

# A New Technical Mode in Mammography: Self-Compression Improves Satisfaction

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## ABSTRACT

**Objective:** We aimed to evaluate the mammography experience of patients using a manually controlled self-compression tool compared to their previous experience based on technician performed breast compression by a questionnaire survey study.

**Materials and Methods:** The survey studies of 365 patients who underwent screening or diagnostic mammography between April 2017 and July 2017 at our center were reviewed retrospectively. Each patient had completed a 12-item questionnaire following mammography examinations. Women who never had a mammography before or who had a previous mammography examination more than 2 years ago or who did not want to use the self-compression device were excluded from the study. 106 women were included in the study.

**Results:** Patient satisfaction was high. Regarding the comparison of the experience of the exam to previous ones, 70.8% said it was a better experience. The examination was found comfortable by 85.4% of the participants and 75.5% found the examination more comfortable compared to previous ones. Only 11.3% were anxious and 52.8% declared they were less anxious compared to previous examinations. Regarding the attractiveness of the new design, 66.9% declared they found the new design attractive, 39.7% found it more attractive than previous examinations, and 27.3% said the new design decreased anxiety. In the evaluation of impact of patient-assisted compression (PAC) on comfort, 80.2% said that they found it more comfortable and 64.2% said that PAC decreased anxiety. Furthermore, 72.6% said the exam was shorter.

**Conclusion:** Self-compression technique decreases pain and anxiety of women during mammography examinations and promises to enhance compliance of clients and patients with follow-up mammography recommendations.

**Keywords:** Mammography, self-compression, pain, patient satisfaction

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## Introduction

Breast cancer is the most common cancer and the second leading cause of death due to cancer among women. The only proven method to decrease the mortality of breast cancer is screening mammography (1, 2). Mammography is a relatively inexpensive and widely available imaging technique. Stabilizing the breast by compression between a compression paddle and the detector housing during mammography examinations is required for many reasons (3-5). This application of force immobilizes the breast resulting in avoidance of motion blur and reduces breast thickness, which limits radiation scatter, resulting in improved image quality and also decreased overall radiation dose exposed to glandular tissue (5). Furthermore, it leads to a more homogeneous exposure from nipple to chest wall resulting in improved dynamic range (5). In addition, adequate compression can improve the diagnostic distinction between tumors and artifacts. However, breast compression is related with discomfort and pain (6), and some patients may experience anxiety or stress and hesitate about undergoing mammography. Sometimes the technician avoids adequate compression due to anxiety to hurt the patient. This results in poor image quality and increased radiation exposure. On the other hand, sometimes the technician applies too much compression to obtain good image quality, which results in the aversion of the examination, lack of compliance in periodic screening, and also discouragement of the participation of peers. There are no quantitative guidelines on the compression force a technologist should apply for acquisition of an adequate mammogram resulting in great variations among technologists and screening centers (1). The most adequate compression is the most compression the patient can endure. The breast tissue should be firm during an optimal compression and no indentation should appear when the tissue is pressed with fingers. To decrease patient anxiety and to reduce the pain and discomfort during the

mammography examinations various methods have been used including a thorough explanation of the procedure with verbal or written information, topical application of 4% lidocaine gel to the skin of the chest, self-controlled breast compression, the use of a radiolucent pad, administration of oral acetaminophen and ibuprofen, and decreasing the compression force (7-13).

Self-compression tool provides women a sense of control by letting them to manually adjust the degree of breast compression; patient-assisted compression (PAC). Guided by a technologist, the patient uses a hand-held wireless remote control to adjust the force of compression after breast positioning. This device gives patients control over the amount of compression for their exam. The technologist then guides the patient to gradually increase compression using the remote control until adequate compression is reached and checks the applied compression and breast positioning.

While it is not a new concept, to our knowledge there are only two reports in the English literature regarding breast compression by the patient during mammography (10, 11). The aim of this study was to evaluate the experience of patients on this next-generation mammography technology compared to previous exams with a questionnaire survey study.

### Materials and Methods

Institutional Ethics Committee approval was obtained for this retrospective study (2018-12/8). Waived consent is obtained before all imaging procedures performed in our institution for research. The survey studies of 365 patients, aged 40-90 years, who underwent screening or diagnostic mammography (Senographe Pristina (GE Healthcare,

Chicago, IL) (Figure 1a), which has a PAC remote control (Dueta<sup>®</sup>, GE Healthcare, Chicago, IL) (Figure 1b) between April 2017 and July 2017 at our center were reviewed retrospectively. The time of the previous examination is recorded in our institution for all mammography examinations. Women who never had a mammography before or who had a previous mammography examination more than 2 years ago or who did not want to use the self-compression device were excluded from the study. In total 106 women were included in the study.

### Mammography procedure

The technologists or the radiologists in our department informed the patients about the presence of a self-compression system before undergoing the procedure. The technologists explained the procedure to each patient, with emphasis on breast compression. The relationship between breast compression, radiation dose, and image quality was explained briefly and basically. For the first breast (selected randomly), the technologist positioned the breast for the craniocaudal view and initiated a minimum compression of 3 dekanewton to immobilise the breast. Then, the patient used the PAC remote control to complete compression. The remote control is equipped with a '+' key to increase and a '-' key to decrease the amount of compression. This protocol was repeated for the other breast and also for both breasts for the mediolateral oblique views. The patient held the remote control on the other side of the compressed breast to provide easy management for PAC. PAC was under the technologist's control and observation and in case the compression performed by the patient was not found sufficient, she stepped in and supported the patient for further compression. The technologist also rechecked breast positioning including the positioning of the nipple and the pectoral muscle. Afterwards, acquisition of images was performed with 30-50 kV and 100-110 mAs.



Figure 1 a, b. Mammography device (a) and remote control of the patient-assisted compression device (b)

Table 1. Questionnaire

QUESTIONS	RESPONSES	RESULTS	
Q1. Number (n) of previous exams	n years	5.1±3.4 years	
		n	%
Q2. Experience compared to previous exams	Much worse experience	1	0.9
	Somewhat worse experience	3	2.8
	No difference	27	25.5
	Somewhat better experience	25	23.6
	Much better experience	50	47.2
Q3. Level of comfort	Uncomfortable	3	2.8
	Neither comfortable nor uncomfortable	13	12.3
	Comfortable	36	34.0
	Very comfortable	54	50.9
Q4. Level of comfort compared to previous exams	Much less comfortable	1	0.9
	Somewhat less comfortable	2	1.9
	No difference	23	21.7
	Somewhat more comfortable	28	26.4
	Much more comfortable	52	49.1
Q5. Level of anxiety	Not at all anxious	94	88.7
	Slightly anxious	11	10.4
	Very anxious	1	0.9
Q6. Level of anxiety compared to previous exams	Somewhat more anxious	6	5.7
	No difference	44	41.5
	Somewhat less anxious	7	6.6
	Much less anxious	49	46.2
Q7. Attractiveness	Not attractive	26	24.5
	Slightly attractive	9	8.5
	Somewhat attractive	50	47.1
	Very attractive	21	19.8
Q8. Attractiveness compared to previous	Somewhat less attractive	1	0.9
	No difference	63	59.4
	Somewhat more attractive	27	25.5
	Much more attractive	15	14.2
Q9. Impact of design on anxiety	It made me much less anxious	19	17.9
	It made me somewhat less anxious	10	9.4
	It made no difference	76	71.7
	It made me somewhat more anxious	1	0.9
Q10. Impact of PAC on comfort	Much less comfortable	3	2.8
	Somewhat less comfortable	4	3.8
	No difference	14	13.2
	Somewhat more comfortable	23	21.7
	Much more comfortable	62	58.5

Table 1. Questionnaire (Continued)

QUESTIONS	RESPONSES	RESULTS	
Q1. Number (n) of previous exams	n years	5.1±3.4 years	
		n	%
Q11. Impact of PAC on anxiety	Much less anxious	46	43.4
	Somewhat less anxious	22	20.8
	No difference	32	30.2
	Somewhat more anxious	5	4.7
	Much more anxious	1	0.9
Q12. Exam duration compared to previous exams	Much shorter than previous exams	27	25.5
	Somewhat shorter than previous exams	50	47.2
	No difference	27	25.5
	Somewhat longer than previous exams	2	1.8

N: number; PAC: patient-assisted compression

**Survey on the patient’s experience**

Each patient completed a survey subsequent to the mammography examinations. The participants were given a brief explanation on the survey by the mammography technician. The survey tool was a structured self-completed 12-item questionnaire on patient’s experience with regards to physical pain, comfort, anxiety, and exam duration. It also included the number of previous mammography examinations. The questionnaire was available both in Turkish and in English.

**Statistical Analysis**

Response frequencies for each of the analytical items were analyzed by actual percentage responses to each of the multiple-choice options. Descriptive statistics were used. Continuous values were given by mean and standard deviation.  $p < 0.05$  was considered statistically significant.

**Results**

The questions, responses and results are presented in Table 1.

The mean number of previous examinations is 5.1±3.4 with a median of 4 (min 2-max 20).

In the evaluation of the experience compared to the previous ones, 47.2% of the participants declared that it was a much better experience compared to previous ones. For 70.8% of the participants it was a better experience compared to previous ones.

In the evaluation of the level of comfort, 84.9% of the participants found the examination comfortable; with 50.9% very comfortable. For 75.5% of the participants the examination was more comfortable compared to previous ones.

Only 11.3% of the participants declared that they were anxious and 52.8% of the participants declared that they were less anxious compared to previous examinations.

In the evaluation of impact of PAC on comfort; 80.2% of the participants declared that they found it more comfortable with 58.5% much more comfortable.

In the evaluation of impact of PAC on anxiety; 64.2% of the participants declared that the PAC decreased anxiety.

Mean duration time of the examination was 9.2±1.4 minutes with a median of 10 minutes (min 5-max 10). In the evaluation of exam duration compared to previous exams; 72.6% of the participants declared that the exam was shorter than the previous exams.

**Discussion and Conclusion**

The results of our study showed that in general patient satisfaction on the experience of the new technology mammography device featuring patient-assisted compression was high. We believe that the presence of having control over the procedure may change their impression on mammography and increase their compliance to the screening programs.

A study by Kornguth et al. (14) reported that 91% of women had low-to-moderate degree of pain during a mammogram. This study provided predictors to pain and one of the variables that were shown to consistently predict pain was pain at the last mammogram. A more recent survey conducted by Padoan et al. (15) highlighted that “fear of pain” was a factor that affects screening compliance. These studies demonstrate the importance of previous mammography examinations in the participation of periodic screening. It has also been reported that the women who undergo mammography for the first time have higher anxiety levels (16, 17). A study conducted by Mendat et al. (18) regarding patient comfort from the technologist perspective showed that “proper communication of exam expectations” was rated to have significantly more impact on patient discomfort as compared to the other options. This indicates the importance of the psychological aspect of an examination.

Previous psychological studies have reported that self-control over a painful procedure helped women to adapt to pain more easily and felt less pain (19, 20). This can be applied to the mammography experience, especially the most distressing part of the examination, which is compression. Verbal control over the degree of compression can provide satisfactory control for some women. However, that may not be sufficient for certain women. To our knowledge there are only two reports in the English literature regarding breast compression by the patient during mammography, even though it is not a new concept. The

first study conducted by Kornguth et al. (10) including a pre-mammography survey of 30 and post-mammography survey of 10 items, reported that the pain experienced was significantly less when the patient controlled the compression paddle. In that study, one breast was initially compressed by the technologist and then the other breast was compressed by the patient herself with a hand-held button. They also demonstrated that there was no difference in adequacy of the images. A very recent study was reported by Balleyguier et al. (11) including 100 female patients using the same mammography device we used in our study. In that study, one breast was also initially compressed by the technologist and then the other breast was compressed by the patient herself with a remote control device. They reported that 70% of the patients assessed the overall procedure as painless. Discomfort and pain was stated by 17% and 13% of the patients, respectively. No significant difference was found in discomfort or pain felt between self-compressed and technologist compressed breast, however they also reported that 74% of the patients declared that this procedure made them more willing to return for their subsequent mammography examination. This supports our notion that self-control can re-construct the women's previous experience and perception of mammography leading to improved uptake and compliance. Also, 90% of the patients found this procedure useful. In that study, image quality was also evaluated and they compared image qualities obtained with PAC and technologist compression (TC). They reported that the image quality obtained by PAC was as good as TC with even higher compression levels, lower breast thickness, and diminished radiation dose.

There are several limitations to our study. Image quality assessment was not included, and image quality assessment including comparison with previous mammograms would make the manuscript stronger. Further studies with recording of breast tissue thickness with PAC and glandular dose for each woman with comparison to previous mammograms can be conducted. In addition, if one breast was initially compressed by the technologist and then the other breast was compressed by the patient herself; the patient could have more understanding of the amount of compression necessary to achieve an adequate compression. Also, a question regarding if they would like to come for another mammography examination after this experience would be useful to evaluate the effect of the new method on reattendance.

In conclusion, women may feel anxiety concerning mammography and self-compression/PAC may be a useful technique for decreasing pain during mammography examinations resulting in compliance of women with screening guidelines. Further studies should be conducted on the efficacy of self-compression to make sure that the image quality is not sacrificed for added patient comfort.

**Ethics Committee Approval:** Ethics committee approval was received for this study from the Ethics Committee of Acıbadem Mehmet Ali Aydınlar University School of Medicine (2018-12/8).

**Informed Consent:** Written informed consent was obtained from patients who participated in this study.

**Peer-review:** Externally peer-reviewed.

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## References

- Smith RA, Duffy SW, Gabe R, Tabar L, Yen AM, Chen TH. The randomized trials of breast cancer screening: what have we learned? *Radiol Clin North Am* 2004; 42: 793- 806. (PMID: 15337416) [\[CrossRef\]](#)
- Tabár L, Yen AM, Wu WY, Chen SL, Chiu SY, Fann JC, Ku MM, Smith RA, Duffy SW, Chen TH. Insights from the breast cancer screening trials: how screening affects the natural history of breast cancer and implications for evaluating service screening programs. *Breast J* 2015; 21: 13-20. (PMID: 25413699) [\[CrossRef\]](#)
- Perry N, BroedersM, deWolf C, Tornberg S, Holland R, von Karsa L. European guidelines for quality assurance in breast cancer screening and diagnosis. Fourth edition--summary document. *Ann Oncol* 2008; 19: 614-622. (PMID: 18024988) [\[CrossRef\]](#)
- Helvie MA, Chan HP, Adler DD, Boyd PG. Breast thickness in routine mammograms: effect on image quality and radiation dose. *American journal of roentgenology* 1994; 163:1371-1374. (PMID: 7992731) [\[CrossRef\]](#)
- Heine JJ, Cao K, Thomas JA. Effective radiation attenuation calibration for breast density: compression thickness influences and correction. *Biomed Eng Online* 2010; 9: 73. (PMID: 21080916) [\[CrossRef\]](#)
- Keemers-Gels ME, Groenendijk RP, van den Heuvel JH, Boetes C, Peer PG, Wobbes TH. Pain experienced by women attending breast cancer screening. *Breast Cancer Res Treat* 2000; 60: 235-240. (PMID: 10930111) [\[CrossRef\]](#)
- Shrestha S, Poulos A. The effect of verbal information on the experience of discomfort in mammography. *Radiography* 2001; 7: 271-277. [\[CrossRef\]](#)
- Yılmaz M, Kuyumcu Ö. Anxiety and pain associated with process mammography: influence of process information before. *J Breast Health* 2010; 6: 62-68.
- Lambertz CK, Johnson CJ, Montgomery PG, Maxwell JR. Premedication to reduce discomfort during screening mammography. *Radiology* 2008; 248: 765-772. (PMID: 18647845) [\[CrossRef\]](#)
- Kornguth PJ, Rimer BK, Conaway MR, Sullivan DC, Catoe KE, Stout AL, Brackett JS. Impact of patient-controlled compression on the mammography experience. *Radiology* 1993; 186: 99-102. (PMID: 8416595) [\[CrossRef\]](#)
- Balleyguier C, Cousin M, Dunant A, Attard M, Delaloge S, Arfi-Rouche J. Patient-assisted compression helps for image quality reduction dose and improves patient experience in mammography. *Eur J Cancer* 2018; 103: 137-142. (PMID: 30223227) [\[CrossRef\]](#)
- Tabar L, Lebovic GS, Hermann GD, Kaufman CS, Alexander C, Sayre J. Clinical assessment of a radiolucent cushion for mammography. *Acta Radiol* 2004; 45: 154-158. (PMID: 15191098) [\[CrossRef\]](#)
- Markle L, Roux S, Sayre JW. Reduction of discomfort during mammography utilizing a radiolucent cushioning pad. *Breast J* 2004; 10: 345-349. (PMID: 15239794) [\[CrossRef\]](#)
- Kornguth PJ, Keefe FJ, Conaway MR. Pain during mammography: characteristics and relationship to demographic and medical variables. *Pain* 1996; 66: 187-194. (PMID: 8880840) [\[CrossRef\]](#)
- Padoan M, Ferrante D, Pretti G, Magnani C. Study of socio-economic characteristics, diagnosis and outcome of women participating or not participating in mammogram screening. *Ann Ig* 2014; 26: 518-526. (PMID: 25524076)
- Hafslund B. Mammography and the experience of pain and anxiety. *Radiography* 2000; 6: 269-272. [\[CrossRef\]](#)

17. Mainiero MB, Schepps B, Clements NC, Bird CE. Mammography-related anxiety: effect of preprocedural patient education. *Women's Health Issues* 2001; 11: 110-115. (PMID: 11275514) [\[CrossRef\]](#)
18. Mendat CC, Mislán D, Hession-Kunz L. Patient comfort from the technologist perspective: factors to consider in mammographic imaging. *Int J Womens Health* 2017; 9: 359-364. (PMID: 28572739) [\[CrossRef\]](#)
19. Bandura A, O'Leary A, Taylor CB, Gauthier J, Gossard D. Perceived self-efficacy and pain control: opioid and nonopioid mechanisms. *J Pers Soc Psychol* 1987; 53: 563-571. (PMID: 2821217) [\[CrossRef\]](#)
20. Staub E, Tursky B, Schwartz GE. Self-control and predictability: their effects on reactions to aversive stimulation. *J Pers Soc Psychol* 1971; 18: 157-162. (PMID: 5578258) [\[CrossRef\]](#)