Clinical Image Evaluation for Mammography Technologists

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

MAMMOGRAPHY EDUCATORS

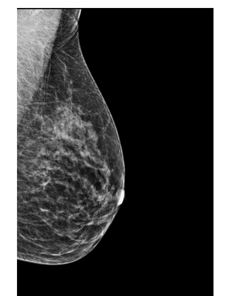
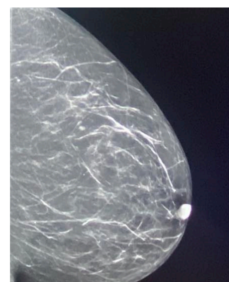
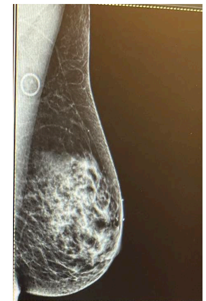
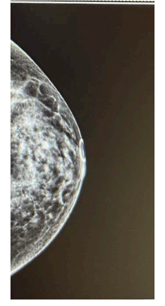
© 2024 Mammography Educators

Categories

- Positioning
- Compression
- Exposure level
- Contrast
- Sharpness
- Noise
- Artifacts
- Exam ID

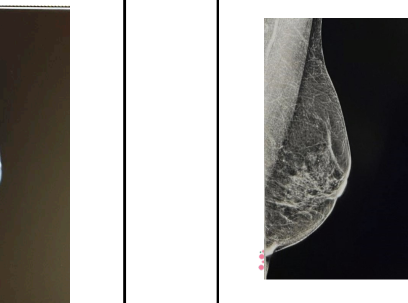
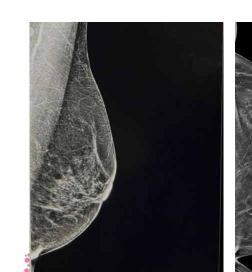
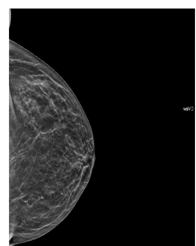
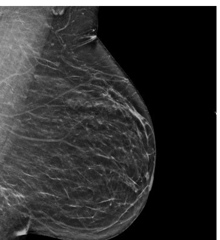
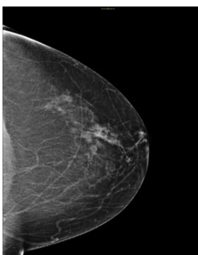
MAMMOGRAPHY EDUCATORS

Positioning… Positioning… Positioning

MAMMOGRAPHY EDUCATORS

Positioning… Positioning… Positioning

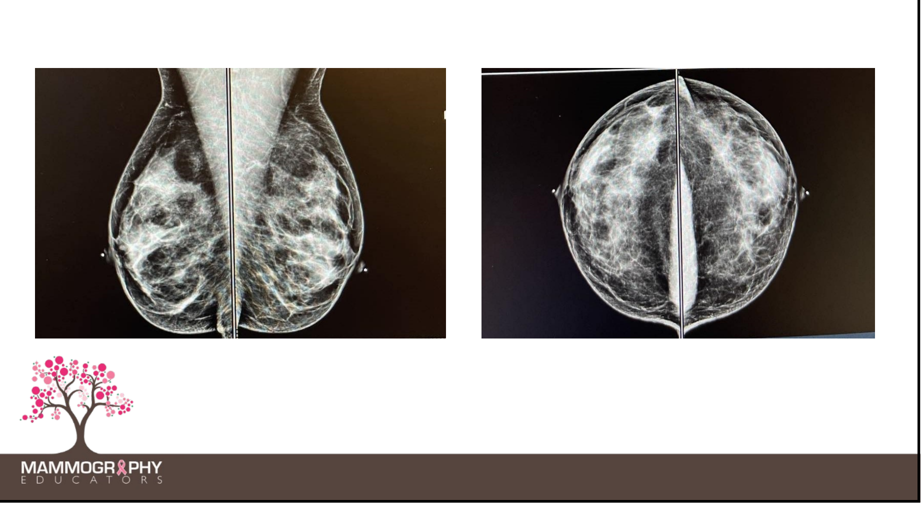
MAMMOGRAPHY EDUCATORS

Meeting the Criteria

- Images for ACR accreditation
- Images that meet image quality criteria

Images for ACR Accreditation

Needs to be a representation of your BEST work… In other words, almost perfect.

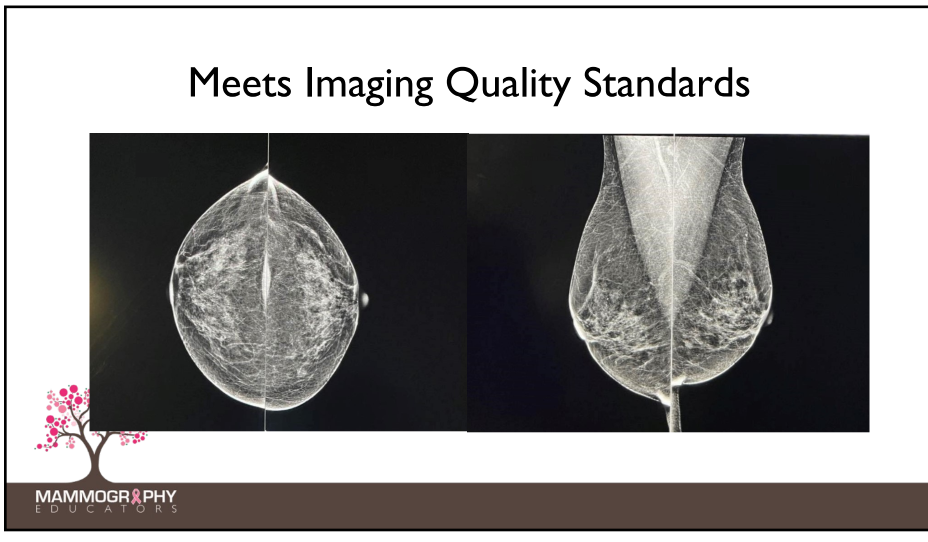


Meeting Image Quality Standards*

- Positioning deficiencies do not impede diagnosis.
- Images that meet basic quality standards
  - Adequate PNL measurement
  - Nipple in profile in one of two views
  - Length of muscle on MLO
  - Minimal IMF (can have folds)

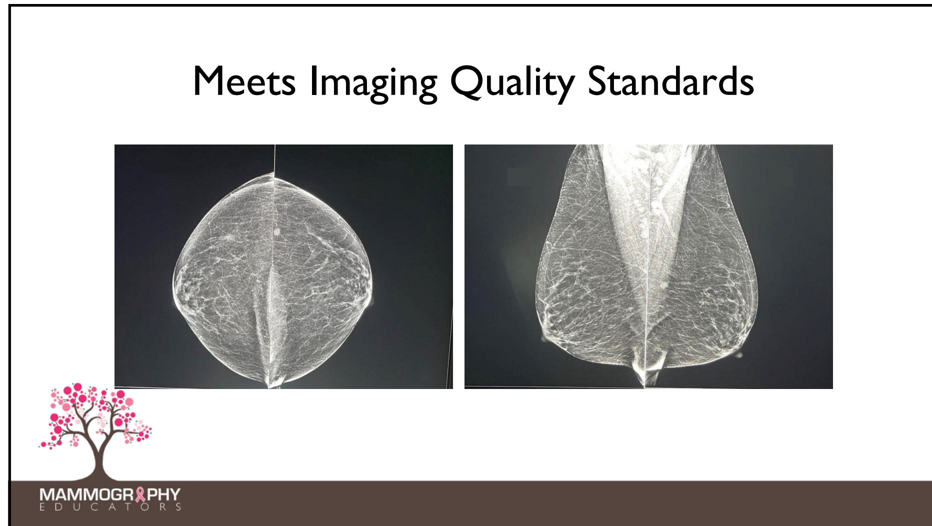
*Unless patient circumstances do not allow for adequate imaging *which must be documented*!

Meets Imaging Quality Standards



MAMMOGRAPHY EDUCATORS

Meets Imaging Quality Standards



MAMMOGRAPHY EDUCATORS

Reasonable Expectations

Even after technologists received the most up to date standardized positioning techniques, approximately 1/3 of all patients did not meet acceptable image criteria.

MAMMOGRAPHY EDUCATORS

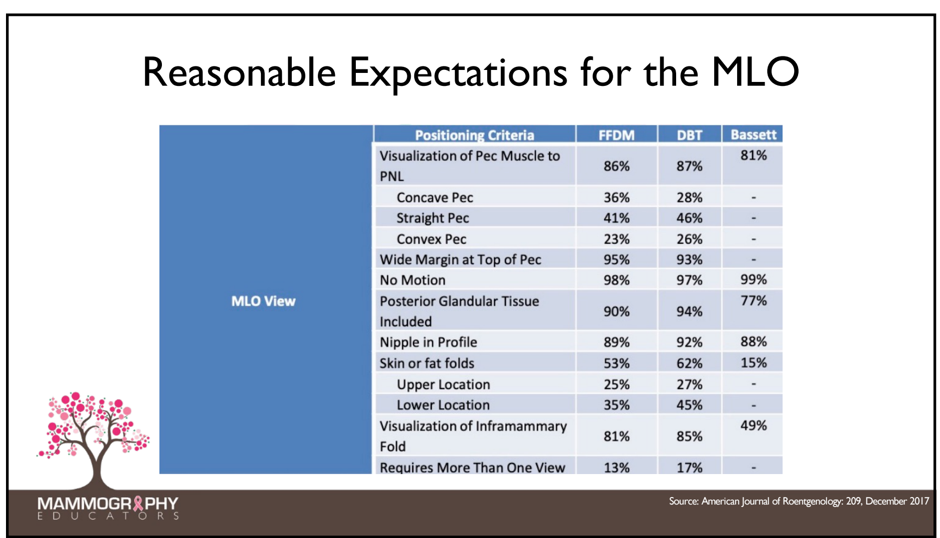
Source: American Journal of Roentgenology: 209, December 2017

Variables That May Compromise Image Quality

- Patient weight and height
- Breast size, shape, mobility, tenderness
- Lack of patient cooperation
- Mobility/stability issues
- Developmentally disabled
- Congenital abnormalities
- Limited ROM
- Dementia/Alzheimer's
- Elderly/infirm
- Body habitus

Should be noted by technologist and dictated into report.

MAMMOGRAPHY EDUCATORS



Reasonable Expectations for the MLO

	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%	-

13

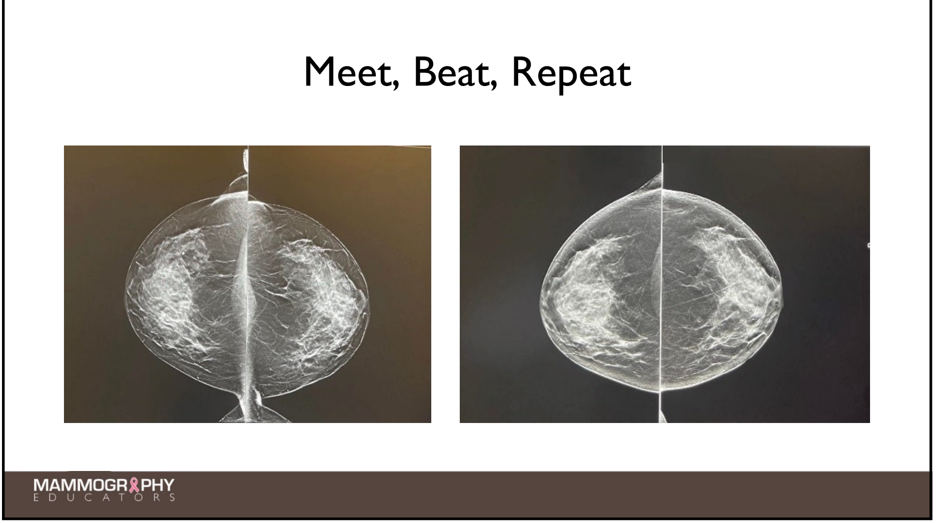
Reasonable Expectations for the CC

	Positioning Criteria	FFDM	DBT	Bassett
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%	-

MAMMOGRAPHY EDUCATORS

Source: American Journal of Roentgenology: 209, December 2017

14



15

Critical Factors

- Positioning techniques used by technologists are not standardized or consistent so image quality can be widely variable especially when comparing images to previous studies
- While technologists can identify imaging deficiencies, they are often unable to identify specific corrective actions needed to improve the image

MAMMOGRAPHY EDUCATORS

16

There are only **2** factors that cause positioning problems that result in insufficient images*…

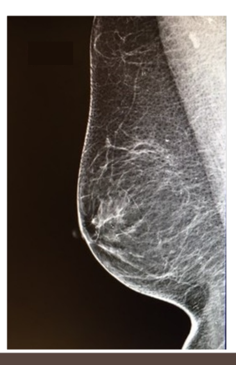
1. **Equipment**: the way the machine is set-up: height of the IR, angle and compression paddle size
2. **Patient**: the way the patient is "set-up": both feet, hips and shoulders facing forward (for all views except the XCCL)

*Excluding patient limitations described previously

MAMMOGRAPHY EDUCATORS

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



MAMMOGRAPHY EDUCATORS

The MLO View

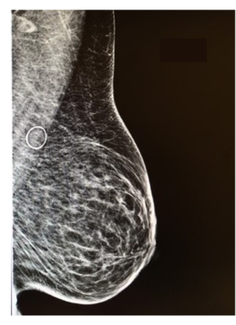
Visualization of the pectoral muscle:

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

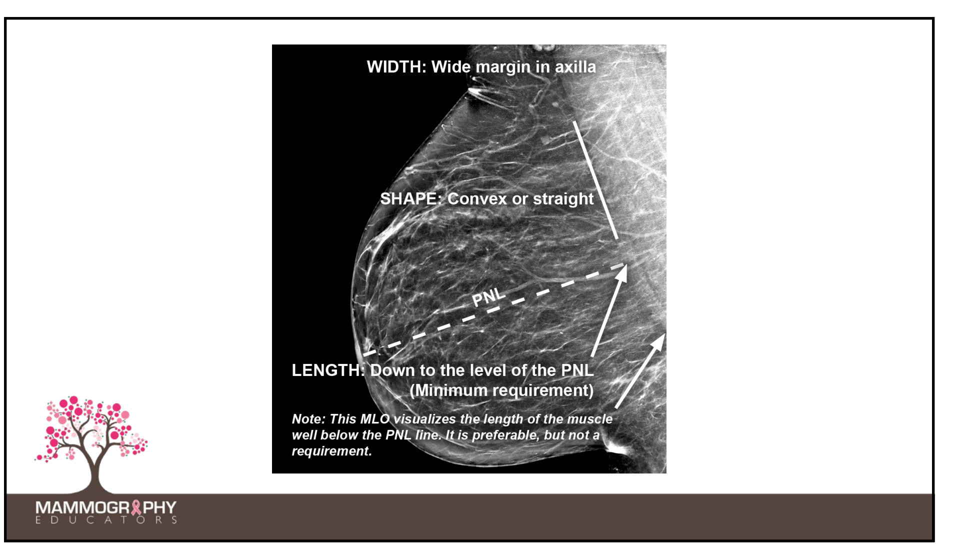
MAMMOGRAPHY EDUCATORS

The MLO View

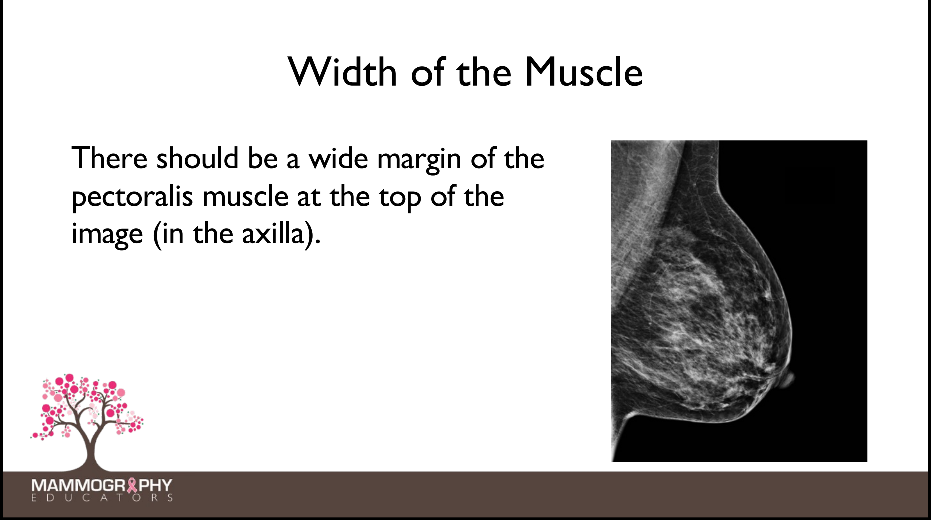
- **Width**: wide margin at the top (axilla)
- **Length**: down to the level of the PNL
- **Shape**: Convex/straight



MAMMOGRAPHY EDUCATORS



21

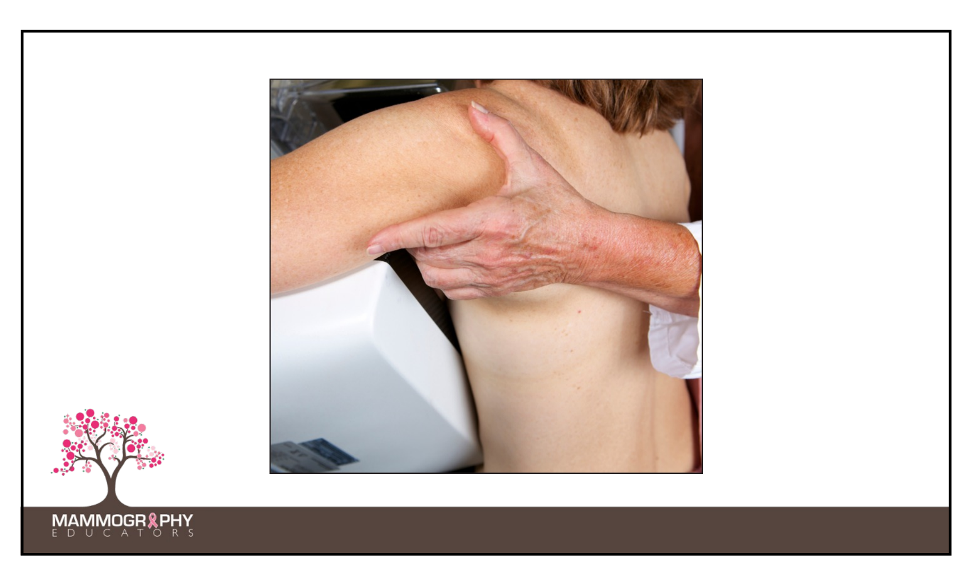


22

Width of the Muscle – Equipment

- Related to the placement of the IR in the axilla
- The back corner of the IR should be placed just anterior to the latissimus dorsi

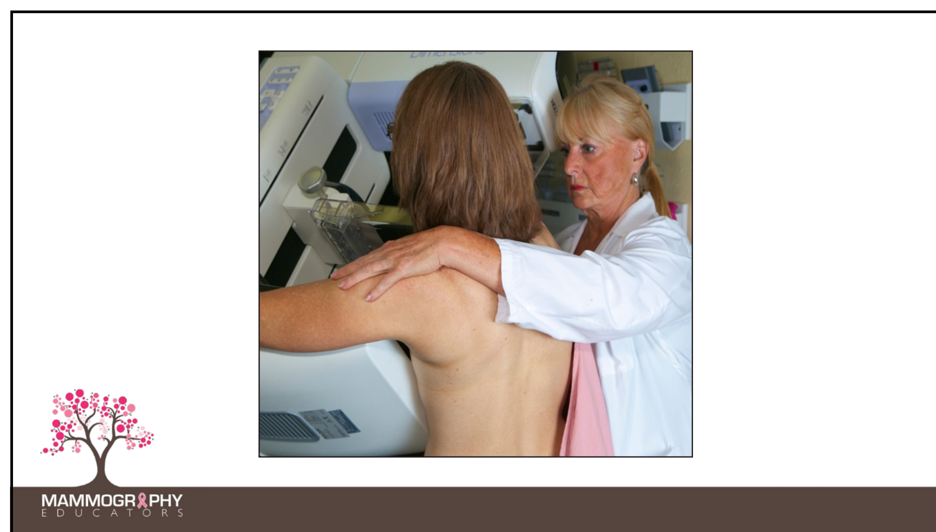
23



24

Width of the Muscle – Patient

- Related to the position of the patient
- Patient must be turned into the machine with feet, hips and shoulder as far forward as possible, with their shoulder down, relaxed and pulled forward and can be held in position by the technologist (if possible)

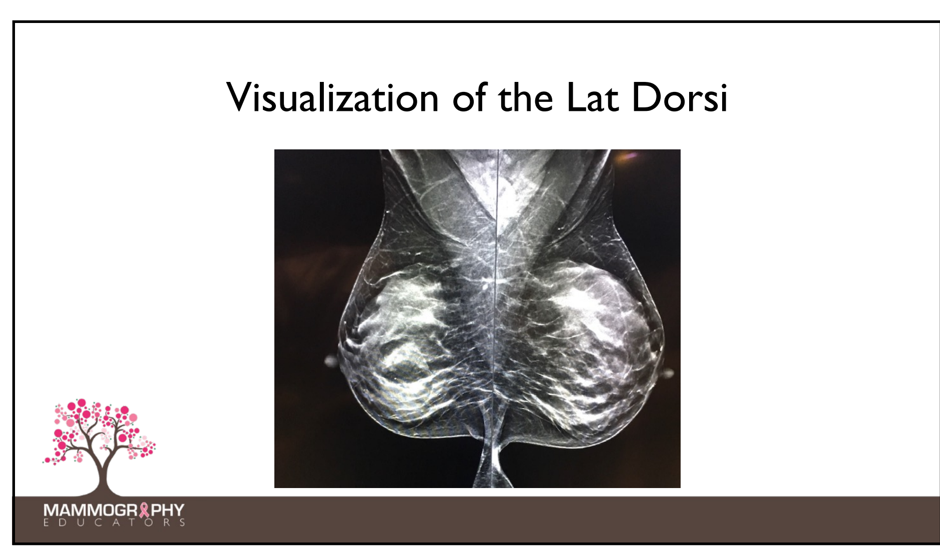


MAMMOGRAPHY EDUCATORS

Width of the Muscle

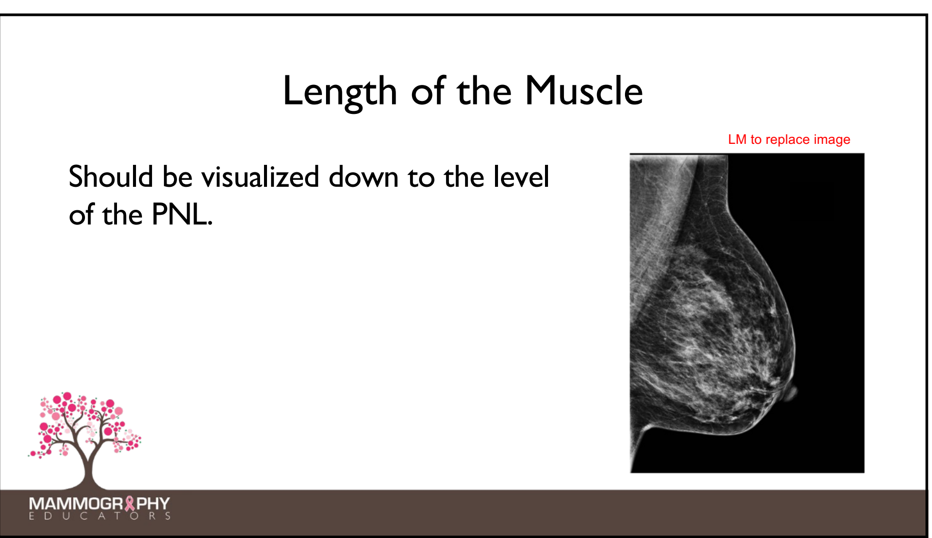
MAMMOGRAPHY EDUCATORS

Visualization of the Lat Dorsi



MAMMOGRAPHY EDUCATORS

Length of the Muscle



Should be visualized down to the level of the PNL.

MAMMOGRAPHY EDUCATORS

29

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 breast
- Lesser angles for shorter thoraxes and larger breasts

MAMMOGRAPHY EDUCATORS

30

Proper degree of angulation.

Pectoralis Muscle Seen on Mammogram

PNL

Angle too steep.

Muscle (and Breast Tissue) Not Seen

MAMMOGRAPHY EDUCATORS

31

Recommended Angulation for MLO

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

MAMMOGRAPHY EDUCATORS

32

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

*Note: 35 degrees for patients who have undergone reduction

Keep Angles Consistent

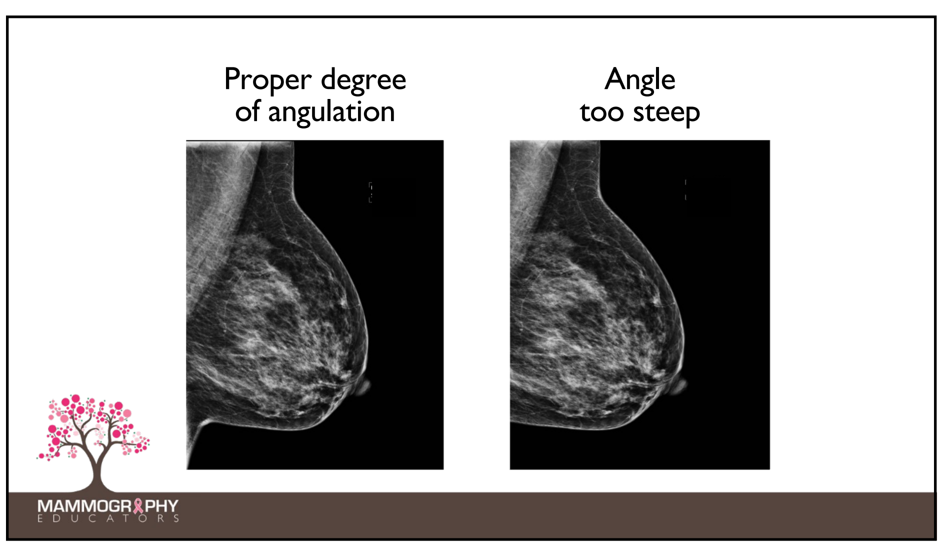
- Use variations of 5-degree increments
- No more 47, 42, 48, 53 etc.

Keep Angles Consistent

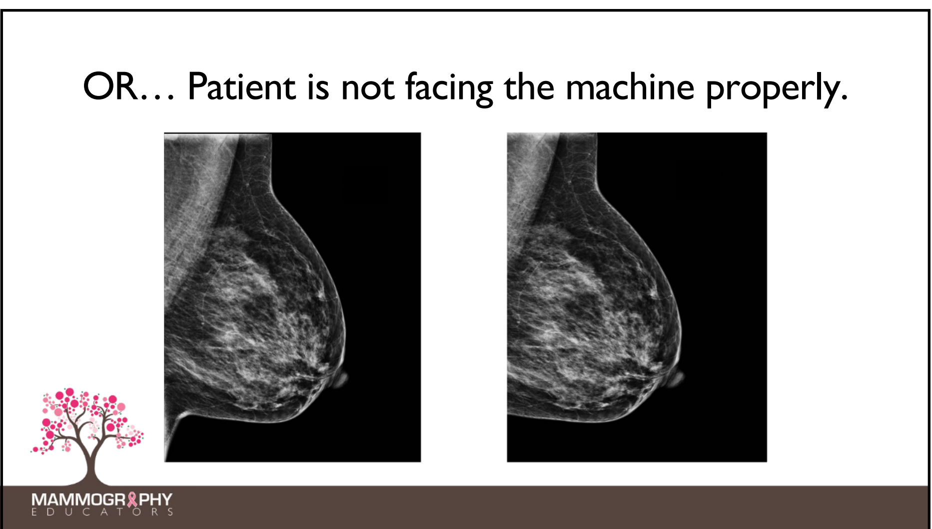
- I am **not** saying to NEVER use 35 or 55, but try to keep it consistent, so comparison is easier from year to year
- An MLO angled at 56-degrees one year will look markedly different than an MLO angled at 42-degrees the next year

Length of the Muscle – Patient

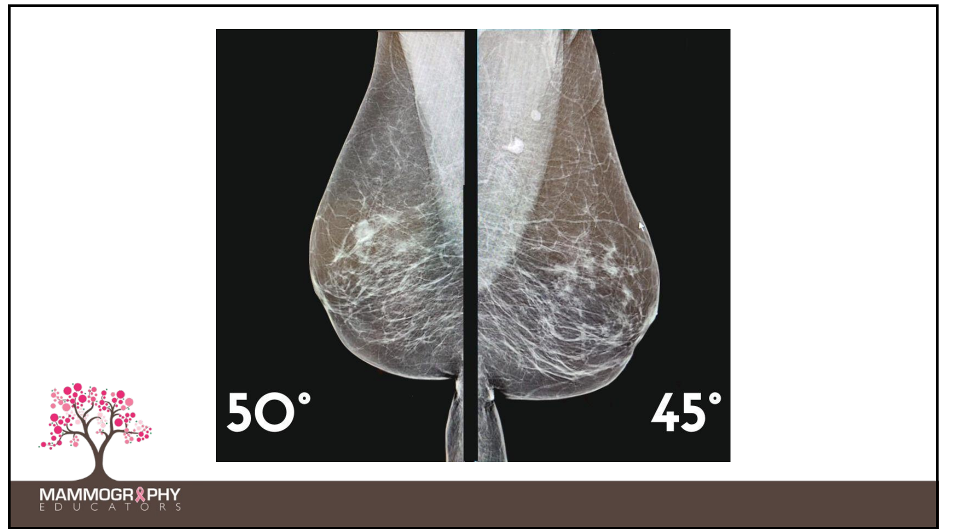
- Related to the position of the patient
- The patient must be turned into the machine with both feet, hips and shoulders as far forward as possible, as not to impede progress of the compression paddle



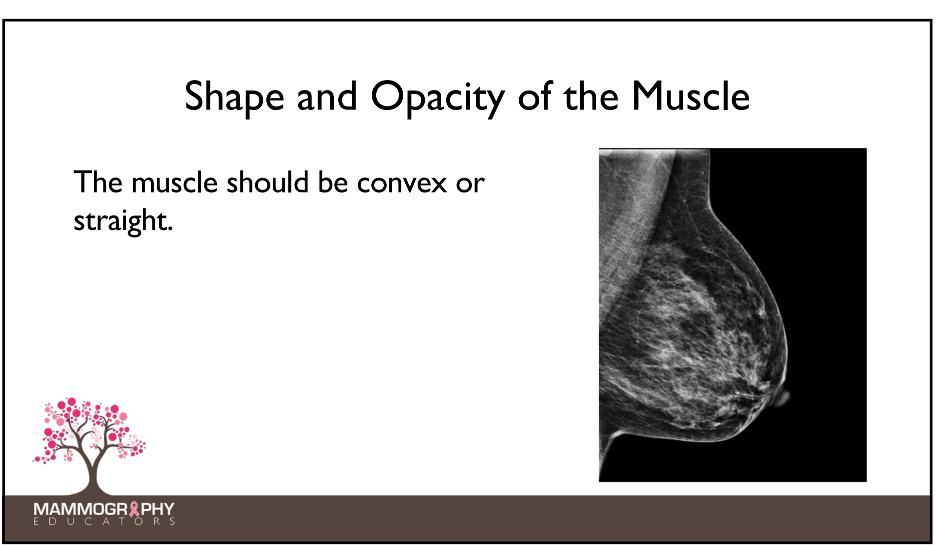
37



38



39



40

Shape and Opacity of Muscle – Equipment

- Related to the height of the IR
- Top of IR should be positioned at the height of the sternoclavicular joint, or halfway between the top of the shoulder and the axillary crease

41

Shape and Opacity of Muscle – Patient

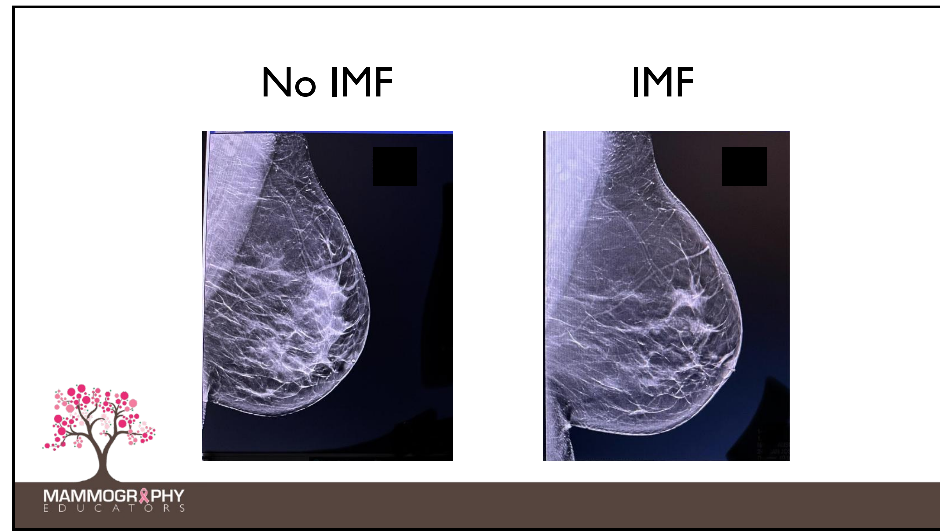
- Related to relaxation of pectoralis muscle
- Patient's shoulder, arm and hand must be relaxed with the elbow bent and relaxed behind the image receptor

42

Problems with the MLO

- No visualization of the IMF
- Folds in the IMF
- Breast drooping
- Breast not centered

43



44

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

- Patient must be facing forward with both feet
- Lower front corner of the IR should be directly below the plane of the patient's nipple or half between her ASIS and umbilicus
- This requires the patient taking a "side step" towards the technologist

MAMMOGRAPHY EDUCATORS

45

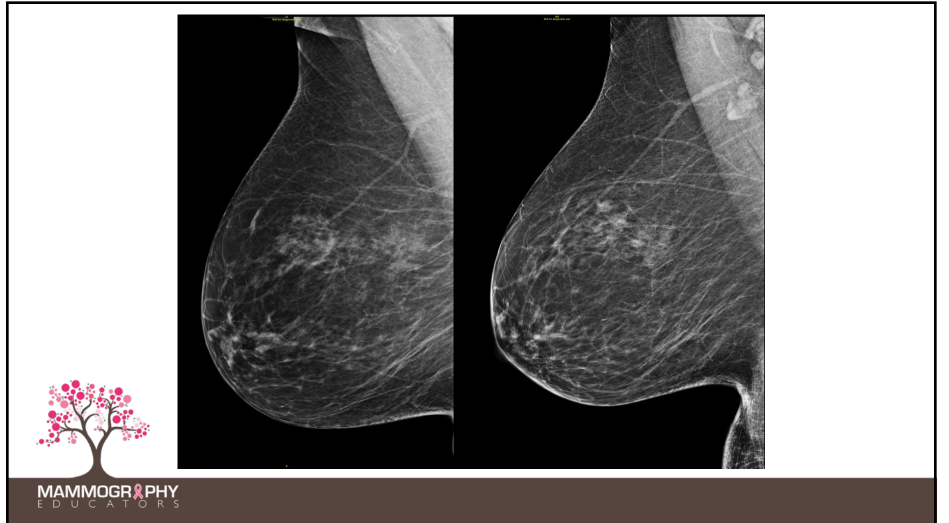
Improper
Edge of IR in front of IMF

Proper
Edge of IR in behind IMF

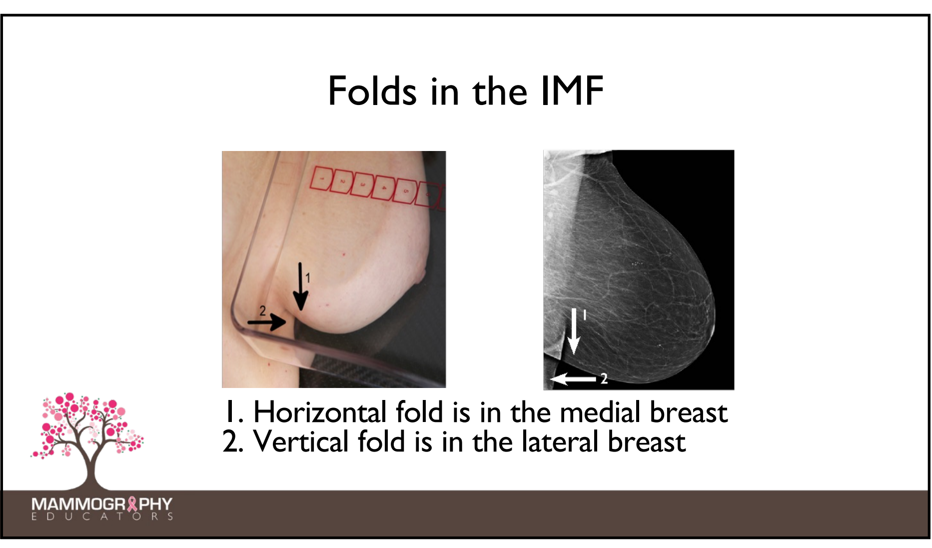
Top edge of IR indicated by vertical dotted line

MAMMOGRAPHY EDUCATORS

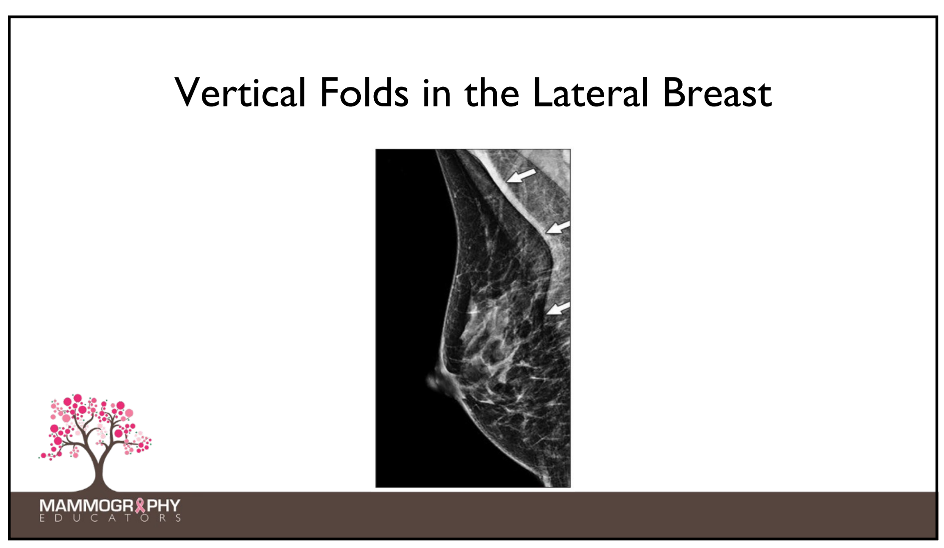
46



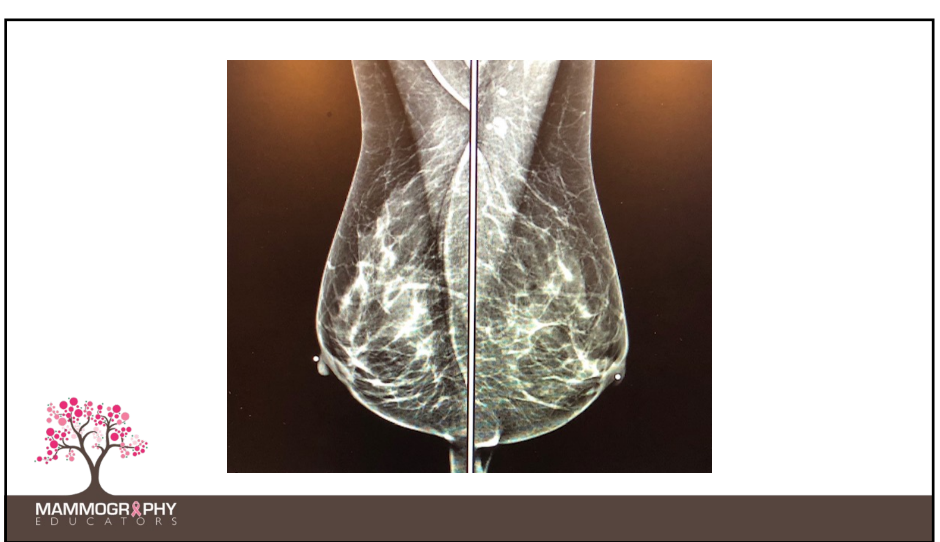
47



48

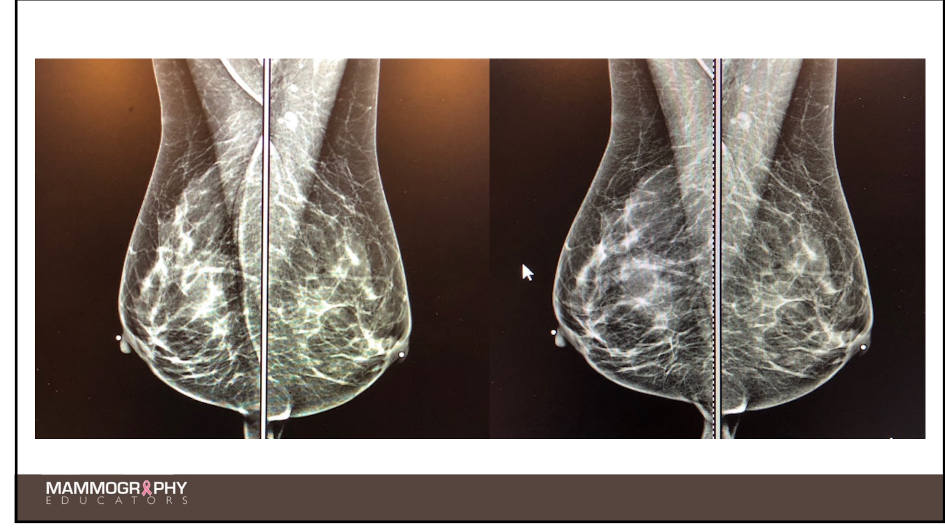


49



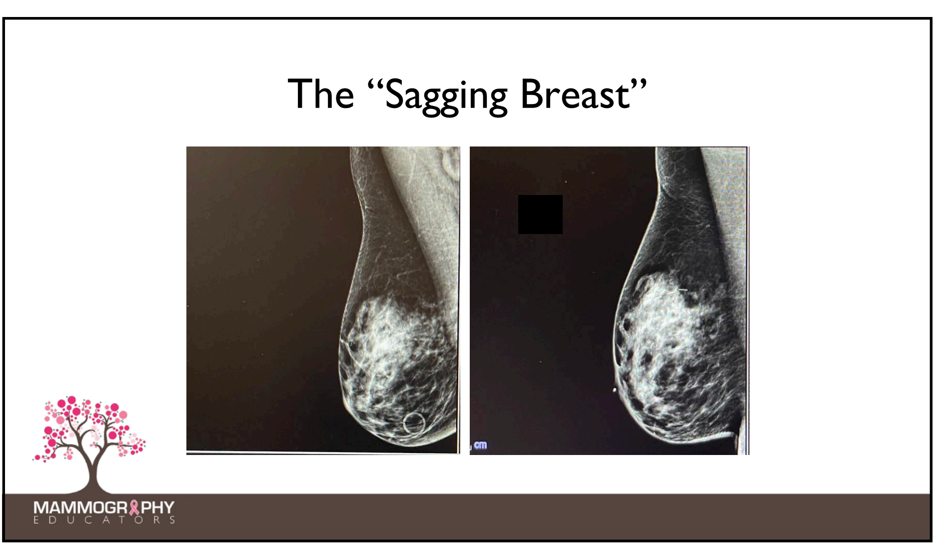
50

51

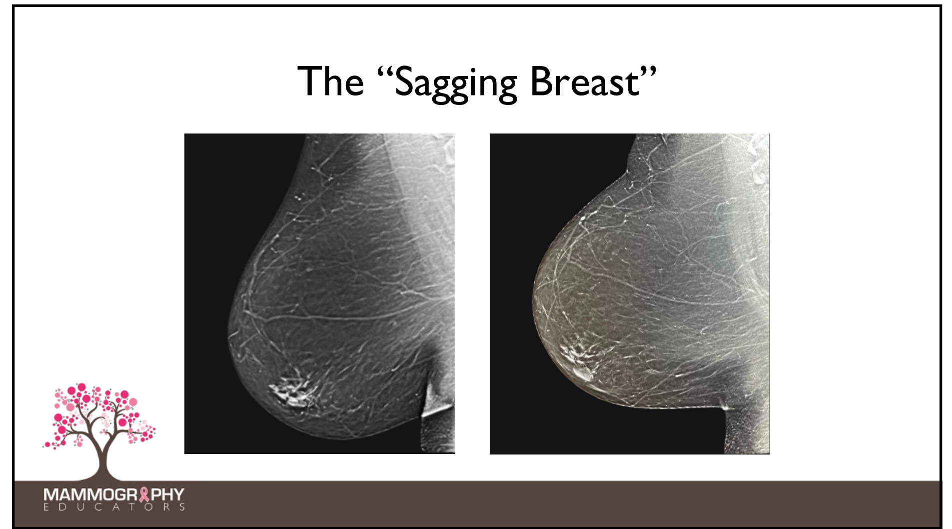


52

53



54



55

56

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
- Have the patient lift and flatten the contralateral breast

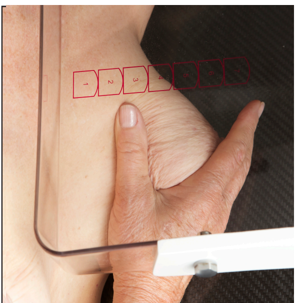
57

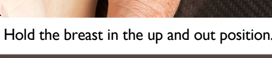
Maintain the Breast in the "Up and Out" Position*

- Keep the nipple as close as possible to perpendicular to the chest wall.
- Don't let go of the breast until compression **is complete.**

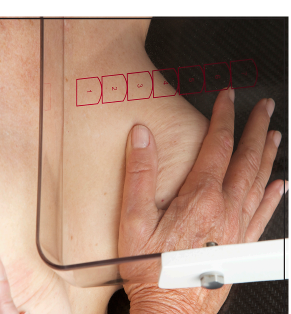
**This will help eliminate the "sagging breast"*

58



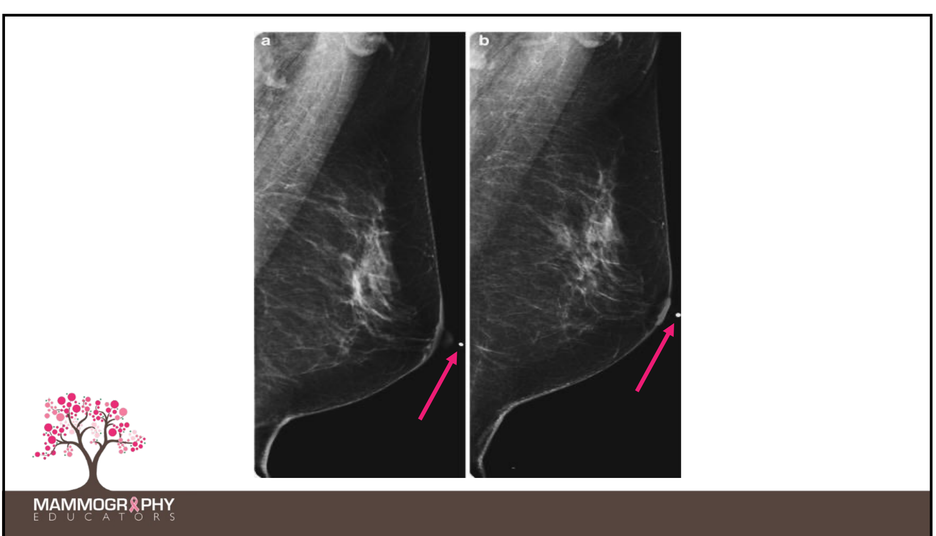


Hold the breast in the up and out position.

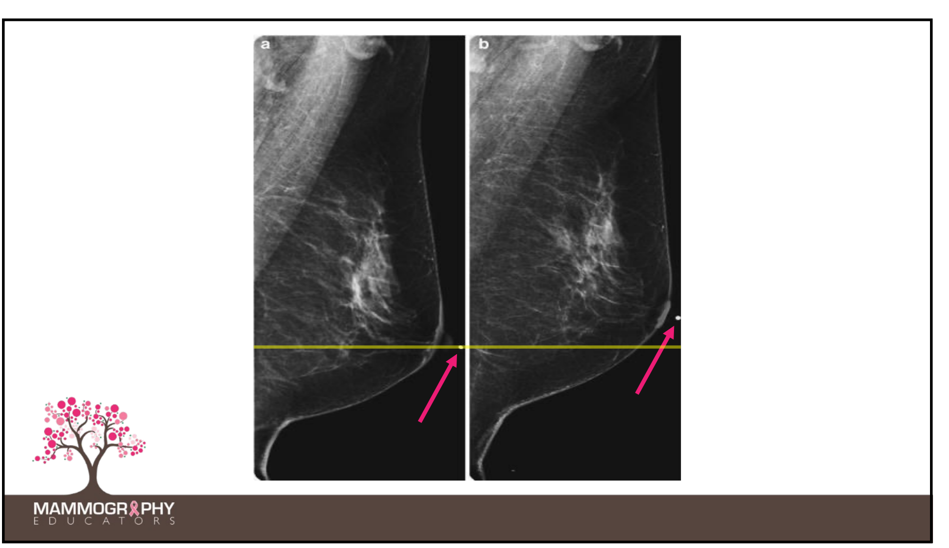


Compress.

59



60



61

62

Solution for Breast Not Centered

- Large compression paddle is needed for the CC due to the width of the breast
- If the patient has a short thorax, the compression paddle should be changed to the small size for the MLO*
- Paddle size should be consistent for the same view of each breast

*There is no published literature that states that changing the compression paddles between views is *not* recommended.

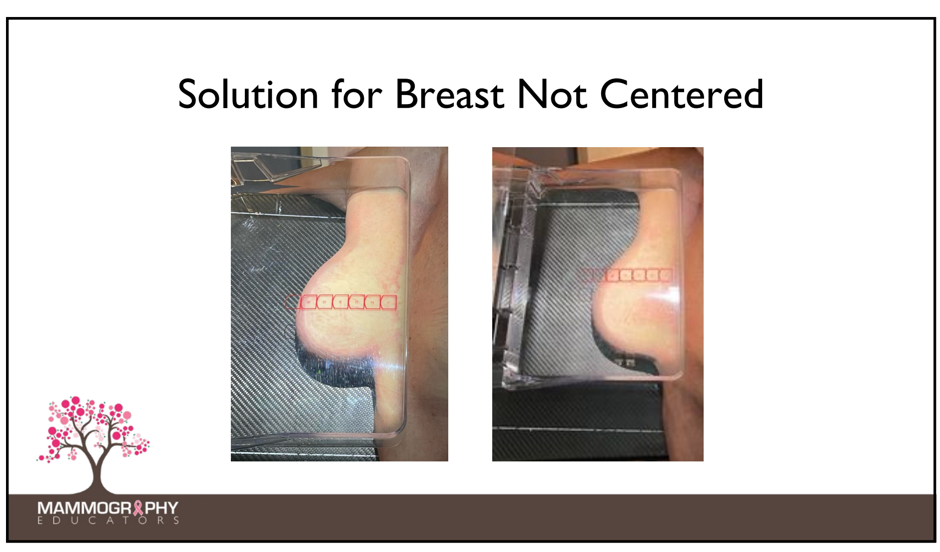
MAMMOGRAPHY EDUCATORS

63

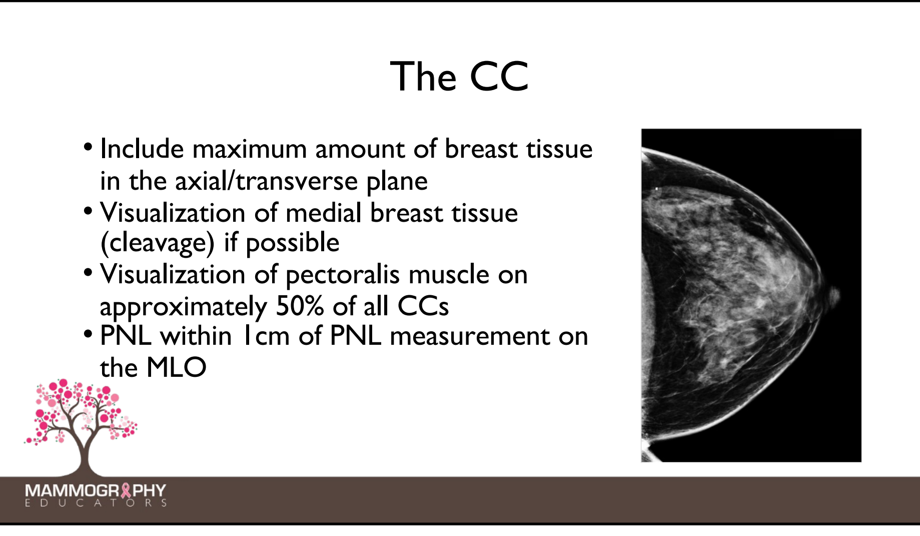
Solution for Breast Not Centered

MAMMOGRAPHY EDUCATORS

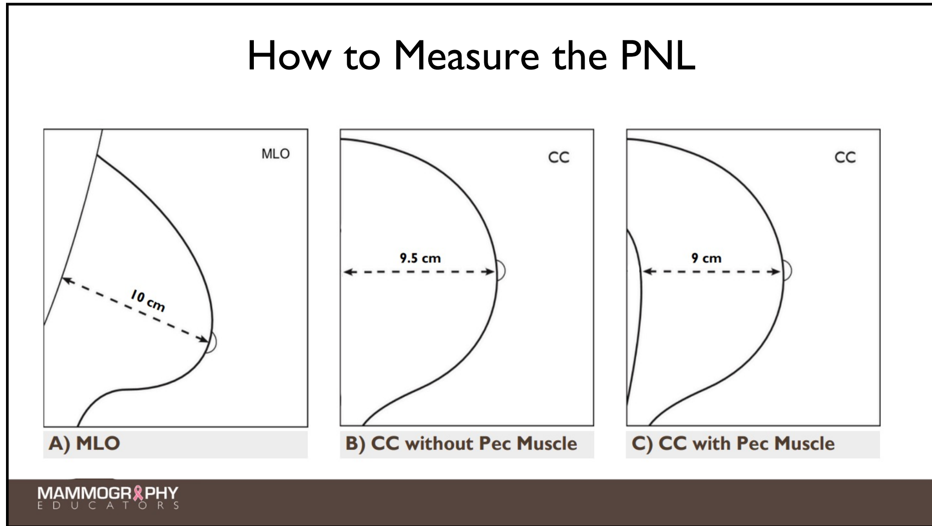
64



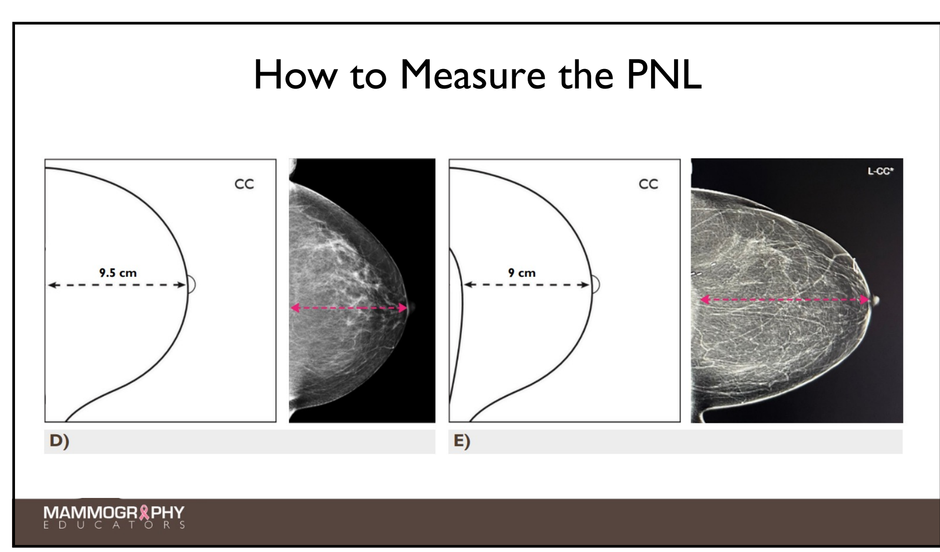
65



66



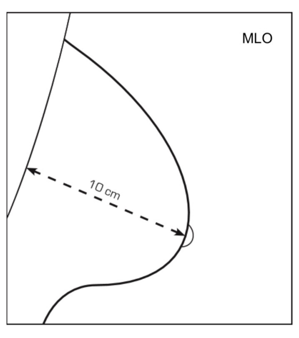
67



68

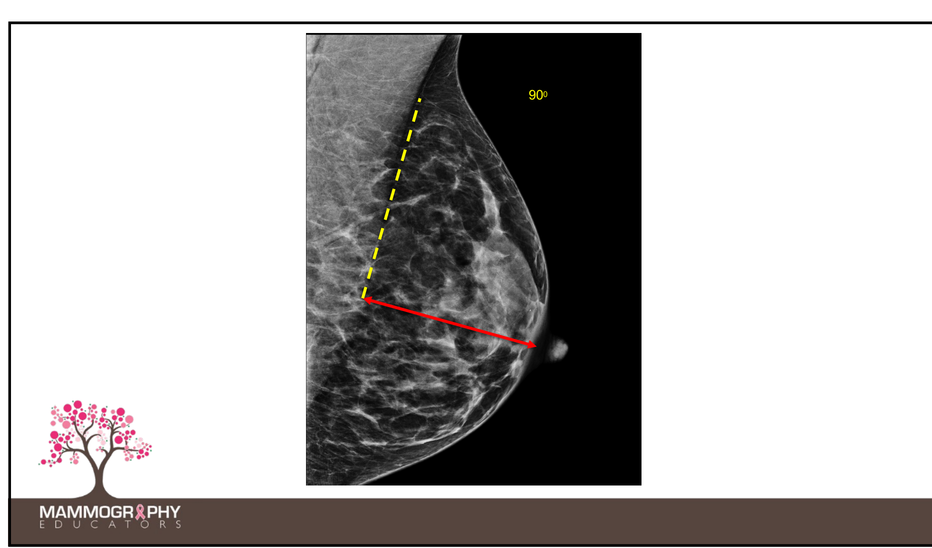
Measurement of the MLO

Measure from the base of the nipple to the anterior margin of the pectoralis muscle where the intersection can be measured as a 90-degree angle.



MAMMOGRAPHY EDUCATORS

69



MAMMOGRAPHY EDUCATORS

70

MAMMOGRAPHY EDUCATORS

71

Is it the Equipment or the Patient?

Equipment:

- IR too high or too low
- Compression paddle size

Patient:

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

MAMMOGRAPHY EDUCATORS

72

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

MAMMOGRAPHY EDUCATORS

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

MAMMOGRAPHY EDUCATORS

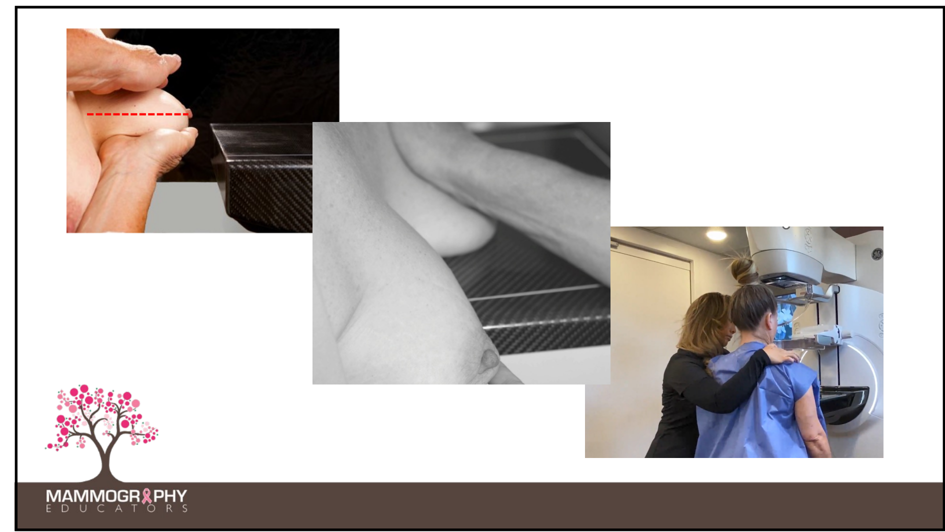
The CC

Common problems:

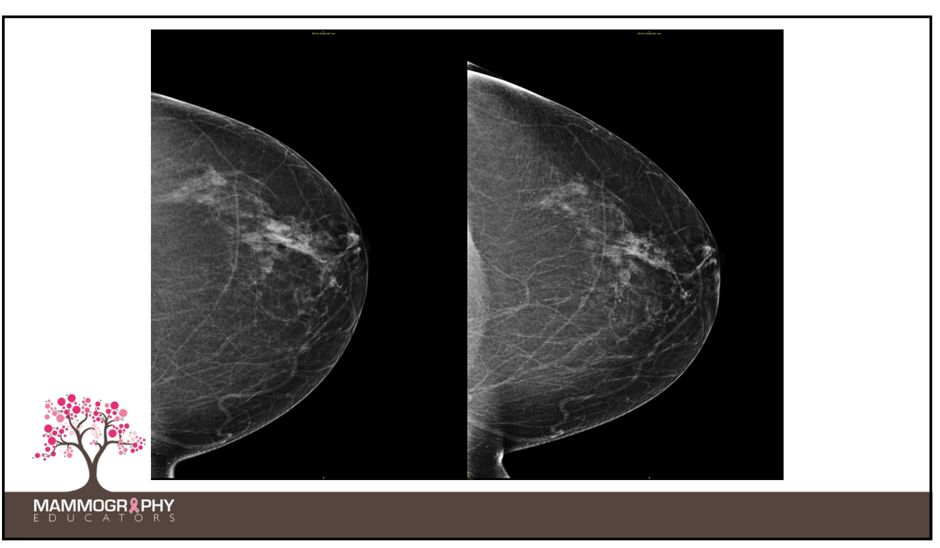
- Short CC (PNL measurement on CC is less than 1 cm of PNL measurement on the MLO)
- No pec muscle (remember the 50% rule!)
- No visualization of deep medial breast tissue (cleavage)

All are most often related to *positioning technique,* vs. equipment and patient position. (Although they are still important!)

MAMMOGRAPHY EDUCATORS



MAMMOGRAPHY EDUCATORS



77

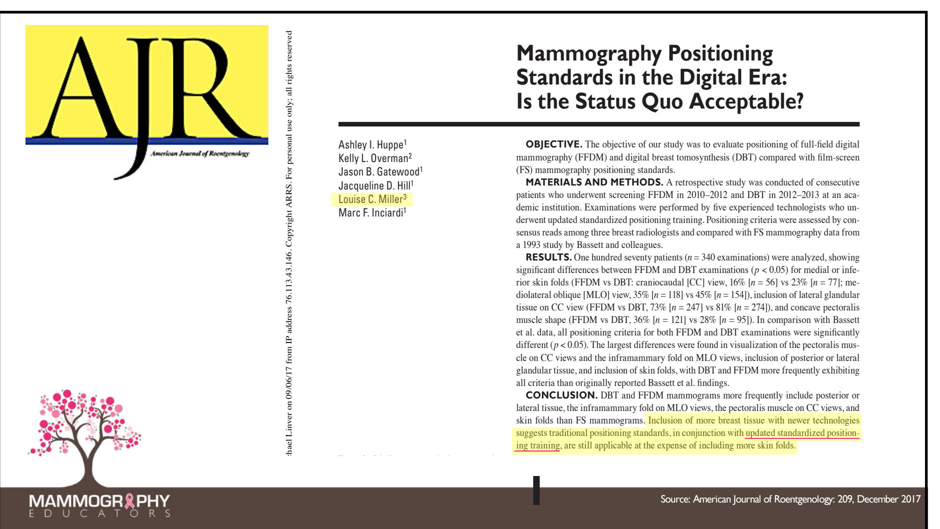
What my 35+ years of experience tell me…

If the tech has the machine set up properly and uses standardized positioning techniques it is almost always the position of the patient that causes the deficiency.

You need data! The recommendations made in this lecture are based on scientifically proven techniques.

MAMMOGR PHY
EDUCATORS

78



AJR
American Journal of Roentgenology

...hael Linver on 09/06/17 from IP address 76.113.43.146. Copyright ARRS. For personal use only; all rights reserved

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

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

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, 16% [$n = 56$] 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% [$n = 274$]), and concave pectoralis muscle shape (FFDM vs DBT, 36% [$n = 121$] 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.

MAMMOGR PHY
EDUCATORS

Source: American Journal of Roentgenology: 209, December 2017

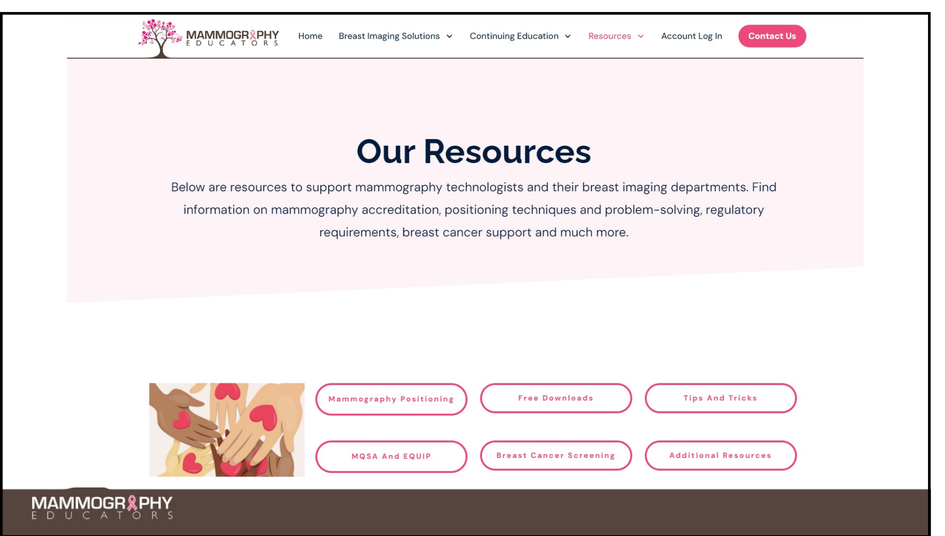
79

FREE RESOURCES AND VIDEOS

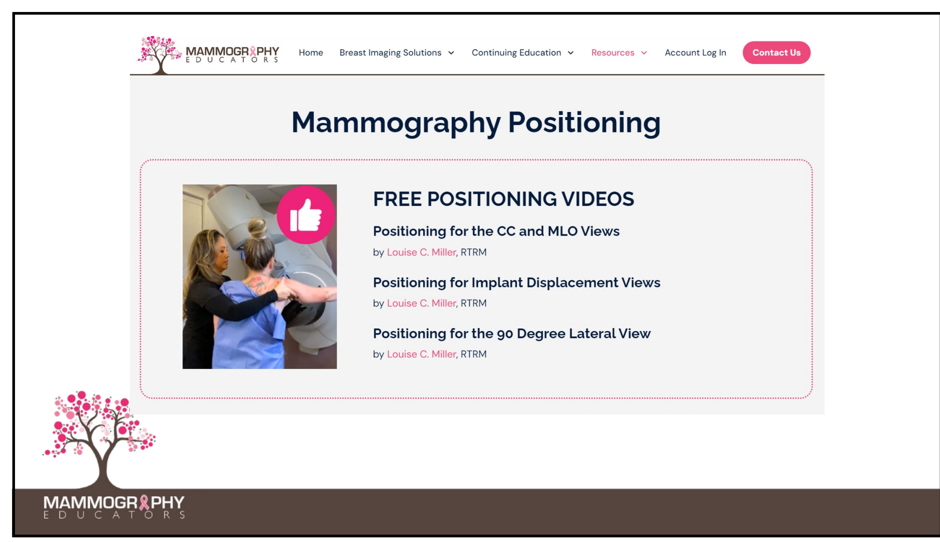
www.mammographyeducators.com

MAMMOGR PHY
EDUCATORS

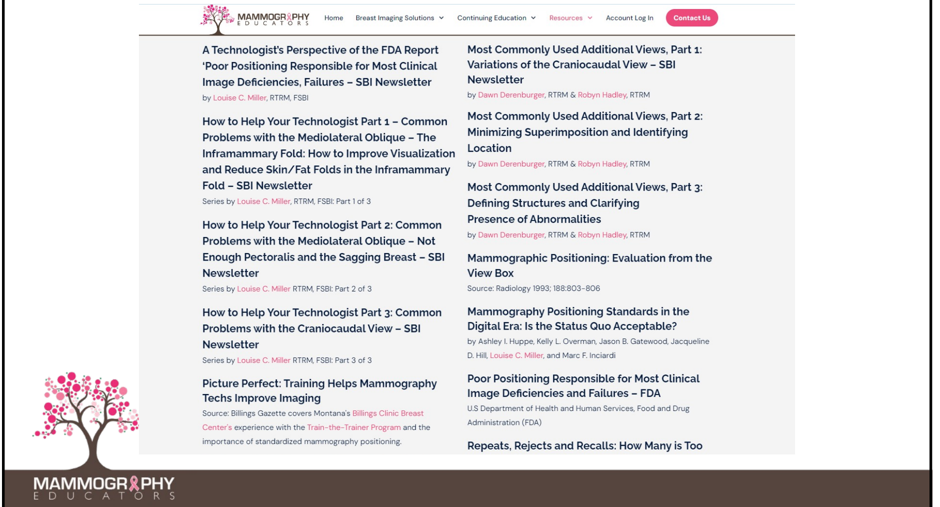
80



81



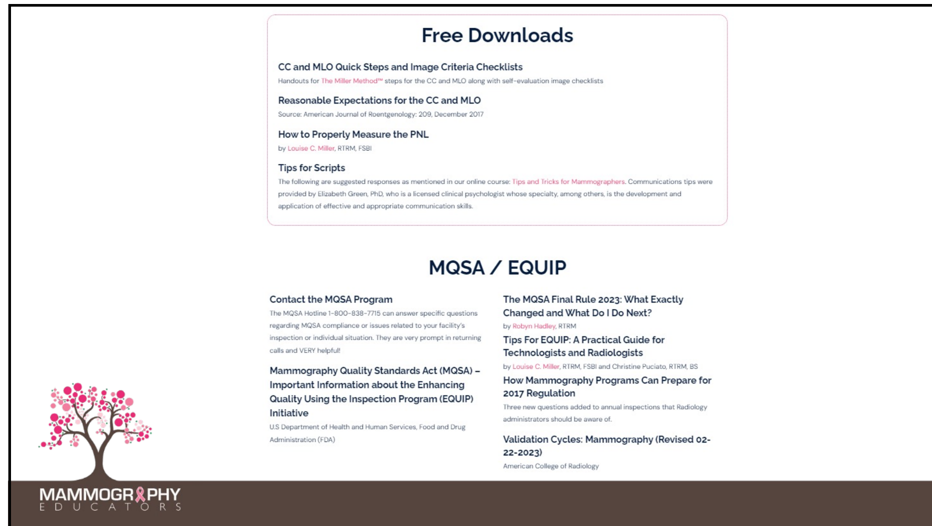
82



83

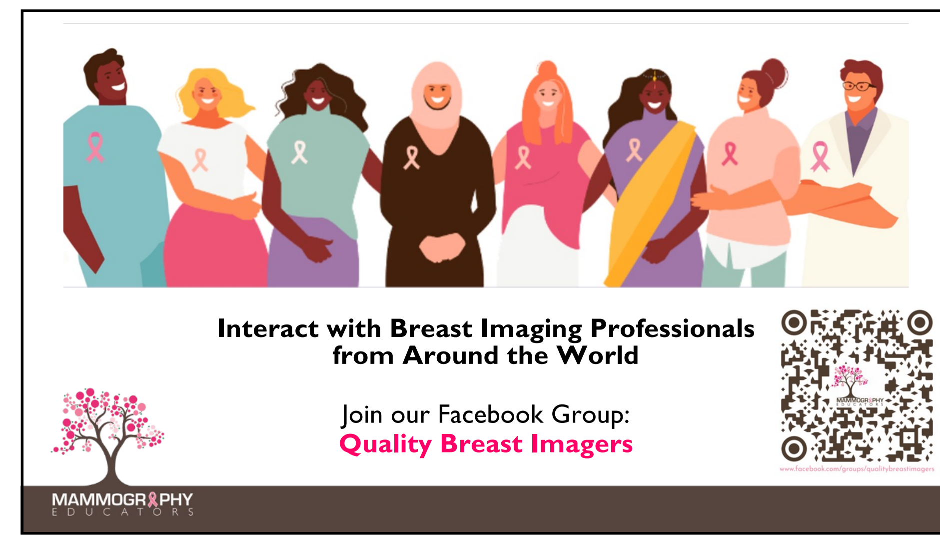
84

85



86

87



88

info@mammographyeducators.com

Services we offer, include:
- Onsite Positioning Training
- Assistance with Accreditation & Inspection Processes
- Live Webinars
- Customized Continuing Education Programs

MAMMOGRAPHY EDUCATORS

References

Huppe, A. I., Overman, K. L., Gatewood, J. B., Hill, J. D., Miller, L. C., & Inciardi, M. F. (2017). Mammography Positioning Standards in the Digital Era: Is the Status Quo Acceptable? *American Journal of Roentgenology*, *209*(6), 1419–1425. doi: 10.2214/ajr.16.17522.

Miller, Louise C. (2015) *Mammography Positioning Guidebook*. San Diego, CA.

Miller, Louise C. (2020) *Meeting EQUIP Standards: Image Quality & Positioning Problem-Solving For Breast Imagers.* San Diego, CA.

Miller, Louise C. (2024) *Mammographic Imaging of Challenging Patients.* San Diego, CA.

MAMMOGRAPHY EDUCATORS