Reducing the risk of work-related musculoskeletal disorders in mammography screening

Philips MicroDose Mammography

Summary

- Work-related musculoskeletal disorders (WRMD) are a major occupational hazard for mammography radiographers.
- The National Health Service Breast Screening Program (England) has recommended equipment improvements specifically to address this issue.
- A study of experiences from radiographers using the MicroDose Mammography system at BreastCheck (the Irish Breast Screening Program) and Musgove Park Taunton Breast Screening (Somerset, England) was conducted in 2011.
- The study shows that the ergonomic design and unique features of the MicroDose system help make radiographers' working routine less stressful and exhausting.
- Thus, the MicroDose system may help reduce the risk of repetitive strain injury for radiographers in breast screening.

Introduction

Work-related musculoskeletal disorders (WRMD), which encompass a wide range of inflammatory and degenerative diseases and disorders, are a major occupational hazard for mammography radiographers. These conditions are caused by repetitive, forceful, or awkward movements that result in injury to muscles, nerves, tendons, and ligaments. The repetitive nature of mammography radiographers' work, as well as the postures used while working, can cause significant stress on their bodies.

This white paper discusses how the design of the MicroDose Mammography system may help reduce WRMD risks for mammography radiographers without compromising detection quality or the operational effectiveness of the system.[1, a]

Mammography radiographers and the risks of musculoskeletal disorders

A study conducted in 1997 sought to determine if breast screening radiographers experienced any musculoskeletal discomfort and, if so, the nature and extent of the problem.[2] The study was extended to investigate and determine the possible occupational, causal, or contributory factors; and proposed a technique for mammography radiographers to adopt to help alleviate discomfort caused by their repetitive actions. In 2007, the National Health Service Breast Screening Program (NHSBSP) in England conducted an ergonomic assessment of different mammography units and reported that repetitive strain injuries affecting thumbs and wrists remains a particular problem.[3]

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sense and simplicity

Repetitive strain injuries in mammography radiographers have more recently been described in a professional document published by the Society of Radiographers (SoR).[4] This document includes a survey of radiographers, in which 62% indicated that they often or always have to maneuver into awkward positions. This, combined with the inevitable time constraints of the job and ever-increasing workload, can lead to a range of symptoms, such as pain, tenderness, swelling, and muscle weakness. These symptoms often result in conditions such as rotator cuff syndrome, carpal tunnel syndrome, tendinitis, and trigger finger or thumb. The aforementioned conditions are progressive and, typically, can be divided into three mild, moderate, or severe stages, as classified by E. Ransom (2002).[5] At the severe stage, sleep can be disturbed, sometimes leading to an inability to carry out even the most mundane tasks, and can even result in permanent disability. In the SoR's document, SoR CEO Richard Evans states that, "Work-related injury to members of the radiographic workforce is a threat to the health of our members, a threat to their careers and a threat to the services that they have worked so hard to establish."[4]

Equipment design is important in helping to reduce repetitive strain injury to radiographers, as different functions and workflows all play their part in either contributing to or limiting these risks. While the NHSBSP has recommended equipment improvements specifically to address this issue, as yet, no industry standards have been created.

Reducing risk of repetitive strain injury in mammography screening: a study of experiences from radiographers using the MicroDose Mammography system

Janice Miles, Senior Lecturer at University of Glamorgan, conducted a study of radiographers in 2011 who used the MicroDose Mammography system at BreastCheck (the Irish Breast Screening Program) and Musgove Park Taunton Breast Screening (Somerset, England).[1] The study compiled views and comments of radiographers obtained through a series of interviews, questionnaires, and free discussions, as well as written assessments of the system.

Janice Miles, MSc, Senior Lecturer at University of Glamorgan, UK

Janice Miles has been a sonographer since 1988. In 2005, she completed an MSc, writing a dissertation on Work-Related Upper Limb Disorders (WRULD) in Sonographers. She had a paper published in 2006 on WRULD in the Society of Radiographers Synergy publication. As an applications specialist, she was a source for WRULD and Repetitive Strain Injury (RSI) issues and spoke at many presentations on this topic. She organized study days for the South Wales manual handling group and led presentations at the British Medical Ultrasound Society on the topic. She became interested in WRULD in mammographers as result of her sales work in this field. She is now a Senior Lecturer at the University of Glamorgan.

Philips MicroDose Mammography system – ergonomically designed to help reduce WRMD

1. The column/gantry

The MicroDose system's gantry was designed based on feedback from mammography staff and refined to fulfill their requirements.

Radiographers' comments:

"The MicroDose system has a small footprint, is compact, and the tube head and collimator are more compact than other models. This facilitates a full view of the breast in the MLO position."

Isocentric rotation

The C-arm's isocentric rotation provides consistency of breast position height following rotation. This means that when a radiographer rotates the C-arm from one projection to another that is at a different angle, the area above the center of the breast platform remains at a consistent height, so the radiographer doesn't have to manually adjust the height for each patient. Isocentric rotation is an important feature for screening mammography equipment, as it reduces the amount of manual intervention required by the operating radiographer.[b]

A second major reduction of fatigue and stress results from how rotation is configured. Even with powered rotation, conventional systems require the radiographers to initiate the movement by pressing a button on the tube head. This requires radiographers to raise their arms up to the button height, and to maintain finger pressure on the button as the tube head rotates. To maintain continuous pressure on the button, radiographers have to stretch their arms through the rotations, and if the radiographer did not have correct posture at the initiation of the rotation, this could result in inappropriate twisting.

Radiographer's comment:

"There is isocentric rotation of C-arm – automatic tube angling - the tube head angles automatically for the angled view, by means of a one button press at close proximity on the column or at the workstation. This reduces the reaching and stretching we have to carry out for every examination and in reducing the stress on the body."

While the automatic tube angling contributes to reducing the risk of musculoskeletal injury, any automatic movement of a mammography system requires safety precautions. The safety features associated with auto-rotation on the MicroDose system were independently assessed by KCARE[c] and the Medicines and Healthcare Products Regulatory Agency in the United Kingdom when the equipment was introduced there.

Easy height adjustment by light-touch buttons

Only a light touch is required to depress buttons on the MicroDose system, and reaching the buttons is almost effortless. Buttons are replicated both on the tube head and side of the breast platform, so radiographers can use the set of controls that are easiest to access from their position, or alternate between controls to help reduce repetitive movements and the risk of repetitive strain.

The NHSBSP guidelines indicate that it is good practice to offer a choice in how to manipulate the system, and ergonomic development will help vary routine and reduce repetitive strain injuries.[2,3]

Radiographer's comment:

"We can vary the routine we use; this saves repeating the examination in the same way every time."

Easy access to rotation and height adjustment by light-touch buttons in four different places.

Hand rail

Patients can rest their arms on the edge of the breast platform and an ergonomically designed handrail. This allows the radiographer to slide the patient's hand up the rail to the appropriate level to facilitate full imaging of the axilla. Correct positioning of the arm is important to avoid skin folds in the field-of-view (FOV) that compromise image quality. The handle's shape also provides benefits for the user. It facilitates appropriate patient positioning without the radiographer having to physically lift the arm into the correct position, and thus reduces the associated physical stress.

2. Easy positioning of the breast

Scanning technology and Smart AEC

The MicroDose system actively detects the breast's position and composition during a scan, and as such, the breast can be positioned anywhere in the FOV. This differs from conventional systems that require the breast to be positioned so that the densest area of the breast is placed over an automatic exposure sensor.

During a scan on the MicroDose system, the leading edge of the detector measures the amount of radiation exiting the breast, and this information is used to constantly modulate the scan speed to provide sufficient penetration. This method of exposure control affords several benefits to both the woman and the screening radiographer. For the woman, the received radiation dose is reduced, because the system uses the minimum amount of radiation required to achieve full penetration of all tissue.[6] For the radiographer, he or she can position the patient wherever is easiest to allow good technique.

The exposure methods and ease-of-positioning are also improved by the fact that the dead space has been reduced at both the lateral and breast wall edges. This is essential for precise positioning and patient comfort.

The scanning technology and Smart AEC allows flexible positioning, because the breast can be placed anywhere in the FOV while removing 97% of scattered radiation.

Uniquely sized field-of-view

The MicroDose system features a uniquely sized FOV of 24 cm x 26 cm, which has proven to be large enough to image the vast majority of women with four routine projections and with almost no need for extra views, as discussed in a study conducted at Coventry and Warwick breast screening unit.[7]

Curved and warm breast support

While radiographers varied in their assessment of whether the curve of the breast support makes it easier to position patients, all agreed that it provides a more comfortable experience for the woman. The fact that the detector is warm also contributes to a more comfortable patient experience. The combination of these features helps the radiographer position the patient quickly, while reducing the physical effort required.

Radiographer's comment:

"The fact that the detector is warmer makes it easier to position the patient."

3. Compression paddles

In an analog environment, paddles needed to be changed when swapping the Bucky size to accommodate different women. Due to the size of the FOV on the MicroDose system (24 cm x 26 cm), there is no need to change the paddles as regularly as before. Because the breast can be placed at either side of the breast support, the MicroDose system does not require shifting the compression paddle. As previously discussed, the scan will automatically detect breast position and appropriately modify the exposure parameters.

Radiographers have commented that they no longer need to make the mental decision of which compression paddle size is required for each patient. In addition, it is easy to change the compression paddles when required for spot compression or magnification views, as they are light in weight and easy to negotiate onto the column.

The positioning light comes on automatically when the paddle compression starts, which saves a reaching and pressing action. The high-edge compression paddle provides an additional advantage because it helps keep the contralateral breast out of the radiation beam without assistance from the patient.

Easy positioning of the breast.

4. Motorized compression with foot pedals and "Compression done" foot switch

The MicroDose system uses a smooth breast compression technology that the radiographers felt made it easy to acquire an appropriate compression pressure. The compression is achieved by the use of a foot switch, which allows radiographers to use their hands for positioning the breast. On other systems, a manual compression knob is sometimes provided. However, the repetitive twisting of a compression knob could be a factor in rotator cuff syndrome or other related injuries.

The two foot pedals operate the up/down motion for the compression paddle. In addition, the foot switches in the middle of pedals are used to confirm the completion of the compression step, and then initiate a sequence of pre-exposure processes. Once the Compression done foot switch is activated, the tube begins to prepare for exposure. Simultaneously, the radiographer returns to the acquisition workstation where he/she starts the exposure by pressing the Exposure button as soon as it is lit.

Alternatively, the radiographer can use the Exposure foot switch. This foot switch is particularly beneficial to screening radiographers, as it can be used to negate the need for a hand-initiated exposure process. The task of breast screening is quite intensive on the radiographer's hands and arms, so this ability to move a function to foot operation is beneficial.

Motorized compression foot pedals and Compression done foot switch.

Foot switch for X-ray exposure.

5. User-friendly acquisition workstation (AWS)

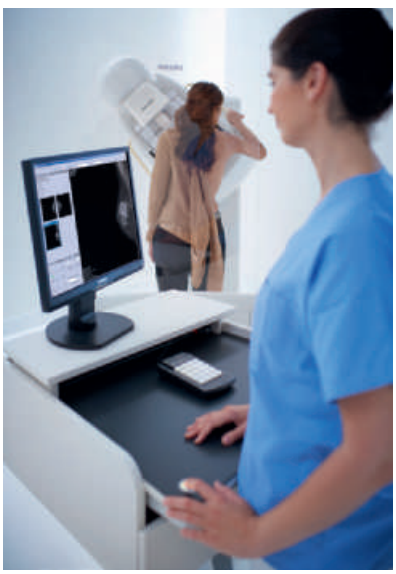
The AWS is height-adjustable, easy to use, and has enough space to work easily with documents, a mouse, and keypad.

The AWS has a light-touch Exposure button on each side, offering both right- and left-hand use. The radiographer must maintain pressure on one of the buttons for the duration of the exposure, and as with all X-ray equipment, this poses a possible musculoskeletal injury risk. The Exposure button helps to reduce this risk because it:

- Is light to press, which lessens strain on the hand tendons
- Allows the operating radiographer to vary their exposure method to reduce risk of repetitive strain injury

An additional MicroDose system feature is the Exposure foot switch option, which further helps to reduce this risk.

Light-touch Exposure buttons on each side of the acquisition workstation.



User-friendly acquisition workstation.

6. Dedicated shortcut keypad

The MicroDose system also has a unique feature to automatically angle the tube by means of a single button on a shortcut keypad. The rotation of the C-arm is initiated at the acquisition workstation and will rotate the C-arm to a pre-defined angle for the projection to be acquired. This single-button press saves radiographers from having to manually keep a finger on the rotation button, which helps to reduce the risk of trigger finger or associated tendinitis.

Most of the examination steps can be performed with the dedicated shortcut keypad located at the acquisition workstation:

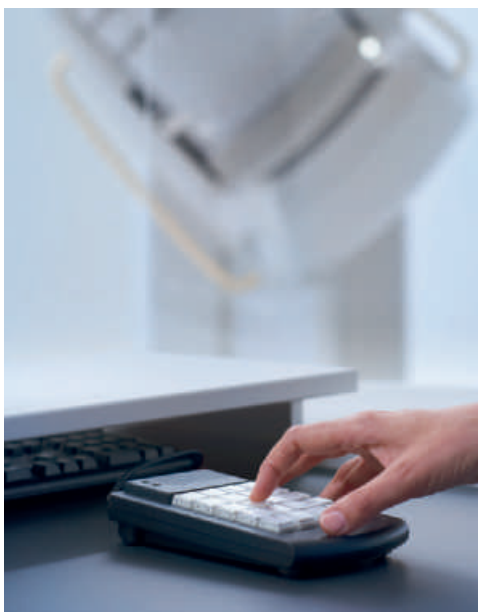
1) Select patient from the worklist
2) Select the first projection for the four views to be obtained (e.g., RCC)

3-5) Repeat Step 2 for the remaining projections

6) Press the Approve button

This concludes the examination and sends the finished examination to a PACS or – in a mobile environment – to an encrypted USB drive.

A consistent theme throughout the interviews was that the small number of interactions with the computer makes the system easy to use. The radiographers appreciated that the MicroDose system has efficient image-taking procedures. Fewer steps reduce stress on the radiographers during busy working days. The system also provides flexibility so that radiographers can work in their own preferred sequences, rather than forcing them to perform imaging projections in a fixed sequence.



Dedicated shortcut keypad.

Conclusion

Due to the repetitive nature of breast screening, and the fact that the performance of mammography is a notably physical activity, great care should be taken to support the well-being of mammography staff. In deciding which equipment to use, consideration should be given to the ergonomic suitability of the systems. Mammography staff should be well-versed in using the equipment effectively, so that excellent image quality is obtained without compromising their own health.

The extensive study conducted with radiographers working at BreastCheck and Musgove Park Taunton Breast Screening points out that the MicroDose Mammography design and unique features help to reduce physical strain. The interviewed radiographers stated that they were confident in commenting that the MicroDose system is user-friendly and ergonomical, which makes their working routine less stressful and exhausting. The MicroDose Mammography system is an excellent and logical choice for heavy-volume screening environments.

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7. Hoffmeister, S., 2009. *A Comparison of Digital Mammography Field of View Detector Sizes and the Need for Extra Views*. BSC DCR.

a. This text is based on the study conducted in 2011 by Janice Miles and edited by Philips Healthcare, which purchased Sectra's mammography operation in September, 2011.
b. As the isocentric rotation is based on the average breast size and physique, it is still recommended that radiographers use their professional skill to assess and adjust to the ideal height for the patient.
c. KCARE is an equipment evaluation center that provides advice to the National Health Service in the United Kingdom on the selection and purchase of radiological equipment.

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