Breast Cancer Recovery Program for Individuals With Breast Cancer-Related Lymphedema: Rationale and Exercise Parameters

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Individuals with breast cancer-related lymphedema (BCRL) without continual management experience symptom progression over time, highlighting the need for quality, long-term therapeutic programs. Exercise is recommended as one of the four components of established decongestive therapy for individuals with BCRL; however, previous attempts to identify an effective exercise program in a controlled study that effectively decreases arm swelling and improves flexibility have been a challenge for the medical profession. Exercise recommendations made during decongestive therapy for a home program that addresses physical symptoms, but not the emotional symptoms, may result in less effective long-term home compliance.

The high degree of physical morbidity in individuals with BCRL, including swelling and loss of limb flexibility, may lead to fibrosis, stasis and bouts of infection. Also, the high degree of psychological morbidity seen in individuals with BCRL has been well established with more severe emotional symptoms seen compared to those with a primary breast cancer diagnosis or the general population. Psychological morbidity appears to continue even after completion of active lymphedema treatment and is unrelated to the severity of the swollen limb.

The Breast Cancer Recovery Program© (BCRP) is a program that provides an exercise/relaxation program which improves BCRL symptoms and compliance with home exercise. The purpose of this paper is to provide:

1) a description of the BCRP;
2) supporting evidence for the BCRP Circle of Healing concept; and
3) a rationale for exercise parameters used in the BCRP.

Program Description

The BCRP is an evidence-based, comprehensive exercise/relaxation rehabilitation program for individuals following breast cancer surgery and BCRL. In a controlled study, this program has demonstrated significant overall treatment effects of decreased extracellular fluid in the affected arm, as well as improvement in affected shoulder active range of motion (AROM), mood, quality of life (QoL), and wanted weight loss. Treatment subjects completing the program demonstrated high exercise and relaxation compliance, both during the study and during the following 3-month home program. Treatment subjects that demonstrated significant improvement in decreased extracellular fluid also showed significant improvement in mood and QoL areas as compared to controls; this relationship is described in the program as a synergistic, feed-forward Circle of Healing effect (page 7). In the controlled study, the BCRP was found to be a safe and effective baseline standard of exercise for individuals with BCRL; easy to implement, cost effective, able to fit within the participant’s daily schedule, and could be used within a home program as well as a hospital or clinic setting.

The BCRP consists of three components: 1) the FLOW® video, “From Lymphedema Onto Wellness” (2003 BCHI, TouchStar Productions, Inc.); 2) written, instructional material regarding lymphedema and relaxation techniques; and 3) a hands-on practice component exploring self-help and relaxation techniques, including deep diaphragmatic breathing (DDB).

The 17-minute FLOW® video uses gravity-resistive arm exercises together with DDB, supplemented by imagery, a natural scenery backdrop of flowing water, and background music. Although the exercises visually resemble Tai Chi or Qigong, the arm movements are designed to increase lymphatic fluid flow and arm flexibility (AROM). Exercises are cued by the directive message from the storyline while promoting relaxation.

A central concept of the BCRP is described as a Circle of Healing loop (page 7). In this continual feed-forward healing loop, initial improvement at one point on the loop may result in improvements at subsequent points on the loop’s continuum in other physical, emotional and immune system areas. This healing loop is seen as...
self-perpetuating and self-motivating due to the unwanted, devastating physical and psychological morbidity associated with BCRL symptoms and the alternative relief and self efficacy experienced when positive results are being achieved in a successful therapeutic program.

**Supporting Evidence For The BCRP Circle Of Healing Concept**

The rationale for the BCRP feed-forward Circle of Healing concept is based on lymphatic system physiology as it relates to areas of exercise/relaxation, DDB, mood, QoL, and central nervous system (CNS) and immune system function. The positive results from the controlled study of the BCRP show that treatment subjects who improved in physical symptoms also improved in emotional symptoms, in support of the Circle of Healing concept. It is proposed that initial progress along the Circle of Healing loop could begin at any point on the loop, but for this discussion, we will begin at the point in which the BCRP helps to move fluid from the affected arm.

**Role Of Exercise In Improving Physical Symptoms**

It is established that lymph propulsion through lymphatic and venous drainage systems is increased by varying total tissue pressure, in part, through muscular contractions. Exercise has been established as one of the most effective ways to achieve lymph propulsion, along with DDB, external pressure on the limb, and MLD. Exercise may play a role in enhancing macrophage action, improving lymph flow, in part, by skeletal muscle movement, resetting the sympathetic drive of the lymphatic routes, encouraging resorption of proteins, encouraging lymphangiogenesis, and reducing stress on damaged axillary lymphatics in individuals with BCRL. Exercise, along with DDB, has been reported to decrease arm volume in one non-randomized study. DDB is a recommended component of the Casley-Smith and the Vodder lymphedema treatment approaches due to its ability to facilitate lymph flow from local total tissue pressure changes during respiration. Through DDB, congested fluid in the limb is drained out of the affected limb toward the cleared trunk, similar to the manual lymphatic drainage sequence of decongestive therapy. Accordingly, the BCRP has used these physiological studies in developing a strategy to improve physical symptoms of BCRL. In the controlled study, extracellular fluid reduction, a measure of decreased swelling, showed overall significance in the treatment group compared to controls. DDB is one of the key exercise components of this program due to its ability to clear lymphatic fluid from the trunk.

**Role Of Exercise In Improving Emotional Symptoms**

In at least 15 meta-analyses of over 100 studies, the literature supports the benefit of exercise for cancer patients, including a biopsychosocial mechanism through a psychological pathway thought to improve an ability to cope with a cancer diagnosis. Exercise and depression have been shown to be inversely related and, reportedly, can be extrapolated to include individuals with mild to moderate depression. This inverse relationship is seen in mild aerobic exercise, even in the absence of cardiovascular benefits. Exercise has been shown to provide emotional benefits in specific QoL areas for breast cancer patients and individuals with BCRL. Historically, DDB/relaxation techniques have been a major component of Yoga, Tai Chi, and Qigong, with several studies identifying the efficacy of these techniques to initiate immune system changes and improvements in emotional areas.

Accordingly, in this study, the act of exercise, including DDB, is designed to improve the emotional symptoms of BCRL. The BCRP study resulted in significant overall improvements in mood and quality of life symptoms seen in the treatment group compared to controls.

**Effect Of Emotional States And Behavior On The Immune System/CNS**

A plethora of studies have shown that psychological chronic stressors as seen in BCRL, result in a dose-related immune response with the most chronic stressors resulting in the most global immunosuppression. These responses include reliable decreases in almost all areas of immune function and regulatory changes in the CNS and endocrine systems. Behavior represents a potential pathway linking stress with the immune system. Behavior and stress are postulated to affect the body through sympathetic fibers, descending from the brain into bone marrow, thymus, spleen, and lymph nodes. The reported suppression...
of immune competency in limbs with LE may complicate further the body’s ability to maintain a healthy homeostasis within the lymphatic pathways, lympho-venous anastomoses and the regulatory systems of the body while a stronger immune system may improve BCRL symptoms.26

**Interrelations Among The CNS, Glucocorticoid, And The Immune System**

The functional interaction among the CNS, neuroendocrine, and immune systems occurs as each responds to internal and external events, such as hormonal levels and changes in levels of exercise and physical activity. This interactive network allows the CNS to regulate the immune function locally at inflamed sites, in regional lymph nodes, and throughout the body through hormonal input.27

Glucocorticoids are the most powerful immunosuppressive agents within the CNS, affecting every major physiological system and all aspects of immunity; they modulate vascular function, energy metabolism, behavior, and circulating numbers of immune monocytes28 and macrophages.27 Physiological concentrations of glucocorticoids, from either physical exercise or psychological stress, result in changes in the transcription of genes involved in the inflammatory response.27 Also, glucocorticoids may play a role in the development and pathogenesis of depression.29

The immune system is affected by extrinsic and intrinsic interconnections within the CNS, exercise, and mood.27 A strong interactive immune system attempts to return the CNS to a balanced state as it responds to the CNS and increased glucocorticoid production from high levels of physical or psychological stress factors.24

Part of the immune system’s function is fighting infection,4 a major concern for individuals with BCRL, by the action of its phagocytic macrophages, which destroy pathogens that cause infection.31 Immune function has been shown experimentally to be suppressed in the skin of lymphedematous limbs.26 Thus, it is postulated that BCRP may enhance physiological balance within the affected lymphedematous limb through a *Circle of Healing* loop and may improve lymphatic function, and thus physical and emotional BCRL symptoms. No data in the BCRP study was collected in regards to CNS/immune function changes.

**Rationale For Exercise Parameters**

The BCRP provides an evidence-based practice standard of exercise/relaxation for individuals with BCRL by using reported scientific studies, including the efficacy study of the BCRP to establish and confirm its proper exercise design parameters, including type, intensity, duration, frequency, and progression/grading of exercise.

**Exercise Type**

In individuals with BCRL, isotonic, not isometric, exercise with muscle shortening has been found to yield the highest lymphatic flow.8 Lymph flow has been shown to increase approximately 3-6 fold with dynamic exercise actively moving out away from the body compared to static isometric exercise, such as in gripping.30 FLOW© exercises in the BCRP combine slow, moderately-intense, muscle-shortening, gravity-resistive arm movements with DDB techniques.

The FLOW© video incorporates intermittent work/rest arm positions to allow the physiologically impaired lymphatic system time to stabilize the increased arterial flow seen during exercise in order to allow healthy total tissue pressure changes to be reestablished. Work positions in FLOW© against gravity and moving out away from the body are designed to encourage lymphogenesis and increased flow in alternate lymphatic routes away from the axilla. Muscular contractions underlying alternate lymphatic pathways are stimulated during work positions in a proximal-to-distal sequence, as in MLD.13 Arm movements in work positions correspond with the inhaling breath. Following work positions, flexed arm positions moving toward rest positions close to the body are used to encourage increased lymphatic fluid flow by providing a change in total tissue pressure. Arm movements toward resting arm positions correspond with the slowed exhaling breath and a brief rest period from active muscle pumping done in work positions.

Limited shoulder flexibility has been reported to be one of the most serious emotional concerns of individuals undergoing breast cancer surgery.31 Physical activity plays an important role in relieving physical symptoms of BCRL in that the primary physical limitations reported by BCRL patients are the same ones helped by physical activity.32

Shoulder limitations in work positions of flexion, abduction and adduction in the immediate postoperative period have been reported in breast cancer patients and may be related to axillary treatment.33 Shoulder flexibility deficits have been found to persist even 20 years after breast cancer surgery.34 They limit the individual’s level of independent functioning in daily activities and may be related to lymphedema progression. These flexibility impairments, along with other BCRL symptoms become constant reminders of the physical and emotional scaring from the diagnosis.

The BCRP is designed to improve flexibility both in positions of work and moving toward positions of rest. Those arm movements which are reported to be the greatest impediment to good functional return following surgery have the most overall repetitions in FLOW©. The storyline, scenery and music together present a relaxed exercise.

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atmosphere to counter fear of movement due to fear of pain.

During the controlled study, subjects in the treatment group overall showed significantly less extracellular fluid in the affected arm compared to controls. Also, treatment group subjects showed significantly overall flexibility improvements in both positions of work and in moving toward rest positions.

**Exercise Intensity**

Progressively intense exercise has been shown to result in an initial dosage-related response on the body’s regulatory system homeostasis. Increased responses from immune cytokines have been reported in intense exercise while a lower immune response toward homeostasis was seen with moderate intensity exercise. Moderate, not high intensity exercise has been shown to result in a dosage-related increase in oxidative burst immune activity (killing pathogens once engulfed by macrophages of the immune system). Lack of motion has been shown to lead to greatly decreased lymph flow and increased risk of swelling.

Studies evaluating exercise have reported conflicting results in terms of increased or decreased swelling with exercise in breast cancer survivors. Only one non-randomized gentle exercise/DDB study reported swelling reduction. The FLOW™ video uses a light-to-moderate AROM exercise intensity format. In the BCRP study, this program demonstrated a safe baseline of exercise intensity in which more aggressive exercise levels could be evaluated under controlled conditions.

**Exercise Duration**

The duration of exercise used in the BCRP has been supported by several studies which demonstrated 5 times higher output of lymph flow during the initial 15-minute period of exercise. During the next 25 minutes of exercise, lymph flow dropped to 2-3 times higher than at rest. Thus, the 17-minute duration of exercise was chosen for the FLOW™ video to achieve the greatest amount of lymph flow in the shortest amount of time, in order to fit into a typical busy daily schedule and fit within the U.S. insurance reimbursement of one unit of treatment time for therapeutic exercise.

**Exercise Frequency**

Although there appears to be no universal standard for exercise frequency or best time of day to exercise, one study found no significant difference in the overall magnitude of immune response in women who exercised either in the AM or PM. Many of the women in the BCRP study, who were instructed to do the FLOW™ video daily, chose to do the video at bedtime and reported that they fell asleep more easily and slept more soundly using this choice.

**Exercise Progression/Grading**

Tailoring exercise programs to the needs of each individual improves outcomes. A full length mirror may be used to determine arm flexibility limitations by comparing flexibility of the affected with the unaffected arm during this bilateral exercise program. Thus, arm positions needing additional range can receive additional focus during the exercise program. Intensity may be increased by increasing weights, exercise duration, and frequency, although these parameters were not evaluated in this initial baseline study. Changes in these parameters may be initiated as appropriate by the physician and treating lymphedema therapist. The program can be completed in standing, seated, or supine positions with adaptations for individual differences in levels of exercise tolerance.

In the efficacy study of the BCRP, treatment group subjects significantly improved compared to controls in decreased swelling and increased arm flexibility, while being educated in grading techniques and the importance of safe, progressive exercise. The FLOW™ video is designed to be used under the direct care of a lymphedema therapist and physician in order to establish a baseline level of safe exercise for each individual.

**Conclusions**

The results of the controlled, randomized efficacy study of BCRP supports its use as a standardized program of exercise/relaxation for improvements in physical and emotional BCRL symptoms. This paper provides rationale and supporting evidence for the theoretical design of the BCRP in providing a comprehensive mind, body, spirit approach to improve physical and emotional symptoms of BCRL. A program that improves BCRL symptoms, is easy to implement in the home/clinic setting and flexible to daily schedule changes, is cost effective and reimbursable, and promotes good compliance would be beneficial for individuals with BCRL.

The BCRP is available from Breast Cancer Healing, Inc., www.BreastCancerRelatedLymphedema.org or mkmcclure@yahoo.com.

*The Breast Cancer Recovery Program was developed by Marjorie McClure, OTR/L, CLT-LANA during her recovery from breast cancer and breast cancer-related lymphedema. The research was conducted through Magee Women’s Research Institute, Pittsburgh, Pennsylvania. The formal paper will be published through The AJOT journal You can reach Marjorie through www.BreastCancerRelatedLymphedema.org or email her at mkmcclure@yahoo.com."
REFERENCES