Impact of a pressure-based flexible paddle in digital breast tomosynthesis on the participant and technologist

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Impact of a pressure-based flexible paddle in digital breast tomosynthesis on the participant and technologist

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<table>
<thead>
<tr>
<th>Name</th>
<th>Position</th>
<th>Company/Institution</th>
</tr>
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<tbody>
<tr>
<td>Kathy Schilling</td>
<td>Consulting Radiologist and Investigator</td>
<td>GE Healthcare</td>
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<td>Monique van Lier</td>
<td>Employee and Shareholder</td>
<td>Sigmascreening BV</td>
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<td>Serge Muller</td>
<td>Employee</td>
<td>GE Healthcare</td>
</tr>
</tbody>
</table>
Compression paddle
- Real-time mean-pressure indicator

Pressure-based compression paddle:

- Adjusts the compression force to the size and stiffness of the individual breast
- Pressure = \( \frac{\text{Force}}{\text{Area}} \)
- Real-time pressure visualization
  - 8 LEDs
  - 2kPa (~15 mmHg) per LED
- Visible for both technologist and patient
Impact on clinical practice

- Real-time mean-pressure indicator in 2D mammography

Using a target pressure range and a rigid paddle with a real-time mean-pressure indicator in 2D mammography:

- Avoids extreme high pressures, a contributor of patient discomfort\(^1,2\)
- Improves workflow\(^3\)
- Contributes to the mammography quality improvement by compression standardization\(^1,4,5,6\)

2. de Groot, J.E. et al. (2014) Med Phys 41(2)
Study aim

Evaluate the effect of a **pressure-based flexible paddle** for **Digital Breast Tomosynthesis (DBT)**

- Technologist experience
- Patient experience
- Compression parameters
- Average glandular dose

Methods

- Study protocol

Women with appointment for DBT

Informed consent

Digital breast tomosynthesis examinations:
  - Pressure-based flexible paddle guided breast compression
  - 2-views (CC and ML0), bilateral

Experience questionnaires
  - Participant
  - Technologist

Aiming for LED 5-7 pressure range: 8-14 kPa
Methods

- Study protocol

**Prior examinations**
Conventional compression

**Compress parameters**
376 DBT views (RCC, LCC, RMLO, LMLO)

**Subgroup analysis - dose**
100 DBT views (RCC, LCC, RMLO, LMLO)

**Examinations in study period**
Pressure-based compression

**Compress parameters**
376 DBT views (RCC, LCC, RMLO, LMLO)

**Image Pairs**
94 participants

**Subgroup analysis - dose**
100 DBT views (RCC, LCC, RMLO, LMLO)

**Experience questionnaires:**
1. Participant
2. Technologist

**Subgroup analysis** - dose
Same DBT system
Results

1. Participants questionnaire

- Less uncomfortable compared to previous examination? 59%
- Recommend pressure-based compression to a friend? 87%
Results

2. Technologist questionnaire

What was the impact of the pressure-based compression paddle on your workflow?

- 97% strongly positive
- 4% agree
- 1% neither positive/negative
- 4% negative
- 4% strongly negative

The pressure-based compression paddle makes it easier to explain compression.

- 100% strongly agree
- 4% agree
- 0% neither agree/disagree
- 0% disagree
- 4% strongly disagree
Results

2. Technologist questionnaire

What was the impact of the pressure-based compression paddle on your interaction with the patient

89%

The pressure-based compression paddle helped to involve the patient in the compression procedure

99%
Results

- Compression parameters - Force

Force became dependent on contact area:

- Indication for correct execution of the pressure-based compression protocol
Results

- Compression parameters - Force

Force became dependent on contact area
Results

- Compression parameters - Pressure

Pressure variability decreased significantly

![Graph showing compression pressures and variability with p=0.0009 and SD: -50%](image)

- Conventional compression (prior)
- Pressure-based compression (study)
Results

- Compression parameters – Pressure

Pressure variability decreased significantly

○ In line with prior studies in mammography\textsuperscript{1,4,5,6}

## Results

- Compression parameters – Breast thickness

<table>
<thead>
<tr>
<th>Compression Method</th>
<th>CC-view</th>
<th>MLO-view</th>
</tr>
</thead>
<tbody>
<tr>
<td>Conventional compression</td>
<td>n = 188</td>
<td>n = 188</td>
</tr>
<tr>
<td>Pressure-based compression</td>
<td>n = 188</td>
<td>n = 188</td>
</tr>
</tbody>
</table>

**Mean breast thickness decreased significantly**

- **Mean: -8.4 %** (Conventional compression, CC-view)
- **Mean: -10.0 %** (Pressure-based compression, MLO-view)

### Graphical Representation

- **p < 0.0001** for both comparisons (CC-view and MLO-view).
Results

- Sub-group analysis - Average glandular dose

CC-view:
Average glandular dose unchanged

MLO-view:
Average glandular dose decreased significantly
Limitations

Conventional compression and pressure-based compression were not executed on the same day in the same patient.

- Reduced comparability between the examinations due to a different:
  - DBT-system for image acquisition
  - Technologist performing the procedure

- Time between the examinations may have affected the memory of the prior examination experience by the participant.
Conclusions

Using a **pressure-based flexible** paddle for **Digital Breast Tomosynthesis improved**:

- **Compression standardization**
  - Reducing pressure variability
  - Lowering breast thickness and average glandular dose (large breasts)

- **Participant appreciation**
  - Less uncomfortable
  - Recommend it to a friend

- **Technologist experience**
  - Improved interaction with the patient
  - Helped involving the patient in the compression procedure
  - Eased compression explanation
  - Positively impacting workflow
Acknowledgements

• Lynn Women's Health & Wellness Institute, Boca Raton Regional Hospital, Boca Raton, USA
  Technologists
  Radiologists
• GE Healthcare

Ethics statement
• The study was approved by the institutional review board
• All participants gave written informed consent