Original Research

Implementing a 4 Week Balance Protocol to Impact Quality of Life in Cancer Patients

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ABSTRACT

International Journal of Exercise Science 8(2): 145-153, 2015. As a result of various cancer treatments, balance, fall risk, and quality of life (QOL) of cancer survivors are often negatively compromised. There has been no prior research conducted examining balance ability and its association with QOL in cancer patients. The purpose of this study was to investigate whether improved balance will positively influence QOL. Eight female cancer patients (age 55.8 ± 11.8 yrs.) volunteered for an experimental group, and five sex-matched cancer patients (age 64.5 ± 4.6 yrs.) volunteered for a control group. A 4-week balance program, employed twice per week and consisting of 5 different exercises, was utilized with the experimental group participants. Measures of balance and fall risk were obtained using a balance system (Biodex SD 950-440). QOL was assessed by employing the Functional Assessment of Cancer Therapy-General (FACT-G) survey. Alpha level of .05 was used for all statistical analyses. There was no significant relationship between QOL and fall risk (r=.08, p=.790). A two-way ANOVA demonstrated significant group difference in QOL, but not time. More specifically, control group had higher QOL score than did experimental group. A second two-way ANOVA shows no significant difference in fall risk between groups nor time. Due to a lack of improvement in balance from pre- to post-tests, we did not examine an improvement in QOL scores among cancer patients. Further research needs to be completed to more appropriately measure improvements in balance and a longer-term intervention.

KEY WORDS: Oncology, postural sway, postural stability, self-efficacy, fall-risk, exercise, post-treatment

INTRODUCTION

An estimated 50-75% of cancer deaths in the US are related to smoking, poor dietary choices, and physical inactivity (12). Wiggins and Simonavice (12) stated that exercise has a positive influence on fatigue levels, psycho-social measures, and QOL. There is limited research available comparing QOL, cancer, and balance; however, there is a wide variety of research describing the relationships between balance and QOL, cancer and QOL, and cancer and fall risk. QOL is defined as an assessment of emotional, social, physical, and psychological well-being of an individual's life, or lack thereof. After finding the connecting variables of cancer, balance, and QOL, we interrelated these variables to determine a research hypothesis. It has been found that greater balance has a positive correlation with an

improved QOL. It has also been discovered that cancer impedes QOL, especially regarding treatment. According to Spoelstra, Given, and Schutte, cancer treatment alone can increase falls in older adults. For example, chemotherapy has a negative effect on cognitive impairment, resulting in an increased fall risk (9). Since there is limited research available to explain the impact of a short term balance program on fall risk and QOL in cancer patients, there is a need to conduct intervention of a balance protocol and monitor QOL changes.

One of the main gaps found regarding this topic is that there has been no research conducted to tie all of the variables together. While analyzing these variables, Tuunainen, Rasku, Jäntti, Moisio-Vilenius, Mäkinen, Toppila, and Pyykko (11) found that after exercise intervention was completed, QOL was impaired and participants felt a greater level of mental stress than at the beginning of the intervention due to fatigue from a change in their lifestyle. Additionally, Spoelstra, Given, and Schutte (9) concluded from self-reported data and clinical validation that older adults with cancer have an increased fall risk. For the purpose of this study, fall risk is defined as an increased susceptibility to falling that may cause physical harm, as interpreted by the researchers. An increased fall risk, however, could be due to the fact that older adults reportedly have decreased balance because of age-related factors (6).

Often, research does not look at fall risk as a main factor of QOL, but instead uses it as a secondary variable. For example, Yajima, Ise, Wako, Katayama, and Kizu (13) found that fall risk is correlated with other health risks in cancer patients, such as infection. This was determined by a fall risk assessment score sheet that Yajima et al. created (13). Another factor that has been a limitation in many studies is why QOL has improved in cancer patients. A secondary hypothesis we considered throughout the study is that the QOL scores may be impacted by the length of time post-cancer treatment prior to the balance exercise program.

While previous research has only looked at balance/fall-risk as an extraneous or secondary variables, our study is aimed to examine the impact of balance exercise program on QOL scores and fall risk individually. The study is designed to implement a balance program and determine if there is a direct influence on improving QOL among various cancer patients, inclusive of different cancer diagnoses, age groups, and cancer treatment methods. More specifically, since there is a lack of research in the population of cancer survivors examining risk of falling and its effect on QOL in cancer patients, we aim to implement a balance protocol, study its impact on the QOL in cancer survivors post treatment, and compare these results to a group of cancer survivors not participating in a structured balance regimen.

The purpose of this study is to determine if a short-term balance protocol will improve the QOL in cancer patients. We hypothesize that balance will improve in the experimental group, subsequently improving the QOL significantly more than in the control group from pre- to post-test. Given that numerous studies have shown that a decrease in fall risk can lead to an increased QOL, conducting the present

research will be beneficial for health practitioners by providing new information elucidating the effect balance has on QOL in this specific population. Addressing this unknown variable will also influence future development of exercise and cancer recovery programs.

METHODS

Participants

Participants were recruited via a cancer recovery program at a regional university, and through a local hospital's cancer center in the upper Midwest of the US. A total of 8 female cancer patients participated from the University of Wisconsin-Eau Claire (UWEC) Cancer Recovery & Fitness Program as an experimental group. The control group consisted of 5 female cancer patients from the Marshfield Clinic Cancer Center (Eau Claire). In order to participate in the study, participants must have been diagnosed with cancer. Participants were excluded from this study if they had a drastic change in activity levels during the duration of the study, dropped out due to health issues, or a death occurred. There were no exclusions throughout the duration of our study for any of the reasons previously mentioned. For the experimental group the mean ± standard deviation (SD) age was 55.8 ± 11.8 years with a mean ± SD height of 63.6 ± 1.4 inches. The control group had a mean ± SD age of 64.5 ± 4.6 years with a mean height 64.2 ± 1.4 inches. Cancer types for both groups included breast, primary peritoneal, brain, small lymphatic lymphoma, AML, ovarian, and colon. In the experimental group the mean time post-treatment was 7.5 ± 6.1 months. In the control group the mean time post-treatment was 17.2 ± 20.4 months. Treatment types included chemotherapy and other treatment types. This study was approved by the International Review Board. Each participant read and obtained a copy of the informed consent prior to data collection.

Protocol

The following information was found via the demographic survey: age, cancer type, time from/to treatment, treatment type, fear of falling, perceived ability to balance, and confidence in recovering from a fall. Fear of falling, perceived balance ability, and confidence of recovering from a fall were all scored on a 0-10 scale. Height was measured using a Stadiometer that is calibrated regularly. Although all researchers were trained in proper data collection protocol, only one researcher measured each client's height for consistency. Three different measurements were taken to find an average. Height was utilized when measuring fall risk and postural stability on the Biodex Balance System.

Quality of life values were assessed by employing the Functional Assessment of Cancer Therapy-General (FACT-G) survey (version 4). It takes into consideration social, physical, emotional, and functional well-being. This survey was created by David Cella, Ph.D. and was copyrighted in 1987, 1997. The faculty mentor for the study (Dr. Wiggins) taught each of the authors to correctly administer and score the FACT-G surveys. "The FACT-G is a valid and reliable instrument for use in the older patient with cancer. The FACT-G is not an age-biased instrument" (7).

Fall risk and postural stability were assessed using a Biodex Balance System (BBS, Biodex SD 950-440, Shirley, NY).

Figure 1 shows a fall risk test being performed. Before each test was administered, foot angle and heel placement of each foot was measured by the proctor. Fall risk was categorized into the three categories above average, average, and below average in relation to age and height. Postural stability was measured based on time spent in four separate zones (A, B, C, and D).The BBS instrument has been reported to have an acceptable level of reliability in measuring balance (2).

Figure 1. Biodex balance system.

The International Physical Activity Questionnaire (IPAQ) short form (4) was used to gather information on baseline physical activity levels of the participants. The purpose of the IPAQ was to get an overall estimate of the participants' free-living (out of exercise session) activity levels rather than to record the changes that may have occurred throughout the intervention. Self-report physical activity level was gathered via a demographic survey at both pre- and post- testing. There were three categories including light intensity activity, moderate/vigorous intensity, and sedentary time. Both the light intensity and moderate/vigorous intensity activities were measured in minutes per week, and sedentary time was measured in hours per day. Two or more examples for each intensity of physical activity were provided for the participants to appropriately estimate the amount of physical activity per intensity (4).

Participants came to the Human Performance lab located on the UWEC campus. After completing the informed consent form, they filled out the FACT-G survey, as well as the demographic survey. Next, their height was taken and recorded prior to the fall-risk and postural stability tests on the BBS. To prevent a possible learning effect, each test had a trial run that was not recorded. Three trials were recorded for each test, and the participants were not provided with their results at this time. The pre-test procedure lasted 20 minutes.

The intervention for the experimental group consisted of a four week balance program conducted twice weekly in the Cancer Recovery & Fitness Program. This program took place in a physical education center on the UWEC campus under supervision of the program director. The balance portion of the program, as shown in Table 1, was approximately 5-10 minutes and was completed in addition to an exercise program that was run by the Cancer Recovery and Fitness Program director. The balance protocol was completed at the end of the regular exercise session. Some participants had lower functional capacities and needed limited assistance; however, all balance exercises were completed at each client's individualized level. The duration of the

Table 1. Balance protocol used twice per week by experimental group.

Exercise	Sets	Duration	Rest	Comments
Cone Pattern-Semi Circle	2	hold 5-30 seconds	30 seconds	
Balance Beam Pad	2	2 lengths of the beam	30 seconds	Step over ankle-Length wise
Balance Beam Pad	2	2 length of the beam	30 seconds	Walk Sideways-Feet perpendicular
Foam Square	2	1 rep each leg	30 seconds	Front, Back, Side Touch
Heel-Toe rocks	2	15 seconds	30 seconds	Against a wall
Balance ball leg extension	2	5 reps each leg	30 seconds	Can start on chair

balance protocol was chosen to avoid fatigue, one of the most prevalent symptoms of cancer treatment (12), as to avoid increased risk of falls during each session. The balance tools utilized were as follows: square foam pad, foam balance beam, cones, and physio ball. Kinesiology students/volunteers led each participant through all of the balance exercises. The control group maintained their normal lifestyle for the four weeks of the study.

For post-testing, participants in both groups returned after the four weeks to be reassessed. Each participant repeated the surveys conducted during the pre-test. Their height was gathered again and each participant was reassessed on the BBS for fall-risk and postural stability. The procedure lasted 15 minutes. The participants received their results upon completion of data analysis.

Statistical Analysis

The design of this study is an experimental design. The dependent variable investigated was QOL, and the primary independent variable looked at was balance among the cancer patients. Balance was assessed by postural stability and fall risk, which were measured by the BBS. An association between fall risk and QOL was analyzed with a Pearson's r correlational analysis. A two-way repeated measures ANOVA was employed to examine changes in QOL and fall risk from pre- to post-testing between control and experimental groups. There were extraneous independent variables that were taken into consideration, including self-report physical activity level, psychological factors (fear of falling, perceived balance, and confidence in getting up), treatment type, cancer type, and time post cancer treatment. A one-way ANOVA was also performed to demonstrate the impact of various types of cancer treatment (chemotherapy vs. other) with baseline QOL and baseline fall risk score. All results were analyzed using SPSS version 19.0. *Alpha* level was set at 0.05.

RESULTS

After completion of the intervention, there was one drop out from the control group due to a scheduling conflict for post-test prior to completion of data collection. Descriptive statistics for age, height, self-reported siting time in hours, and physical activity (minutes) at baseline are presented in Table 2. All participants filled out a FACT-G quality of life questionnaire at pre-testing. The experimental group scored 19.76 ± 1.94 out of 26 (higher score indicating better QOL), while the control group averaged 22.79 ± 1.60 (Table 4).

Table 2. Descriptive statistics of self-reported physical activity at baseline by groups

	Control Group (n=5)	Experimental Group (n=8)	Total (n=13)
Age (years)	64.5 ± 4.59	55.75 ± 11.83	59.5 ± 9.81
Height (inches)	64.17 ± 1.38	63.59 ± 1.43	63.84 ± 1.39
Sitting Hours (hr/day)	4.83 ± 2.04	6.94 ± 1.66	6.04 ± 2.06
Light Intensity Exercise (min/week)	1796.67 ± 1589.89	813.75 ± 326.06	1235.0 ± 1133.25
MVPA (min/week)	425.0 ± 123.57	461.88 ± 410.16	446.07 ± 311.15

Note. Values are presented as means and standard deviations. MVPA=moderate-to-vigorous physical activity.

Four weeks later, both fall risk and the QOL were assessed in post-testing. Post-testing results of fall risk in the experimental group equated to 2.01 ± 1.2. Control group recorded fall risk scores at 2.06 ± 1.09 (Table 3). Total values assessed between the two groups at post testing measured at 2.03 ± 1.10. FACT-G scores in the experimental group after four weeks averaged 19.68 ± 3.03, while the control group scores resulted in 22.60 ± 2.36.

Association between fall risk and QOL was described using a Pearson Correlation Analysis. The analysis results demonstrated the relationship was inconclusive (r= .08, p=.790). A one-way ANOVA was employed to determine the effects of cancer treatment type on baseline QOL and baseline fall risk scores. The analyses results in no significant differences between cancer treatment types (F=0.10, p=.902),).Correlations between fall risk and time since last treatment (r=.28, p=.350), light activity level (r=..06, p=.835), moderate/vigorous activity level (r=.48, p=.098), sitting hours (r=.46, p=.116), fear of falling (r=.51, p=.076), confidence in recovering from a fall (r= .50, p=.085), and perceived balance (r=.23, p= .441) non of which were insignificant. Correlations were also run between QOL time since last treatment (r=.37, p=.219), light activity level (r= ,173, p=.571) moderate/vigorous level (r=.259, p=.392), sitting hours (r=.427, p=.145), fear of falling (r=,294, p=.329) confidence in recovery, perceived balance (r=.495, p=.085), A two-way repeated measures ANOVA was employed to examine the impact of intervention on QOL before and after intervention. There was no significant interaction effect on QOL (F=0.01, p=.945) or time effect (F=0.01, p=.828). However, there were significant differences in QOL between the experimental and control group (F=5.41, p=.040). This significant difference in QOL scores at baseline between the experimental and control group is also demonstrated via Independent Samples t-test (p=.009). A two-way repeated measures ANOVA was also employed to examine the intervention's impact on fall risk before and after the program was implemented. There was no significant interaction effect on Fall Risk

Table 3. Fall risk before and after completion of a 4-week balance protocol.

	Pre-Test	Post-Test
Treatment Group (n=8)	2.16 ± 1.29	2.01 ± 1.20
Control Group (n=5)	2.26 ± .86	2.06 ± 1.09
Total (n=13)	2.20 ± 1.11	2.03 ± 1.11

Note. Score Range: 0.5-4.7.

Table 4. Quality of life scores by group and time.

	Pre-Test	Post-Test
Treatment Group (n=8)	19.76 ± 1.94	19.68 ± 3.03
Control Group (n=5)	22.79 ± 1.60	22.60 ± 2.36
Total (n=13)	20.91 ± 2.05	20.8 ± 3.07

(*F*=0.01, *p*=.914,) or time effect (*F*=0.60, *p*=.458). There were no significant differences in fall risk between the experimental and control group (*F*=0.01, *p*=.914,).

Postural stability was assessed and measured. However, all participants scored in the small range and remained consist over the intervention. Due to the lack of variability across participants, statistical analyses were not performed. Although data may be found in-significant, findings can still be applicable in that after a four week balance intervention QOL is not significantly impacted by fall risk.

DISCUSSION

This study was conducted to determine if improved balance has a positive impact on QOL in cancer patients. Many studies have shown that falls occur more often in the cancer population, but few have discovered the reasons behind this correlation. Allan-Gibbs (1) claims that cancer patients are unique because their treatments may cause side effects that may increase fall risk due to a weakness in physiological systems from the treatment. To compare these results to our own, the participants in our study had a relatively "average" fall risk score at their baseline measurements. An "average" fall risk score was determined by the BBS instruments standards using age and height. The mean ± SD baseline fall risk score (range .5-4.7) of the experimental and control group is 2.16 ± 1.29 and 2.26 ± 0.86, respectively. Although a four week balance protocol did not impact fall risk in the current study, literature review by Allan-Gibbs (1) found that fall risk is still a problem in cancer patients. Further research with more participants and a longer intervention is necessary to determine the impact of fall risk on QOL in cancer patients. A four week balance protocol may not have been an adequate amount of time for neuromuscular adaptations to take place; however, a longer or more intense intervention may result in an increased fatigue level and a decrease in QOL (12). For this study, a correlational analysis showed no significant association between QOL and fall risk.

Cakar et al. (3) concluded that better balance skills lead to an increased health-related QOL. For our study, the mean baseline QOL score of the experimental group was 19.76±1.94 at pre-testing and 19.68±3.03 at post-testing, disagreeing with Cakar et al. The control group's QOL scores were significantly greater than that of the experimental group, suggesting heterogeneity of the sample. This is possibly due to a lack of randomization of the sample, and low participant numbers. Another potential reason for this difference is that the control group members had been out of treatment longer than the experimental group had.

Postural sway was not examined due to the small variability in scores across participants. The BBS may not have been

the most appropriate instrument to accurately track improvements in balance. Functional assessment tools may be more appropriate to measure balance in cancer patients. Such tools include, but are not limited to, the Tinetti Balance Assessment Tool, Berg Balance Test, and Dynamic Gait Index (8, 10).

This study is strong due to its unique variables. To our knowledge, it is the first study to measure the impact of balance improvement on the QOL in individuals with cancer. Another strength of the study is that we controlled many different extraneous variables, including: activity level, psychological factors, treatment type, cancer type, and time post-treatment. The present study, however, did not take into consideration the fatality rate of different types of cancer or the strength of each treatment which might have influenced on the individuals' QOL. Also, the mean baseline QOL was higher in the control group than the treatment group which may have played a role in the significance between groups in the two-way repeated measures ANOVA. Additionally, our study was limited due to the small sample size, lack of adequate time to carry out the study, and the possibility that the BBS machine may not have been sensitive enough to measure the balance changes that occurred within the four weeks. A study completed by Meltzer (5) found that functional and specific balance training can improve voluntary stepping and balance control in healthier older non-fallers, parameters previously found to be related to increased risk of falls and injury in older adults. Their balance protocol was performed twice a week for 12 weeks and a nine month follow up was completed.

We hypothesized that balance would improve in the experimental group, therefore, improving the QOL more-so than the control group. The control group's QOL would likely improve throughout the study, as well, due to the increase in QOL that occurs after treatment; however, the gains would not be as large. The hypothesis was not supported by the results obtained from this study. The QOL scores from pre-to-post did not change significantly for both groups. However, there was a significant difference between group FACT-G scores at baseline.

Future research conducted in this area should recruit more participants, thus providing for a more powerful study to detect significant differences/changes. The duration of future studies should also be longer to potentially see greater improvements in balance and/or QOL. Utilization of a more sensitive balance assessment machine is suggested to detect differences between the groups. It would also be of interest to include participants with a greater range of baseline fall risk scores, as the participants in this study began with relatively similar fall risk scores.

The data of the present study were not sufficient to demonstrate the impact of a short-term balance exercise program on fall risk and QOL in cancer patients. Further research should be conducted with more participants over a longer time period to carry out the intervention portion of the study. It may also be beneficial for future studies to utilize more sensitive instrumentation in order to assess the more accurate difference in balance. The importance of this research is attributed to its uniqueness and specificity. This study is the first experimental design to implement

a balance program to impact QOL in cancer patients. Preliminary data can be used as a guidance for future balance program to improve one's QOL. If stronger data is derived to support this statement, cancer recovery programs can make appropriate modifications of exercises in order to maximize the functionality and overall QOL in these individuals.

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