The Effects of Walking Poles on Shoulder Function in Breast Cancer Survivors

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Breast cancer treatment often results in impaired shoulder function, in particular, decrements in muscular endurance and range of motion, which may lead to decreased quality of life. The purpose of this investigation was to determine the effects of walking pole use on shoulder function in female breast cancer survivors. Participants had previously been treated with 1 or a combination of the following: mastectomy, breast conservation therapy, axillary lymph node dissection, chemotherapy, or radiation. Participants were randomly placed in experimental (n = 6) and control (n = 6) groups and met with a cancer exercise specialist 2 times each week for 8 weeks. The experimental group used walking poles during the 20-minute aerobic portion of their workout, whereas the control group did not use walking poles but performed 20 minutes of aerobic exercise per workout session. Both groups participated in similar resistance training programs. Testing was done pre- and postexercise intervention to determine upper body muscular endurance and active range of motion at the glenohumeral joint. Repeated-measures analysis of variance (ANOVA) revealed significant improvements in muscular endurance as measured by the bench press (*P* = .046) and lat pull down (*P* = .013) in the walking pole group. No within-group improvements were found in the group that did not use walking poles. The data suggest that using a walking pole exercise routine for 8 weeks significantly improved muscular endurance of the upper body, which would clearly be beneficial in helping breast cancer survivors perform activities of daily living and regain an independent lifestyle.

Keywords: ***breast cancer; shoulder function; exercise; walking poles***

Breast cancer is the most common malignant disease in women of the western hemisphere. In the United States, it causes the second most cancer-related deaths.[1] However, as the incidence of breast cancer has increased in women aged 50 to 64, the death rate has decreased.[2] According to the American Cancer Society,[3] an estimated 75% of women diagnosed with breast cancer survive for at least 5 years. Many survivors battle the side effects of breast cancer treatment that result from surgery, radiation, and/or chemotherapy. Shoulder impairment is common following localized treatment, such as surgery and radiation, and often severe enough to negatively effect quality of life.[4,5] Chemotherapy, on the other hand, does not directly effect shoulder function but can contribute to cancer-related fatigue and ultimately a diminished quality of life.[6,7]

Cardiorespiratory exercise is beneficial psychologically and physiologically as a mode of cancer rehabilitation.[8-10] Exercise programs for breast cancer survivors have been shown to decrease psychological distress, enhance mood states, improve body image, increase functional capacity, stimulate natural defense mechanisms, decrease fatigue, prevent weight gain, and improve quality of life.[8,10-18] Thus, it is important to include aerobic exercise in an exercise rehabilitation program for breast cancer survivors for physiological and psychological well-being.

In a healthy population, the addition of walking poles to a walking program resulted in greater cardiorespiratory overload and greater energy expenditure than walking without poles. Rating of perceived exertion did not increase in proportion to the increased cardiorespiratory overload.[19] Therefore, walking with walking poles elicited a greater cardiorespiratory overload but did not increase a person's perception of greater physiological exertion. In addition, using walking poles engages the large muscles of the upper body (pectoralis major, latissimus dorsi, and deltoid) as well as the triceps and forearm muscles. Breast cancer survivors using walking poles (appendix) as part of their exercise rehabilitation regimen may realize greater improvements in shoulder range of motion (ROM) and upper body muscular endurance versus a group that does not use the

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walking poles. The purpose of this study was to determine if an 8-week exercise program using walking poles would increase shoulder ROM and upper body muscular endurance in breast cancer survivors.

Methods

This study was designed to address the impact of walking pole use (experimental group) during cancer rehabilitation on shoulder ROM and upper body muscular endurance when compared to a control group that did not use walking poles. Both groups engaged in similar aerobic, strength, and flexibility training exercises throughout the 8-week study. The only difference between the 2 study groups was the use of walking poles by the experimental group. Therefore, any increases in shoulder ROM and upper body muscular endurance can be attributed to the use of the walking poles.

Subjects

Sixteen women who had undergone primary breast cancer treatment were selected for this study and randomly assigned to a control or experimental group. Two participants from the control group and 2 from the experimental group dropped out for reasons unrelated to the study. Participants were breast cancer survivors who chose to participate in the Rocky Mountain Cancer Rehabilitation Institute's (RMCRI's) exercise rehabilitation program. Prior to training, all RMCRI participants signed an informed consent approved by the university's Institutional Review Board, had a thorough medical screening, had a physical examination by a physician, and completed a battery of physical assessment tests. Based on screening, physical examination, and assessment results, the cancer patients were given an exercise prescription and personal training.

Exercise Intervention

The exercise rehabilitation program consisted of aerobic conditioning, total body resistance training, and flexibility training for both the control and experimental groups. Exerstrider® walking poles were used in the experimental group during the aerobic portion of their exercise intervention. The poles consisted of a 1-piece aluminum, nontelescoping design with a rubber tip to dampen vibration. Poles were fitted to participants by placing the pole tip on the ground, close to and in line with the participant's foot. Proper length put the participant's elbow at a 90-degree angle, with the forearms parallel to the ground and the upper arm perpendicular to both the forearm and the ground. All experimental group participants were formally oriented to the correct use of the walking poles. A cancer exercise rehabilitation specialist from RMCRI supervised each pole-walking session. The experimental group engaged in 20 minutes of aerobic activity using the Exerstrider® poles an average of 2 days per week for 8 weeks. Aside from the couple of days of inclement weather, pole walking occurred outdoors. Pole-walking pace corresponded to an intensity of 40% to 50% of heart rate reserve (Karvonen method). Heart rate was continuously monitored using a Polar® heart rate monitor. Participants in the control group engaged in outdoor walking for 20 minutes, 2 days per week, for 8 weeks. Following cardiorespiratory exercise, participants (experimental and control) performed 30 minutes of resistance training that targeted all the major muscle groups of the body. All sessions concluded with stretching exercises. The control group exercise regimen was identical to that of the experimental group, minus the use of walking poles during the 20-minute aerobic sessions.

Physical Testing

Prior to and following the 8-week intervention in the control and experimental groups, ROM and muscular endurance were measured. During the muscular endurance testing, a metronome was set at 30 repetitions per minute, and participants were instructed to perform as many repetitions as possible before volitional muscular fatigue. A predetermined weight, based on age and a percentage of body weight, was used for each participant. Participants used the same weight before and after the exercise intervention. Muscular endurance exercises included the bench press, shoulder press, and latissimus dorsi (lat) pull down. These exercises targeted the muscles (pectoralis major and minor, anterior deltoid, triceps brachii, and latissimus dorsi) used during walking with poles. A Baseline™ goniometer was used to measure active ROM in the shoulder joint. ROM measures included shoulder flexion, extension, and abduction.

Data Analysis

The ROM and muscular endurance measures (right shoulder flexion, left shoulder flexion, right shoulder extension, left shoulder extension, right shoulder abduction, left shoulder abduction, bench press, shoulder press, lat pull down) were analyzed using repeated-measures ANOVA. Differences between and within groups were considered significant at the 95% level of confidence ($P \leq .05$).

Results

Participants showed no significant differences between groups in age, body weight, time between cancer treatment and exercise intervention, and number

Table 1. Participant Characteristics

Characteristic	Control Group (n = 6) x̄	Control Group (n = 6) SE	Experimental Group (n = 6) x̄	Experimental Group (n = 6) SE	P Value
Age, y	59.17	4.62	50.33	2.74	.059
Weight, lb	181.50	21.48	177.83	14.67	.855
Treatment to intervention, mo	26.00	5.17	19.83	5.11	.509
Number of workouts	12.50	1.41	13.17	1.04	.706

Table 2. Breast Cancer Treatment

	Control Group (n = 6)	Experimental Group (n = 6)
Surgical procedure		
Mastectomy	5	6
Breast conservation therapy	2	2
Axillary lymph node dissection	1	3
Breast cancer location		
Right	3	3
Left	2	3
Both	1	0
Chemotherapy	5	5
Radiation	4	3

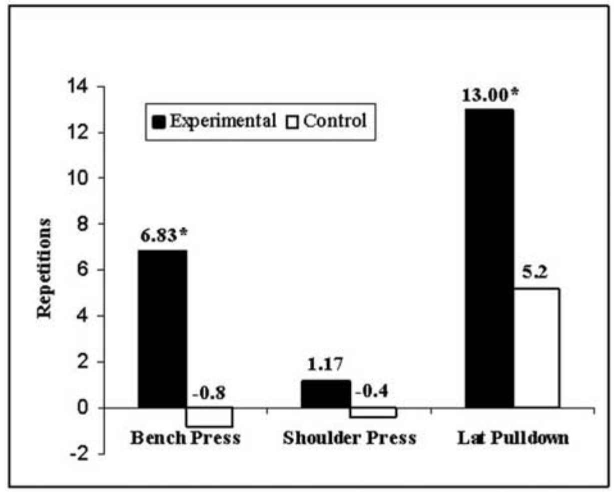

Figure 1 *Differences from pre- to postexercise intervention in the control and experimental groups.*
*Differs significantly from pretest values ($P < .05$).

of workouts performed during the study (Table 1). The type of breast cancer treatment received by study participants is shown in Table 2, and again, the type of treatment for each group was similar. Mastectomy was the most common surgical procedure, and chemotherapy was prescribed more often than radiation therapy.

Figure 1 illustrates changes in repetitions for each muscular endurance test over time. The experimental group showed significant improvement ($P < .05$) on the bench press and lat pull down exercises over the 8-week study. The control group showed no significant change in the measures of upper body muscular endurance (Table 3).

Discussion

Breast cancer treatment, surgical and adjuvant therapies alike, often result in impaired shoulder function in breast cancer survivors. Impaired shoulder ROM, impaired muscular endurance of the shoulder, and impaired strength are common side effects of treatment, which often lead to a decreased quality of life. This study examined the impact of walking pole use on shoulder function.

Range of Motion

More than 18 months had elapsed between treatment and exercise intervention in both groups (19.83 ± 12.51 months in the experimental group and 26.00 ± 12.66 months in the control group), and pretest ROM measurements showed little impairment in either group. These findings are in line with the research of Shimozuma et al,[20] who found that 56.3% of women who had been treated with a modified radical mastectomy suffered from limited arm mobility 1 month after surgery, but 1 year after surgery, only 3.7% still suffered from impairment. However, Ernst et al[21] found that 5 years after undergoing a modified radical mastectomy, 10% of patients suffered from impaired ROM that negatively affected quality of life.

All participants began this study with shoulder ROM values within the normal range. Thus, no significant differences were found in either group over time.

Muscular Endurance

Researchers[5,20] have investigated impairment of upper body muscular endurance in women recovering from breast cancer treatment. Shimozuma et al[20] found that 40% of women who had undergone a modified radical mastectomy experienced arm weakness 1 month after surgery, and 22.2% were still plagued by weakness 1 year after treatment. Lash and Silliman[5] found that 5 years after breast cancer treatment, 40% of women had some decline in the ability to either push or pull objects, lift objects weighing more than 10 pounds, or reach above shoulder level. It is clear that impairment of muscular endurance of the shoulder is a serious concern post–breast cancer treatment. In our study, muscular endurance of the upper body was measured using the bench press, lat pull down, and shoulder press because these muscles are more active when walking with poles than when walking without poles.

Not surprisingly, the experimental group significantly improved in the number of repetitions

Table 3. Change for Control and Experimental Group in Muscular Endurance

	Control Group (n = 5)				Experimental Group (n = 6)			
	Preexercise		Postexercise		Preexercise		Postexercise	
Exercise	$\bar{x}$	*SE*	$\bar{x}$	*SE*	$\bar{x}$	*SE*	$\bar{x}$	*SE*
Bench press	14.8	4.7	14.0	5.0	8.7	1.2	15.5	1.1
Shoulder press	13.4	2.6	13.0	2.5	13.00	2.0	14.2	1.5
Lat pull down	16.0	4.8	21.2	6.8	15.7	3.7	28.7	8.1

performed on the bench press ($P = .046$) and lat pull down ($P = .013$) exercises. Improvements in these exercises imply that using walking poles during the aerobic portion of a fitness program results in significant gains in muscular endurance in the major muscles of the upper body.

Conclusion

Many breast cancer survivors suffer from impaired muscular endurance of the upper body following treatment. Shoulder impairment, which makes seemingly simple tasks such as pulling an object off of a shelf or reaching overhead difficult, often results in a decreased quality of life. Therefore, finding rehabilitation options that target shoulder function is of utmost importance for breast cancer survivors. Walking poles are easy to use in a variety of situations, provide increased stability for those who may need a third point of contact, and also increase the intensity of walking. For breast cancer survivors in particular, using walking poles is more beneficial than performing cardiorespiratory exercise and resistance training alone as a result of improved muscular endurance of the shoulder.

More research is needed in this area to determine the impact of walking pole use on shoulder function in women who have more recently finished their cancer treatments. It is likely that improvements in all facets of shoulder function would come more quickly if walking poles are included in posttreatment exercise. Walking poles may be a convenient and inexpensive addition to posttreatment rehabilitation with far-reaching, positive outcomes. Examples of walking pole activities that may improve shoulder function are displayed in the appendix.

Appendix
Walking Pole Exercises

Walking poles can be used almost anywhere. Poles similar to those used at the Rocky Mountain Cancer Rehabilitation Institute can be purchased by visiting www.exerstrider.com or by calling 800-554-0989. To choose the appropriate size, the patient will stand, holding a walking pole in each hand, placing the tips of the poles on the ground, even with the patient's feet. The proper pole length will leave the patient's elbow at a 90-degree angle, the forearm parallel to the ground, and the upper arm perpendicular to both the forearm and the ground (Figure A1).

- Begin by having the patient take a step forward with the left foot. As the left foot is planted, the patient should plant the walking pole in the right hand even with the left foot (Figure A2).
- The patient will keep the pole in the right hand planted and push down while moving past the pole, feeling the latissimus dorsi and triceps muscles contract.
- The patient will then plant the left walking pole even with the right foot (Figure A3).

Have the patient continue walking, taking comfortable strides and focusing attention on planting the poles in the correct position. A common mistake occurs when the patient changes the elbow angle. However, the angle of the elbow should remain nearly the same throughout the movement. Have the patient practice using the proper form on level ground before advancing to hilly or uneven terrain.

- To increase the intensity of the patient's workout, add hills to the patient's route. Walking up hills and stairs will increase the demands on the patient's shoulder, both by increasing ROM as well as increasing muscular demands (Figures A4 and A5).
- Step-ups: Using a stable bench, have the patient place the poles on the bench, initially keeping both feet on the ground (Figure A6). The patient will then step up with 1 foot (Figure A7). Once stable, the patient will bring the other foot up onto the bench (Figure A8). The patient will step down with 1 foot, then the other, and alternate the leading leg.
- Balance disk walking: Set up the balance disks to accommodate the patient's stride length. The patient

Figure A1 Proper pole length.

Figure A2 Walking with left foot forward.

Figure A3 Walking with right foot forward.

Figure A4 Walking uphill.

will use the poles for balance and walk across the disks (Figure A9).

Walking poles are a valuable tool for breast cancer survivors who are hiking uphill as well as on level terrain. Walking poles can be used to lessen the impact on lower extremity joints when walking downhill and will add a third point of contact, increasing confidence in balance on uneven terrain.

Figure A5 Walking up stairs.

Figure A6 Step-ups with poles, first phase.

Figure A7 Step-ups with poles, second phase.

Figure A8 Step-ups with poles, third phase.

Figure A9 Balance disk walking.

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