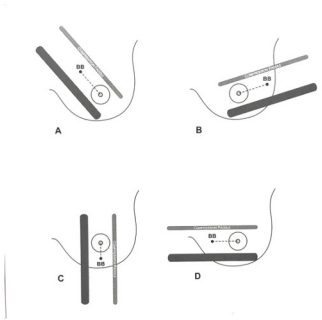
All Would be Labeled LTAN



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Spot Compression Paddles

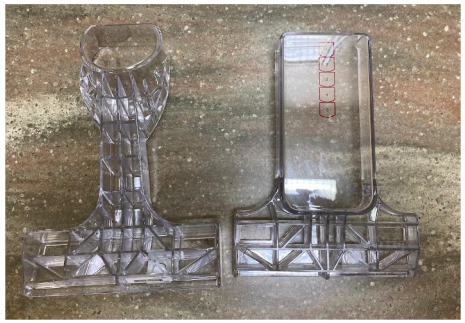

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Image Courtesy of Robyn Hadley, R.T.(R)(M)

231

Square vs Round Paddle

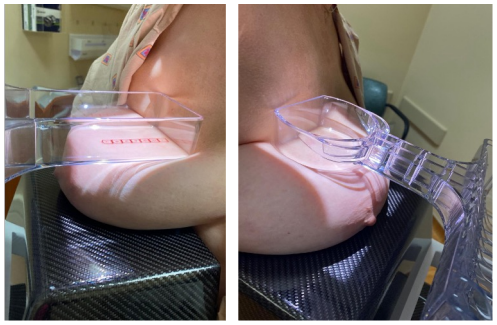

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Image Courtesy of Robyn Hadley, R.T.(R)(M)

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Spot Compression with Magnification

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Image Courtesy of Robyn Hadley, R.T.(R)(M)

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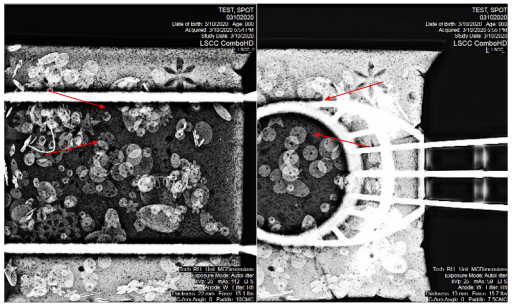
Square vs Round Paddle



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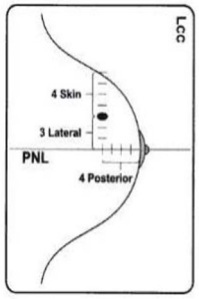

Spot/Mag Measurements

RIGHT LEFT

CC MLO LM ML

4 POSTERIOR / ANTERIOR ____

3 MED / LAT SUP / INF ____

4 SKIN ____

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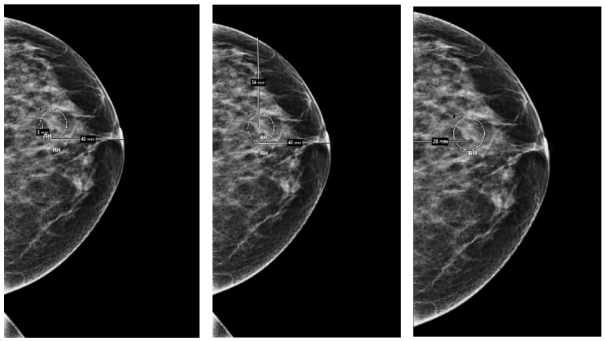

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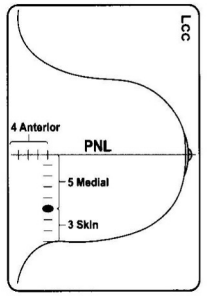

Spot/Mag Measurements

RIGHT LEFT

CC MLO LM ML

____ POSTERIOR / ANTERIOR 4

5 MED / LAT SUP / INF ____

3 SKIN ____

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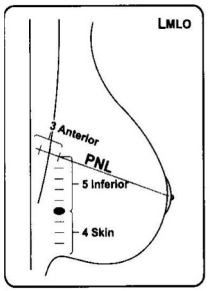

Spot/Mag Measurements

RIGHT LEFT

CC MLO LM ML

POSTERIOR ANTERIOR 3

MED / LAT SUP / INF 5

SKIN 4

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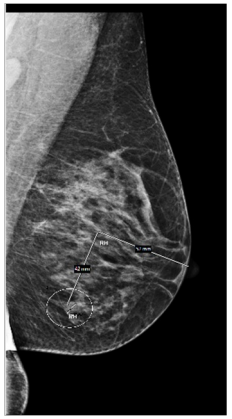

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Image Courtesy of Robyn Hadley, R.T.(R)(M)

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Remember…

- You must simulate compression when making measurements on the breast
- Mark the center of the target area with a surgical marker so you can make appropriate corrections on subsequent images, if needed

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Remember…

- **Roll views** – Used to overcome superimposition of structures by changing the orientation of the beam to the breast
- **Lateral views** – Used to overcome superimposition of structures by changing the orientation of the breast to the beam

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Rolled Views

- RCCRM – Right CC superior breast rolled medial
- RCCRL – Right CC superior breast rolled lateral

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LCCRM – Left CC Rolled Medial

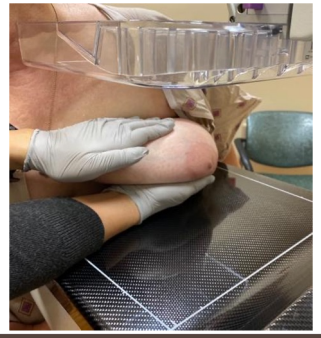

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Image Courtesy of Robyn Hadley, R.T.(R)(M)

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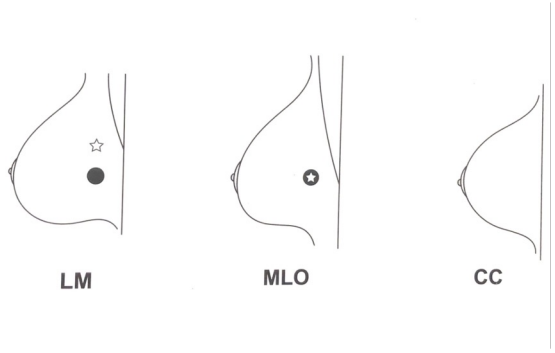
Lateral Used to Overcome Superimposition



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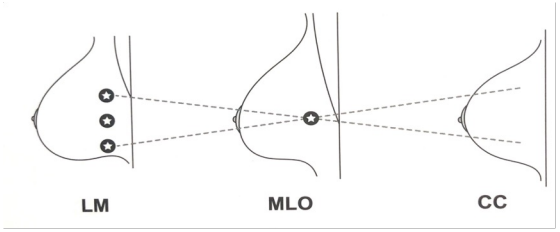
Lateral Used for Lesion Location



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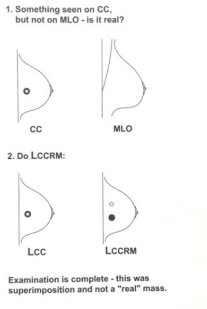
Roll View to Overcome Superimposition



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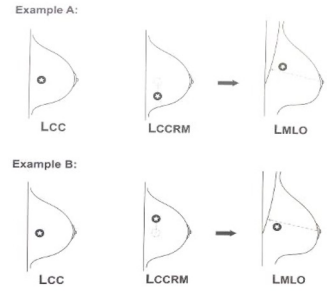
Roll View for Lesion Location



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Imaging of Augmented Breasts

- CCs views of each breast with implants in place
- MLO views of each breast with implants in place
- CCID views of each breast with implant displaced
- MLOID views of each breast with implant displaced

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Imaging of Augmented Breasts: Full Implant Views

- Should be done with only enough compression to immobilize the breast to prevent motion unsharpness
- Curved paddle can be used (if available)
- Appropriate technique (usually manual) should be used

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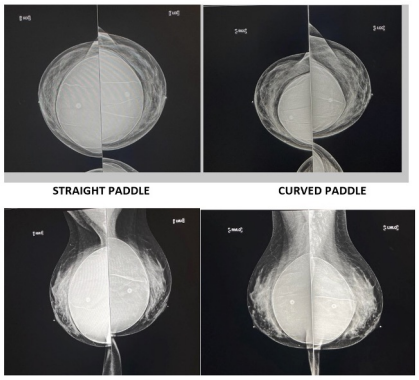

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Imaging of Augmented Breasts: ID Views

- ID views (depending on implant mobility) can be performed with taut compression
- Half paddle can be used for patients with small amount of natural breast tissue
- Appropriate technique (used for patients without implants) should be used
- Patient can be positioned from behind (with tech standing and/or patient seated)

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Half Paddle

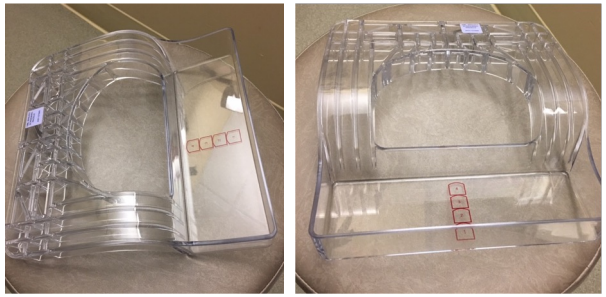

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Image Courtesy of Robyn Hadley, R.T.(R)(M)

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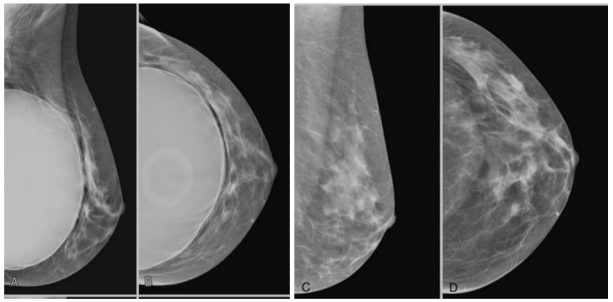
Imaging of Augmented Breasts



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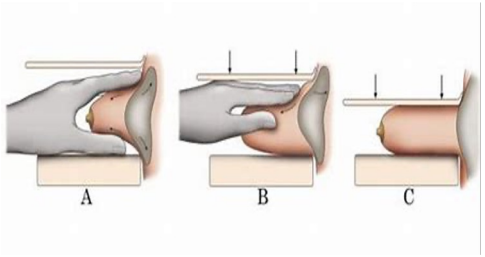
ID – Implant Displaced



Source: leberaldictionary.com

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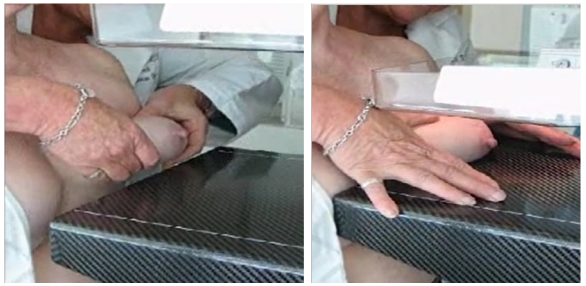
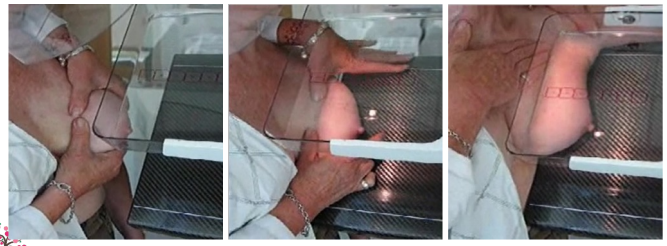
Working from Behind for CCID Views



255

Working from Behind for MLOID Views



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Conclusion

- Additional views are helpful in identifying true location of areas of concern
- They are used for diagnostic work-ups
- Can provide valuable information to aid in diagnosis of breast cancer

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References

Miller, L. C., RTRM. (2015). *Mammography Positioning Guidebook*. CA: Mammography Educators.

Miller, L. C., R.R.(R)(M)(ARRT), Lehmann, T. L., B.S. R.T. (R)(M)(ARRT). (2020). *Image Quality & Positioning Problem-Solving for Breast Imagers: Meeting EQUIP Standards* (1st ed.). San Diego, California: Mammography Educators.

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Derenberger, Dawn, Hadley, Robyn., "Most Commonly Used Additional Views, Part 3: Defining Structures and Clarifying Presence of Abnormalties." SBI News Issue 1, 2021, https://mammographyeducation.com/most-commonly-used-additional-views-part-3-defining-structures-and-clarifying-presence-of-abnormalities/

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Mission and Motivation: The Critical Role of the Mammographer

Louise Miller, R.T.(R)(M)(ARRT), CRT(M), FSBI, FNCBC
Director of Education, Mammography Educators

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What's Changed?

- Cardboard cassette to Xerography
- Xerography to FS
- FS to FFDM
- FFDM to DBT

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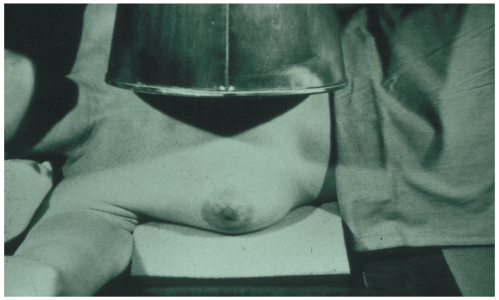
Cardboard Cassettes



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Xerography

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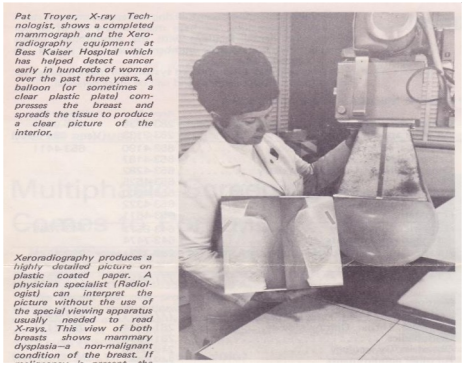

Pat Troyer, X-ray Technologist, shows a completed mammograph and the Xeroradiography equipment at Bess Kaiser Hospital which has helped detect cancer early in hundreds of women over the past three years. A balloon (or sometimes a clear plastic plate) compresses the breast and spreads the tissue to produce a clear picture of the interior.

Xeroradiography produces a highly detailed picture on plastic coated paper. A physician specialist (Radiologist) can interpret the picture without the use of the special viewing apparatus usually needed to read X-rays. This view of both breasts shows mammary dysplasia—a non-malignant condition of the breast. If

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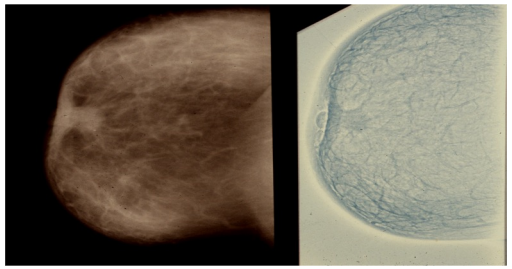
Film/screen vs. Xerox



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Full Field Digital Mammography

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Digital Breast Tomosynthesis

- This technology has been tested since the 1990s
- Invented by Dr. Daniel Kopans at Harvard Medical School/Massachusetts General Hospital
- Approved by the FDA in 2011

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FS - FFDM - DBT

- Increased width in face shield
- Increased thickness and length of IR compared to the bucky

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With change comes challenge *and* opportunity.

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Change Is Not Easy

- It is challenging
- It is something different
- It CAN be fun!!

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How you approach change will directly affect success!

BE POSITIVE!!

AND STAY CALM……

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STAY FOCUSED ON WHAT IS IMPORTANT

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Motivation and Mission

Patients and Perspective

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Motivation

- How do we motivate others?
- How do we keep ourselves motivated?

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Mission

- Our aspirations as individuals
- Our aspirations as a group

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Patients

Why we do what we do.

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Perspective

How we look at things.

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DISTORTED PERSPECTIVE

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Burnout and Stress

278

In Times of Stress

- Remember your mentor or someone you have mentored
- Remember the patient who thanked you for being kind
- Remember something that was personal and positive related to your work

279

This is personal!

Each and every patient belongs to someone.

Take the time to see them as such.

280

Remembering this will help us focus on the commitment we have made as health CARE professionals.

281

ARE YOU TOO BUSY?

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What about your commitment to your work?

Why are you doing this in the first place?

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Committed to a Cause

- Gives us a sense of competence about ourselves and others
- Helps us focus our energy
- Is a positive outlet for our energy
- Creates a positive identification
- Connects us with our spiritual self

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When We Are Committed

- Emotional support
- Empathy
- Engage with our self and others
- Utilize our inner resources to guide us

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285

Committed to a Cause

- Gives us a sense of competence about ourselves and others
- Helps us focus our energy
- Is a positive outlet for our energy
- Creates a positive identification

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Committed to a Cause

- We benefit emotionally
- Create interdependence
- Add to our mental well-being

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COMMITTED TO COMPASSION

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HAVING PRIDE IN WHAT YOU DO

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PRIDE

Acknowledging all that you have… and all that you have accomplished with humility… but without arrogance.

290

Individual and Collective Pride

Experiences in which we can say… "I… we… did this well."

291

Being of service to one another… one colleague, one patient, one life at a time, one moment at a time is essentially what the role of the breast health professional is all about….

292

Being proud of What you do… And your special role as a link in the chain of life.

293

Pride we can feel when we are…

- Kind
- Compassionate
- Mentoring
- Teaching
- Motivating
- Sharing
- Healing
- Helping

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Making a Difference

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This is personal…

Each and every patient belongs to someone.

Take the time to see them as such.

The quality of their exam depends on YOU!

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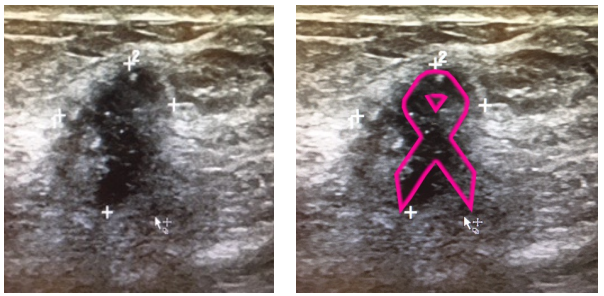

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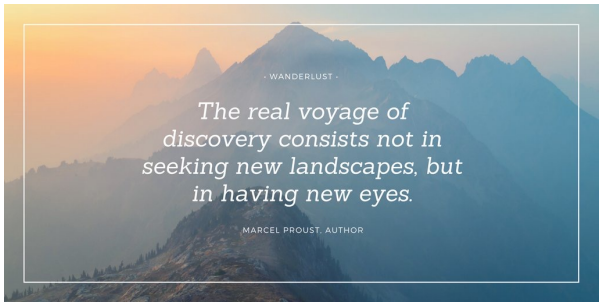

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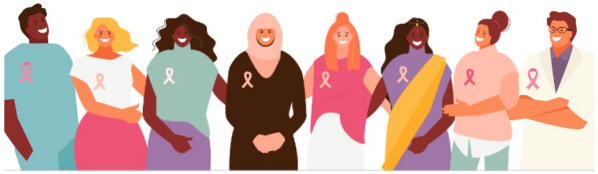

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