BreastScreen SA

Mammography Ergonomics

Measuring forces on the radiographer's shoulder when positioning for a medio-lateral oblique mammogram – a comparison of radiographer's hand technique

BreastScreen SA In collaboration with **The International Centre for Allied Health Evidence** – University of South Australia

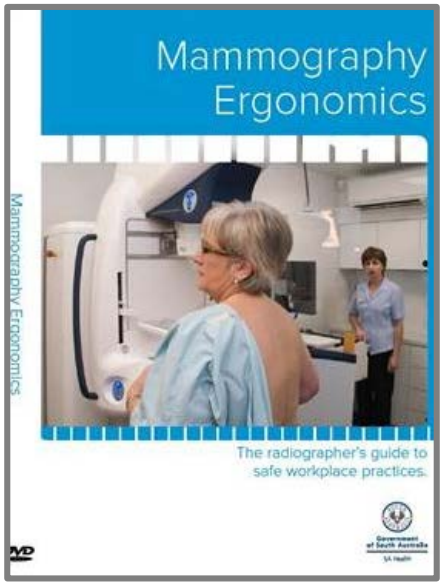
2018 BreastScreen Australia Conference

Government of South Australia

SA Health

Background

- In 2005, BreastScreen SA (BSSA), had an increase in the number of radiographers reporting injuries and claims, particularly overuse injuries.
- We implemented strategies to mitigate injuries.
- As a recipient of an Augusta Zadow award in 2008, BSSA extended our research to reduce the incidence of repetitive strain injury (RSI) when working with digital mammography units.



Strategies developed

- Some strategies developed included:
  - maintain the body in a neutral position as much as possible
  - do not over reach
  - develop/disseminate an educational resource
  - Perform annual ergonomic assessments to review staff techniques.

Shoulder RSI – still occurring

- Implementation of these strategies has resulted in a significant reduction in workplace injuries.

- However shoulder and upper limb RSI is still reported.

What is contributing to shoulder pain?

- Ergonomic assessments identified correct positioning with the more obvious ergonomic considerations such as:
  - stance
  - equipment operation

- But more subtle, potentially incorrect actions are not always considered.
- Poor habits can therefore develop.

Hypothesis:

- BSSA Training Team hypothesised:

  Are subtle potentially incorrect actions contributing to pain?

- Subtle actions were researched in our earlier study, but were not supported with quantitative data.

- BSSA partnered with the University of SA to investigate this.

One subtle positioning action considered

- The technique used to support the breast on the detector as compression is applied for the mediolateral oblique, MLO view.

Research aim – BSSA/UniSA

- Identify the forces a radiographer's upper limb is subject to during positioning for a mediolateral oblique, specifically:

  Supporting the breast on the detector as compression is applied.

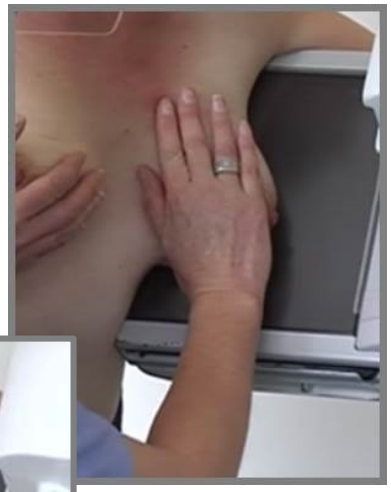
- Apply this research with radiographers of different height relative to client height. This aim was not completed.

Actions assessed - supporting the breast for the MLO

1

Neutral wrist hand position

2



Radiographer’s shoulder close to body.
Hand pronated flat on medial aspect of breast, fingers pointing upwards

3

Shoulder abducted, hand pronated flat on medial aspect of breast, fingers pointing to client sternum

Other considerations contributing to pain/injury

- Repetitive actions are not the only consideration to mitigate injuries/pain.

- Recognised that other factors such as loads, postures and exertion of external forces can be contributing factors.

Force and loads

- Internal Force: tension develops within the muscles, ligaments and tendons during movement.

- External Force: when a force is applied to the body, either voluntarily or involuntarily.

- Forceful Exertion: is most often associated with the movement of heavy loads, such as lifting heavy objects.

https://www.ehs.iastate.edu/occupational/ergonomics/force

Load and posture

- Load: exertion of external force has been established as a risk factor during repetitive work.

- Posture: identified as a risk factor during manual handling tasks (awkward or neutral postures).

- Interaction of posture with repetitiveness is logarithmic in nature.
- Risk exponentially increases the closer the posture used approaches a poor posture.

  (end of joint range)

Static vs dynamic movement

- The task of supporting the breast on the detector as compression is applied is considered an intermittent static task (involves small static movements) as opposed to a dynamic (moving) task.

Kilbom 1994

Method

- Challenges presented with the original intended equipment.
- Difficult to quantify the specific forces through the body for the research.
- Instead identified the relative forces rather than the absolute forces to quantify the relative risk associated with hand techniques to support the breast.

Assumption

- This methodology assumes the risk to the upper limb associated with an activity is proportional to the amount of force applied through the upper limb relative to the maximal force capacity.

- The harder you are pushing relative to your maximum capacity, the greater the risk of injury.

Repetitive task/force

- For repetitive tasks it has been suggested that repetitive forces greater than:

17%

- Of the maximal voluntary contraction represents a risk for manual handling injuries in intermittent static activities.

- Brystom 1991

Equipment

- Laboratory – replica mammography plate – angle varies to replicate MLO positioning.
- Anatomical model – filled with rice-weight 400g.
- Chattanooga pressure feedback unit.

  simple device used to provide feedback to ensure quality and precision in exercise performance and testing. units mmHg

Method

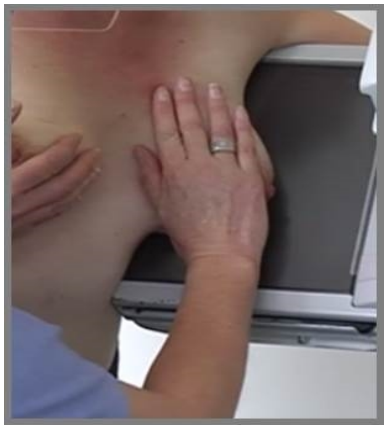
- The biofeedback unit was placed between the radiographer's hand and the anatomical breast.
- The unit was inflated to 10mmHg as a baseline.
- Each positioning action repeated 3X to maintain the anatomical breast in the correct position.
- Pressure recorded on the feedback unit.
- Actions repeated, but with maximum force applied.
- Pressure recorded on the feedback unit.
- Increase in pressure recorded on the unit was proportional to the radiographer force.

Results

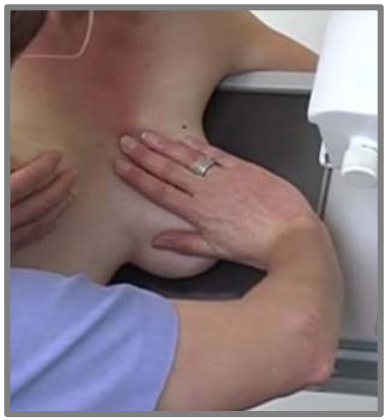
Action	Simulated Action Pressure (mmHg)				Maximum Pressure (mmHg)				Relative force i.e. % of maximum
	1	2	3	Ave	1	2	3	Ave	
1	22	24	26	24	110	100	110	107	22%
2	30	34	40	35	90	95	90	92	38%
3	30	36	36	34	75	95	90	87	39%

Results – summary

> 1/ 22% of maximal exertion capacity required.



> 2/ 38% of maximal exertion capacity required.



> 3/ 39% of maximal exertion capacity required.

Outcome

Position 1 - supporting the breast with a more neutral hand/wrist:

> Represents a 42% - 44% reduction in relative exertion required when performing the task.

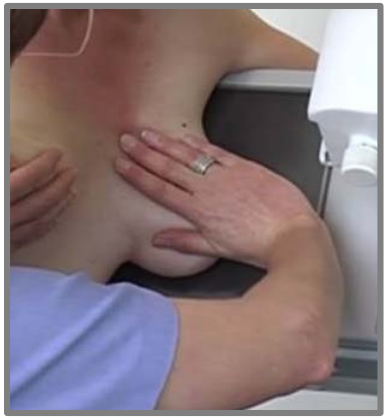
> Suggests the radiographer is not working as hard to generate the force required compared to using a poor posture.

Discussion

- With this study it is not possible to quantify the specific reduction in risk to the radiographer due to other contributing factors, such as:
  - individual radiographer characteristics
  - duration of breast support as compression is applied
- However it represents a sizable reduction in risk associated with the posture and external load used in this task.

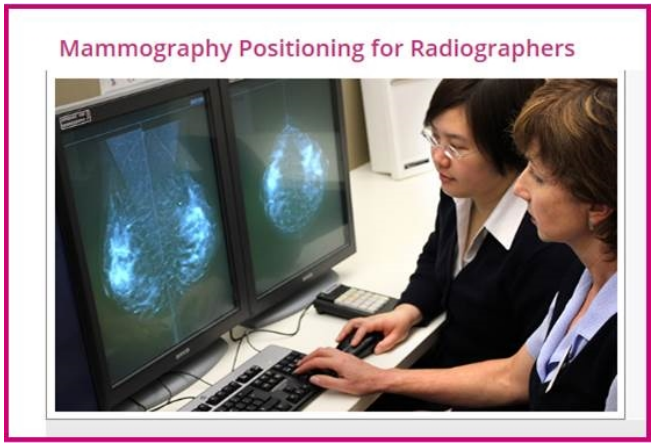
Discussion

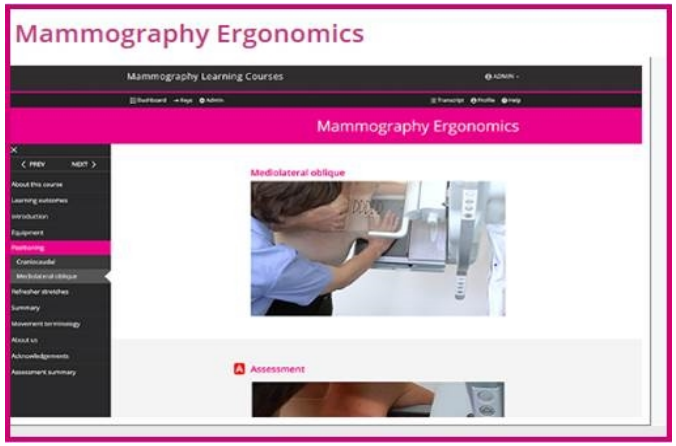
- Important in third posture – shoulder abducted, internally rotated posture.
- Significantly reduces the sub acromial space. Placing increased pressure on the rotator cuff tendons as they pass through the sub acromial space.
- Combination of increased relative exertion, whilst the limb is in a biomechanically disadvantaged position would be expected to increase the risk significantly.



Conclusion

- While this study was very small, it supports the qualitative information we produced in our disseminated training resources.





- The data indicates there is value in encouraging staff to be mindful of their upper limb position when supporting the breast for final compression.

Where to?

- Potentially seek funding to undertake a larger scale study using 3D motion analysis software and biomechanical modelling.
- Include additional variables.
- Disseminate results with educational resources.

Authors and Acknowledgement

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Acknowledgements

BSSA Information Systems Team

BSSA Radiographic Administrative Assistant

BSSA Promotion/Education Team

BSSA Radiography Team

BSSA Training Centre Staff- Mary Sagris

Take Away Message

Don’t let poor ergonomics shelve your dreams

Be ergonomically mindful so you can chase your dreams

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