

## Technology Changes: Positioning Challenges

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Mammographers have seen many changes in mammographic technology and equipment over the course of their careers. Yet many of us have not been given the skills and tools needed to make the transition smoothly. As things evolved, we did our best to adapt with very few resources available. Most manuals and videos for positioning techniques were created for film-screen equipment. Even with mandated initial and continuing education requirements, most of us were not taught consistent, reproducible and ergonomically sound positioning methods. Variations in styles were passed from one generation of mammographers to the next. As technology changed and improved, most of us were not aware that our positioning techniques needed to change and improve also.

If, like me, you remember Xerography, you are most likely ready for retirement. Younger mammographers have no understanding of table-top imaging, blue toner, charged plates, compression balloons, curved paddles or sponges. We learned to position by the “see one, do one, teach one” method. We figured it out. Then it was on to film-screen equipment. No more sponges, no more ribs...and what about the skin line? The pectoralis muscle suddenly became a major focal point and compression changed dramatically: straight paddles instead of curved paddles, “rigid” compression instead of soft sponges. Clinical image evaluation standards were set. There were seminars and application specialists to help us make the transition...barely.

Just when we were getting comfortable, digital imaging arrived. Most of us have direct experience with that transition, perhaps the most significant change that mammographers have experienced. Now technologists of all ages are wrestling with the transition from digital mammography to tomosynthesis. While each new modality requires eight hours of specialized training, most often

offered and obtained from the equipment manufacturer, none includes specific positioning training or hands-on experience with actual patients. So we are left to try to figure it out...again...and most of us struggle a bit at first. In retrospect, we ask ourselves: if the technology and equipment change, do the positions change? Will our images change? A new way of “looking at things” is essential to answer those questions. The real question is: why would it not change?

### Equipment Changes

The biggest positioning challenges are related to the increased length and thickness of the image receptor (IR). The increased width of the face shield can prove to be an additional problem. These differences can frequently be a challenge for the technologist when transitioning to each new modality. How can the technologist compensate for this and how can this affect our clinical images? A complete understanding of the equipment differences, proper positioning and patient anatomy is essential.

### Image Receptor

Standards for film-screen units in the United States are based on two sizes of imaging platforms: 18 x 24 cm and 24 x 30 cm. As digital technology was developed, the 18 x 24 detector was initially adapted. However, according to demographics at that time, up to 30% of patients could not be accommodated on the smaller platform, resulting in sub-optimal “tiling” or “mosaic” image acquisition. Both manufacturers of digital equipment in the United States (General Electric and Hologic) then chose a larger option of 24 x 29-31 cm with various sized compression paddles. While the interchangeable and movable paddles were helpful for positioning, the increased size of the image receptor often pushed back against the patients and mammographers. The next generation of

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tomosynthesis and tomosynthesis upgradeable units arrived with an increase in length of the IR once again. Within most of our careers, we have experienced an increased length in Bucky/IR of up to 49% and an increased thickness of the Bucky/IR of up to 80%.

### Face Shield

While face shield measurements remained fairly consistent from film-screen to digital imaging, modifications were made for tomosynthesis units to accommodate the tube movement. This required an increased width of the shield up to 50% when compared to non-tomosynthesis units.

### Possible, And Often Correctable, Changes In Clinical Images

1. Inadequate length of the pectoralis muscle on the mediolateral oblique (MLO) view, optimally visualized down to the posterior nipple line (PNL), and/or inadequate imaging of the inframammary fold (IMF): The increased length of the IR requires an adjustment of the patient. Patient positioning and selection of the proper degree of angulation are also essential.
2. Inadequate width of the muscle at the axilla on the MLO view: Due to the increased width of the IR, the technologist should ensure that the corner of the IR is placed properly in the axilla.
3. Inadequate visualization of the deep medial breast tissue on the craniocaudal (CC) view: The increased width of the face shield may prohibit the patient's head from coming forward and around the shield and could lead to the exclusion of medial breast tissue and poor visualization of the cleavage area. Careful attention must be given to positioning techniques in order to avoid this potential error.
4. Visualization of the latissimus dorsi muscle, many times identified as the pectoralis minor muscle on the MLO view: Some patients' axillae are too “narrow” to accommodate the

increased thickness of the IR. It therefore may be necessary to place the IR behind the latissimus dorsi muscle.

5. Increase in skin and fat folds: Skin and fat folds, while often “burned out” on film-screen images, are enhanced with digital imaging. This is due to differences in imaging techniques. Attenuation of the beam, caused when the digital algorithm is applied to the thicker skin, is most common in the posterior breast and nipple area on the CC view, and in the IMF and the axilla on the MLO view. While proper positioning can reduce the presence of skin and fat folds, these folds cannot be entirely eliminated. Breast tissue should never be sacrificed to exclude a fold. An additional image should only be taken if the skin or fat folds impede adequate visualization of the breast tissue. Fortunately, tomosynthesis eliminates this need altogether.
6. Motion artifact: Many facilities have seen an increase in call backs due to motion artifact. Unfortunately, technologists cannot see the motion on their workstations, so motion may go undetected until seen by the radiologist and a call back may be required. Many times having the patient stop breathing during the exposure can be helpful.

While there are no current data published on the above observations, my experience is that the evolution in technology has also produced some changes in our clinical images. Ideally, each technologist and each radiologist must be aware of the differences and do their best to adjust to the technological changes so that we can produce optimal image quality for our patients. However, even while taking these factors into consideration, technically ‘perfect’ images are very difficult to obtain. Further studies should be conducted to quantify reasonable expectations based on the numerous variables that mammographers face. ❖