Breast cancer is the most common cancer to affect women. Regular mammographical screening can reduce breast cancer mortality by 40-45% among women between the ages of 40 and 69 [1, 2]. However, studies have found that 31% to 89% of women suffer from some degree of anxiety and pain while undergoing mammography [3-10]. To our best of knowledge, little research has been performed to discover methods of reducing the discomfort associated with mammography [11]. Some interventions for relieving the pain and discomfort of screening mammography have been described: 1) giving women written or verbal information about the procedure prior to the mammography; 2) giving a mammography with radiolucent breast cushions; and 3) premedication with 4% lidocaine gel [3, 11].

Effects of relaxation techniques for stress reduction have been documented in physiological, neurological and psychological domains [12-14]. A number of techniques for relaxation and stress-reduction are described, e.g. music, Tai Chi Chuan (TCC), meditation and yoga [12-18]. The efficacy of music therapy as a non-pharmacological
Relaxation techniques for reducing pain and anxiety during mammography

intervention for the reduction of pain and anxiety has been demonstrated in a variety of medical patients including surgical, cardiac and oncological [12, 15]. TCC is a traditional Oriental mind-body calisthenics that is unique for its slow and carefully controlled movements. TCC consists of a sequence of postures that are smooth, coordinated, and relaxing. TCC training has been shown to be beneficial to cardiopulmonary function, balance, and psychological conditions such as anxiety, depression, chronic pain and the declines associated with aging and inactivity of subjects [17, 18]. In addition, TCC could reduce tension, anxiety, pain and mood disturbance [19]. The reverse abdominal breathing, one of Qi Gong, is one of the basic components of TCC which is relatively easy to perform. Many women suffer from anxiety and pain while undergoing mammography. If a simple, inexpensive, noninvasive intervention could decrease anxiety and pain during mammography, not only would it be of immediate benefit to patients, but also compliance with screening mammography would increase. This study was undertaken to determine whether or not the reverse abdominal breathing and music intervention before and during mammography reduced the subjective reports of anxiety and pain during screening mammography.

MATERIALS AND METHODS

This study was approved by our institutional review board. The measures included State Trait Anxiety Inventory (STAI) questionnaire and 11-point numeric rating scale (NRS) of anxiety and pain. STAI questionnaire has two separate components: one is for trait anxiety (TAI); and the other is for state anxiety (SAI). The State STAI questionnaire has been used extensively in intervention research, it is easily completed in a few minutes and its results are reliable in an acute setting [20]. For each NRS, subjects were asked to mark the level of pain or anxiety that they experienced on a scale of 0 (no pain) to 10 (very painful) and 0 (not anxious) to 10 (very anxious), respectively. Exclusion criteria included women having taken pain or anxiety medication before mammography, those with a current psychiatric diagnosis, and those with a history of breast augmentation or surgery.

Women were approached by a research assistant after they had changed into a gown and were sitting in the waiting room provided for screening mammography patients only. During the recruiting phase, each potential subject was asked if she would be interested in participating in a brief study to determine the effects of a breathing technique or listening to an audio compact disc (CD) before and during mammography. From January 2010 to December 2010, of the 195 women approached for potential recruitment, 40 declined to participate. One hundred and fifty-five women agreed to be screened for inclusion. The research assistant explained the purpose and procedures of the study to them. The study was designed to be randomized and decoded by secret questionnaire. Informed consent was not needed. Before mammography, the research assistant guided subjects to complete the STAI and NRS of the anxiety in the waiting room. Based on drawing of lots, subjects were randomized into one of three groups: reverse abdominal breathing, music, or control. All subjects were informed of their group assignment and were provided with media players. Five subjects were not included in the data analysis for the following reasons: one changed her mind, another did not want to be in the reverse abdominal breathing group, and three did not have enough time before being called in for the mammographical examination. A total of 150 subjects were therefore enrolled in this study: 50 subjects in the relaxation group (52.88 ± 6.67 years old), 50 in the music group (50.42 ± 5.54 years old), and 50 in the control group (51.52 ± 5.17 years old), respectively.

The video CD media of the reverse abdominal breathing contained a TCC practitioner showing the viewer how to practice reverse abdominal breathing. Breathing focused on keeping a smooth and slow gentle movement to relax. When subjects inspire through the nose, they gently contract the muscles of the anus and they visualized the 'chi' or air going into their lungs and upper abdomen. When the lungs are full, they expire through the mouth and relax the anus. They visualized the 'chi' or air went back down to the two inches bellow the umbilical area (dan-tian). This exercise is repeated for at least ten cycles of inhalation and exhalation, filling the lungs to maximum capacity and emptying them out completely with each breath. The music subjects had a choice of audio CD with popular music and ballads. Control subjects received routine examination.

Subjects were instructed to watch video CD or listen to their audio CD while in the waiting room before examination. All subjects were asked not to let the radiographers know their group assignment. All mammographies were performed in the standard fashion utilizing craniocaudal (CC) and mediolateral oblique (MLO) views using digital mammography (Lorad Selenia, Lorad/Hologic, Danbury, USA). All radiographers had over 10 years of experience and were certified in mammography by the Society of Radiological Technologists and Bureau of Health Promotion. After undergoing mammography, each subject was met by the research assistant in the waiting room. They were asked to complete the NRS of the anxiety and pain that they experienced during mammography. They returned the media player and were thanked for participating in the study.

Statistics

Patient age and STAI state scores were compared by one-way ANOVA. Kruskal-Wallis test was used to compare the anxiety and pain of NRS. Wilcoxon signed-rank test was used to compare the anxiety before and during mammography. Two-sided p values of less than 0.05 were considered to be statistically significant.
RESULT

As shown in Table 1 and Figure 1, the groups were equivalent before randomization in terms of age and STAI scores. On the anxiety, the NRS score during mammography (NRS<sub>during</sub>) was lower than the NRS score before mammography (NRS<sub>before</sub>) in both the reverse abdominal breathing (p=0.001) and music intervention groups (p=0.02). No significant difference was found between NRS<sub>during</sub> and NRS<sub>before</sub> of the anxiety in the control group (p=0.90). No significant difference was found in terms of the NRS<sub>before</sub> of the anxiety (p=0.13), the NRS<sub>during</sub> of the anxiety (p=0.71) and the NRS<sub>during</sub> of the pain during mammography (p=0.79) among the reverse abdominal breathing, music intervention and control groups.

DISCUSSION

One of the aims of this report was to investigate the effects of the reverse abdominal breathing before and during mammography on the reduction of the anxiety and pain during screening mammography. Our results demonstrated that reverse abdominal breathing before and during mammography decreased anxiety during the screening mammography. To the best of our knowledge, this is a novel

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<th>Table 1. Study outcome by group</th>
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<td>Assessment</td>
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Data presented as mean ± standard deviation

Figure 1

Figure 1. The NRS<sub>during</sub> of anxiety was lower than the NRS<sub>before</sub> in both the reverse abdominal breathing (p=0.001) and music intervention groups (p=0.02). No significant difference was found between NRS<sub>during</sub> and NRS<sub>before</sub> of the anxiety in the control group (p=0.90). (Wilcoxon signed-rank statistics) Bar presented as mean value of NRS of anxiety.
research result. The effect of reverse abdominal breathing might have resulted from vagal modulation and tilting the sympathovagal balance toward deceased sympathetic modulation [17]. However, reverse abdominal breathing before and during mammography showed no significant effect on the pain during screening mammography.

Subjects who listened to popular music or ballads before and during screening mammography showed anxiety reduction during the screen mammography. These results were different from the previous report [20]. The efficacy of music therapy as a non-pharmacological intervention for the reduction of pain and anxiety has been demonstrated [12, 15, 21]. However, it is important to note that there are a number of individual factors that influence responses to music. These include age, gender, cognitive function, severity of stress, anxiety, discomfort and pain, training in music, familiarity with and preference for the music, culture, and personal associations with the music. Music also evokes various types of imagery in many individuals. Thus, the individual’s unique imagery experience will influence her responses to the music [15].

Our study has some limitations which need to be addressed. First, the subjects included only a small number of screening subjects. Second, the study may have included a biased sample. Approximately 21 percent (40/195) of approached potential subjects refused to participate. It is possible that the more anxious and distressed women excluded themselves and that the calmer women felt more able to listen to the purpose and procedures of the study. However, the opposite could also have been true; it would make sense for the most anxious women to seize the opportunity to participate in a “relaxation study.” Third, our music interventions might be categorized as “music medicine” not as “music therapy”. In music medicine, subjects passively listen to pre-corded music offered by medical personnel. In contrast, music therapy requires the implementation of a music intervention by a trained music therapist, the presence of a therapeutic process, and the use of personally tailored music experiences. Although, music therapy interventions with medical populations are significantly more effective than music medicine interventions for a wide variety of outcomes [15], music medicine may be more suited to practice in clinic during the relatively short examination time of mammography. Forth, the study did not record how long the subjects practiced the reverse abdominal breathing or listened to music in the waiting room. The minimum duration of the reverse abdominal breathing and music listening may be an important factor in a study of physical and psychological interventions. In addition, a number of individual factors that is likely to influence responses to reverse abdominal breathing and music, including age, gender, emotional state, music preference, personal associations with the music, prior reverse abdominal breathing or musical training and culture. They are likely to influence these outcomes.

In conclusion, the reverse abdominal breathing and music intervention before and during mammography decreased the anxiety on the screening mammography, but study subjects did not report any benefit on the pain reduction during screening mammography.

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REFERENCES