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Effects of Focus of Attention on Balance in Chemotherapy Patients

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**EFFECTS OF FOCUS OF ATTENTION ON BALANCE IN CHEMOTHERAPY
PATIENTS**

by

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B.S., Southern Illinois University, 2012

A Research Paper
Submitted in Partial Fulfillment of the Requirements for the
Masters of Science in Education

Department of Kinesiology
in the Graduate School
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RESEARCH PAPER APPROVAL

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CHAPTER 1

INTRODUCTION

Focus can be thought of as the direction of one's attention to the performance environment or to the activity being performed (Magill, 2011; Nolan, 2011). Recent years have seen a number of investigations attempting to determine whether an internal or external focus of attention results in superior motor task learning and performance (Nolan, 2011). Instructing an individual to externally focus their attention has led to a greater impact on learning and this has been shown in studies assessing motor skills such as maintaining balance on a stabilometer (Wulf, McNevin, & Shea, 2001), muscular endurance activities (Marchant, Greig, Bullough, & Hitchen, 2001), and golf putting (Wulf, Lauterbach, & Toole, 1999), as well as within skills associated with team sports such as volleyball and soccer (Wulf, McConnel, Gärtner, & Schwarz, 2002).

A technique designed to improve performance on a novel task is engagement in a non-awareness strategy (Singer, Lidor, & Cauraugh, 1993). The concept of non-awareness is primarily based on the use of an external focus of attention and allows the learner to perform the motor skill with greater automaticity (Singer, 1993; Wulf, Höß, & Prinz, 1998). The concept of focus of attention can be applied to a wide variety of activities, such as serving a volleyball. When attempting to serve a short ball directly over the net, the server could focus on stopping their hand once they have contacted the ball, which adopts an internal focus of attention, or the server could focus on applying enough force for the ball to land on the ten-foot line, which adopts an external focus of attention. Wulf (1998) found the concept of non-awareness and focusing attention in an external direction or focusing on the effects of movements on the environment would allow for greater motor skill learning. This is in opposition to

adopting an internal focus or focusing on their body movements while performing a task (Nolan, 2011; Wulf, 1998; Wulf & Prinz, 2001).

A similar phenomenon has been observed in research that has been conducted on focus of attention and balance tasks, both static and dynamic (Wulf, 2001; Wulf, 2008; Wulf, Landers, Lewthwaite, & Töllner, 2009; Wulf, Mercer, McNevin, & Guadagnoli, 2004). Postural sway and postural adjustments are common dynamic balance test measurements that have been investigated in these studies (Hosseini, Allahyari, Rostamkhani, & Jalili, 2011; Wulf, 2004 ; Wulf, 2008). “Postural sway illustrates the movement of the center of pressure around its mean. Postural adjustments display the frequency at which these adjustments are being made” (Wulf, 2008, p.320).

In a previous study, young healthy individuals showed enhanced balance performance while using an external focus of attention (Wulf, 2004). Hosseini et al. (2011) found that with an external focus, there was a decrease in the amount of postural sway. Another study conducted by Wulf (2008) discovered that the attentional focus conditions had very little effect on a highly skilled population’s postural sway, but found there was a significant difference among attentional focus conditions when postural adjustments were examined. Due to these different findings, there is a greater emphasis on using both postural sway and postural adjustments in research investigating balance (Wulf, 2008; Wulf, 2009).

One population that has received a great deal of attention recently is individuals with cancer. Although there have been enormous advances in the use of newer treatment methods, chemotherapy still retains an integral and crucial role in the

treatment of cancer (Bloomfield & Tanay, 2012). Many individuals who undergo chemotherapy experience a phenomenon known as 'chemo-brain.' According to Staat and Segatore (2007), chemo-brain or chemo-fog presents itself in individuals undergoing treatment "as weakened cognitive abilities, speed of information processing or reaction time, and organizational skills" (p. 713).

Individuals undergoing chemotherapy typically have a reduced ability to balance due to fatigue and muscle weakness from the use of neurotoxic chemotherapy drugs (Toftagen, Overcash, & Kip, 2012). The use of neurotoxic drugs may result in central or peripheral nervous system damage that leads to altered reflexes, unsteady gait, ataxia and confusion (Holley, 2002). As a result of this decreased ability to balance, individuals who have undergone chemotherapy are at a greater risk for falls (Toftagen, 2012). Another side effect associated with chemo-brain is the inability to focus attention effectively (Jackson, 2008; Porter & Anton, 2011). Individuals who have undergone chemotherapy have displayed improved performance and ability to follow direction when focusing their attention externally (Porter, 2011).

Despite the fact that a link between improved balance performance and attentional focus (Wulf, 2004; Wulf, 2008) and between chemotherapy and balance (Toftagen et al., 2012) has been reasonably well established, there has been little research that connects the effects of chemotherapy, attentional focus, and balance simultaneously. Therefore the purpose of this study is to determine if internal and external focus of attention affects postural sway while engaging in a balance activity in individuals who have undergone chemotherapy compared to an age-matched apparently healthy population. It is hypothesized that all participants will have a

decrease in postural sway when engaging in an external focus of attention. A second hypothesis is the age-matched healthy population will have lower amounts of postural sway in both attentional focus conditions than the participants who have undergone chemotherapy.

CHAPTER 2

METHODS

Participants

Ten cancer survivors (2 males, 8 females; mean age: 56 ± 10.46) and 10 age-matched individuals (6 males, 4 females; mean age: 61.6 ± 8.19) were recruited for this study. An inclusion criterion for the cancer group was that the individuals must have undergone chemotherapy treatment sometime within the last 24 months. Cancer patients who have undergone chemotherapy and the age-matched control participants were recruited from the Strong Survivors program in Southern Illinois. Strong Survivors is a 12-week rehabilitation program that focuses on nutrition education and exercise as a therapeutic tool for cancer survivors and their caregivers. All participants signed an informed consent prior to beginning the study and were naïve to the purpose of the study.

Apparatus, Task, and Procedure

The procedures used throughout this experiment were adopted from Wulf (2008). Subjects completed 5 trials of each focus of attention condition while balancing on a rubber disc (Disc 'O' Sit, Perform Better, Cranston, RI) on a balance platform (Wulf, 2008). On the day of testing, participants entered the Cancer Rehabilitation Laboratory at Southern Illinois University, were de-briefed on the testing protocol, and familiarized themselves with the task. The balance disc was placed on a balance platform (AMTI AccuSway, Watertown, MA). The balance platform was used to measure the center of pressure (COP) moving window, a measurement of postural sway, at 50 Hz while the task was being performed. A lower COP moving window indicates there is less

movement of the participants' center of pressure, indicating decreased postural sway. Each participant was instructed to perform the task of balancing on the disc while looking straight forward for 15 seconds in each of the trial conditions. There were three focus of attention conditions (i.e., external, internal, and control). "The participants were instructed to "focus on standing still" (control), "focus on minimizing the movement of their feet" (internal), and "focus on minimizing movement of the disc" (external)" (Wulf, 2008, p. 321). Participants performed five trials for each of the conditions; 15 total trials were collected. Participants were reminded of their focus of attention between each trial. A 30- second rest period was given between each trial. Participants rested for three minutes between each set of 5 trials. The order of attentional focus conditions was counterbalanced across participants to control for order effects. Data collection began when the "participant stepped onto the disc and was able to achieve a "quiet" stand on the disc" (Wulf, 2008, p. 321).

CHAPTER 3

RESULTS

The dependent variables were analyzed using a 2 (group: healthy, cancer) x 3 (condition: internal, external, control) analysis of variance, with repeated measures on the second factor, using a $p < 0.05$ alpha level to determine significance (IBM SPSS Statistics 22). There was no significant difference for Group, $F(1,18) = 2.633$, nor was there a significant difference found for Condition, $F(1,36) = 0.226$. Finally, the results determined there was no significant difference for the interaction between Group and Condition, $F(2,36) = 0.298$.

Table 1: Center of Pressure Moving Window Raw Mean Group Data

	Control Condition	External Condition	Internal Condition
Healthy Population	0.685483	0.688789	0.635502
Cancer Population	0.561729	0.554421	0.561338

Values are group means; n= 20 (10 per group).

Table 2: Center of Pressure Moving Window ANOVA Results

	F
Group	2.633
Condition	0.266
Group*Condition	0.298

Values are variance of the means; $p < 0.05$.

CHAPTER 4

DISCUSSION

Previous research has not bridged the gap between focus of attention, balance performance, and side-effects of chemotherapy. The purpose of the current study was to determine if focus of attention had an effect on balance performance in chemotherapy patients compared to an age-matched population. The results showed that there was no statistical significance between the chemotherapy group's balance performance and the healthy age-matched population (which was contrary to our hypothesis). The results also showed there was no statistical difference in balance performance between the attentional focus conditions for either the cancer population or the healthy population (also contrary to our hypothesis). The raw mean data for the COP moving window indicated that both groups, healthy and chemotherapy, performed similarly in the balance task. Both groups were recruited from the Strong Survivors programs; therefore, their balance training through the program may have attributed to the lack of difference between the two groups.

Previous research has shown the focusing attention externally has led to better balance performance in healthy and older populations (Hosseini et al., 2011; Wulf, 2004). Chiviacowsky, Wulf, and Wally (2010) also found that adopting an external focus of attention lead to better performance in a retention test for older adults learning a balance task. The current study solely looked at which focus of attention condition led to greater performance of the balance task for the two groups. The testing protocol could have utilized a retention test. Incorporating a practice period would determine if the subjects would perform the balance task better using one of the attentional focus conditions, which would demonstrate learning in a retention test. The chemotherapy

patients could complete the initial test immediately after their final treatment, followed by a practice period and a retention test using the balance task. This protocol would be beneficial in determining if a specific attentional focus condition would yield less postural sway in a retention test for a chemotherapy population.

Limitations

The current investigation has a number of limitations to consider. First, the frequency setting of the balance platform was extremely low. The frequency was set at 50 Hz due to the machines' inability to properly perform at higher frequency settings. Other studies, such as Wulf (2004), Wulf (2008), and Wulf (2009), have reported using a frequency setting of 500 Hz which allowed for the collection of 7,500 data points. The frequency setting in this study may have resulted in the balance platform not being sensitive enough to collect enough data points to show significant differences between the groups and conditions.

In the Wulf (2008) study that this study was based on, the researchers calculated root-mean squared error (RMSE) to determine postural sway, which is slightly different than the COP moving window which was calculated for these data. COP moving window determines the differences between trials. RMSE is a much more sensitive calculation necessary for postural sway adjustments within each trial. This study solely compared the differences between trials, but group or condition differences may have been observed if within trial comparisons were made.

Another limitation of this study was the lack of proximity of the study to the final chemotherapy session for the cancer patients. The chemotherapy group inclusion criterion was treatment within the past two years, and was chosen to allow for the

inclusion of a greater number of participants from a limited participant pool. The length of recovery time by itself may have allowed for a natural improvement in balance performance due to the recession of chemotherapy treatment effects. The balance performance observed in this group might not have been seen in a population of survivors either currently undergoing treatment or having just finished treatment. This effect may have been compounded by the influence of exercise training mentioned earlier.

There was also a lack of control regarding the physical activity level of the participants. We mentioned the fact that both groups had participated in structured exercise training that included balance training, but not all participants were active in the program during the time of the study. The lack of knowledge of the subjects' physical activity level makes it difficult to draw conclusions based on the data.

Finally, there were a relatively small number of participants included in this study. This small sample size may have made it difficult to determine differences between the groups. Larger sample sizes typically yield a higher degree of statistical power, which may have particularly helped to discern statistical differences between the focus of attention conditions.

Conclusion

In conclusion, there was no difference in balance performance between the healthy and cancer participants. There was also no difference in either groups balance performance between the three conditions (external, internal, and control). Future research should utilize a larger sample size, as well as change the inclusion criteria for the chemotherapy population. In order to determine the effect chemotherapy has on

balance performance, future research should complete the balance task immediately after participants finish their last treatment (or possibly during treatment as well) and prior to engaging in the Strong Survivors program, in order to reduce the chance of recovery prior to the completing the balance task. Also, by utilizing a retention test protocol, the researcher can determine if one of the attentional focus conditions would lead to better balance performance for the chemotherapy population. Furthermore, the balance platform must be set at a much higher sampling frequency to be sensitive enough to determine any potential differences. Finally, future studies should establish a greater level of control regarding physical activity level amongst the participants and attempt to match participant groups on this criteria, if possible.

REFERENCES

- Bloomfield, J.G. & Tanay, M. L. (2012). Chemotherapy in the community: the importance of patient assessment. *British Journal of Community Nursing*, 17, 278-283.
- Chiviacowsky, S., Wulf, G., & Wally, R. (2010). An external focus of attention enhances balance learning in older adults. *Gait and Posture*, 32, 572-575.
- Holley, S. (2002). A look at the problem of falls among people with cancer. *Clinical Journal of Oncology Nursing*, 6, 193-197.
- Hosseini, S. S., Allahyari, M. A., Rostamkhani, H., & Jalili, M. (2011). Comparison the effect of attention source on balance test performance in elderly subjects. *Australian Journal of Basic and Applied Sciences*, 5, 942-945.
- Jackson, G.E. (2008). Chemo brain - A psychotropic drug phenomenon? *Medical Hypotheses*, 70, 572-577.
- Magill, R. A. (2011). *Motor learning and control: Concepts and applications*. New York: McGraw-Hill.
- Marchant, D. C., Grieg, M., Bullough, J., & Hitchen, D. (2011). Instructions to adopt an external focus enhance muscular endurance. *Research Quarterly for Exercise and Sport*, 82, 466-473.
- Nolan, Russell Patrick, "An External Focus of Attention Enhances Isometric Wall Sit Endurance Time: A Quantitative and Qualitative Analysis of the Attentional Focus Effect" (2011). *Theses*. Paper 590.
- Porter, J. M., & Anton, P. A. (2011). Directing attention externally improves continuous visuomotor skill performance in older adults who have undergone cancer chemotherapy. *Journal of the American Geriatrics Society*, 59, 369-370.

- Singer, R., Lidor, R. & Cauraugh, J. (1993). To be aware or not be aware? What to think about while learning and performing a motor skill. *The Sport Psychologist*, 7, 19-30.
- Staat, K. & Segatore, M. (2007). The phenomenon of chemo brain. *Clinical Journal of Oncology Nursing*, 9, 713-721.
- Toftagen, C., Overcash, J., & Kip, K. (2012). Falls in persons with chemotherapy-induced peripheral neuropathy. *Support Care Cancer*, 20, 583-589.
- Wulf, G. (2008). Attentional focus effects in balance acrobats. *Research Quarterly for Exercise and Sport*, 79, 319-325.
- Wulf, G., Höß, M., & Prinz, W. (1998). Instructions for motor learning: differential effects of internal versus external focus of attention. *Journal of Motor Behavior*, 30, 167-179.
- Wulf, G., Landers, M., Lewthwaite, R., & Töllner, T. (2009). External focus instruction reduce postural instability in individuals with Parkinson disease. *Physical Therapy*, 89, 162-168.
- Wulf, G., Lauterbach, B., & Toole, T. (1999). Learning advantages of an external focus of attention in golf. *Research Quarterly for Exercise and Sport*, 70, 120-126.
- Wulf, G., McConnel, N, Gärtner, M., & Schwarz, A. (2002). Enhancing the learning of sport skills through external focus feedback. *Journal of Motor Behavior*, 34, 171-182.
- Wulf, G., McNevin, N., & Shea, C. H. (2001). The automaticity of complex motor skill learning as a function of attentional focus. *Quarterly Journal of Experimental Psychology*, 54, 1143-1154.

Wulf, G., Mercer, J., McNevin, N. H., & Guadagnoli, M. A. (2004). Reciprocal influences of attentional focus on postural and supra-postural task performance. *Journal of Motor Behavior, 36*, 189–199.

Wulf, G., & Prinz, W. (2001). Directing attention to movement effects enhances learning: A review. *Psychonomic Bulletin and Review, 8*, 648-660.

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