Technical Aspects of Breast Compression in Mammography: Patient Comfort and Impact on Image Quality

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ABSTRACT

Breast cancer is one of the most common malignancies among women worldwide, and mammography remains the primary method for early detection. Breast compression is a key technical component that influences image quality, radiation dose, and patient comfort. Adequate compression reduces breast thickness, tissue overlap, and motion, thereby improving image quality. However, it may also cause discomfort or pain, potentially affecting participation in screening programmes. This review summarises the technical aspects of breast compression and its impact on image quality and patient-reported comfort. Findings highlight the importance of achieving a balance between optimal image quality and patient-centred care, emphasizing the critical role of radiographers.

METHODS

A narrative literature review was conducted to examine the technical aspects of breast compression in mammography, with a focus on image quality and patient comfort. Publications from 2004 to 2025 were included. Peer-reviewed studies provided the main evidence base, addressing compression techniques, image quality parameters, radiation dose optimisation, and patient-reported outcomes. Review articles were used to synthesise existing knowledge, while professional guidelines from international and European organisations were included to reflect current clinical practice. Additional sources, such as academic textbooks, supported the anatomical and technical background.

CONCLUSION

Breast compression is a key component of mammography, improving image quality and enabling radiation dose optimisation, but it may also cause patient discomfort. Achieving an optimal balance between technical image quality and patient comfort is essential. Clearer compression guidelines, improved comfort-enhancing technologies, and effective radiographer–patient communication can help reduce discomfort without compromising diagnostic quality. Further research should focus on defining individualised compression parameters and improving patient experience to support screening adherence.

RESULTS

Technical effects of breast compression: Breast compression plays a key role in optimising mammographic image quality. It reduces breast thickness, tissue superimposition, and motion artefacts, resulting in clearer and more diagnostically reliable images (4). Compression improves spatial resolution and contrast, enhances visibility of fine details such as microcalcifications, and contributes to a more uniform image with a higher signal-to-noise ratio (1). Additionally, reduced tissue thickness allows for lower radiation dose and decreased scatter radiation (7).

Compression force and clinical variability: The effectiveness of compression depends on the level of applied force and resulting breast thickness reduction (5). In clinical practice, compression is typically guided by experience and patient feedback rather than strict protocols (7). Due to the lack of standardised guidelines, there is considerable variability in applied compression force. Recommended values generally range between 60 N and 160 N, with an upper limit of approximately 200 N. However, compression is often limited by patient discomfort rather than technical requirements (3).

Patient comfort and influencing factors: Patient discomfort during mammography is a multifactorial issue. Key factors include breast density, age, previous surgical procedures, and individual pain sensitivity. Mechanical factors, particularly compression force and duration, are the main contributors to pain. Psychological factors, such as fear, anxiety, and previous negative experiences, further influence perceived discomfort (6).

Role of communication and technology: Effective communication by radiographers is one of the most important factors in reducing patient discomfort and improving overall experience. Clear explanations and supportive interaction can significantly reduce anxiety and perceived pain (6). Technological advancements, such as curved compression paddles that conform better to the natural shape of the breast and allow a more even distribution of pressure, have shown potential to improve comfort while maintaining image quality (8).

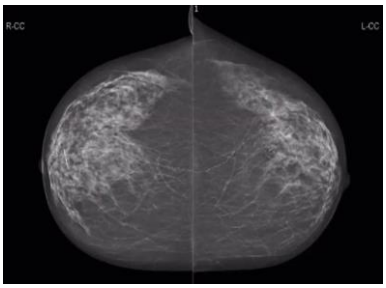

Figure 1. Example of a high-quality mammogram in the craniocaudal (CC) projection.

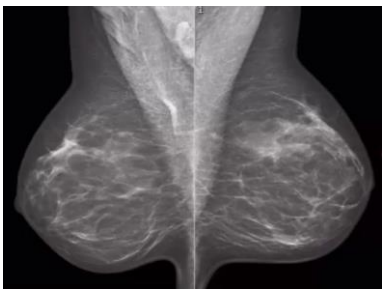

Figure 2. Example of a high-quality mammogram in the mediolateral oblique (MLO) projection.

Image quality: Breast compression significantly improves mammographic image quality through several mechanisms (4).

- **Reduced geometrical blur:** decreased breast thickness brings structures closer to the detector.
- **Increased spatial resolution:** improved visibility of small structures and microcalcifications.
- **Reduces radiation dose:** thinner tissue requires lower exposure.
- **Decreased motion artefacts:** stabilisation of the breast during imaging.
- **Improved contrast and uniformity:** reduced scatter radiation enhances image clarity and signal-to-noise ratio (4).

These effects enable more accurate detection of subtle lesions and improve overall diagnostic reliability. However, increased compression may also lead to greater patient discomfort, requiring a balanced approach (2).

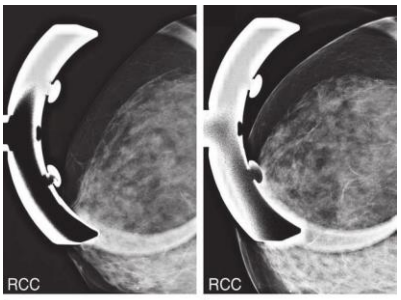

Figure 3. Motion artifact. (a) Right craniocaudal (RCC) mammogram shows blurred microcalcifications and dense breast tissue. (b) On a corrected RCC mammogram, the microcalcifications appear more distinct against a fibroglandular background, and the breast tissue is less dense.

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