

**Sigma's 30th International Nursing Research Congress
Innovations in Cancer Recovery Care: Neurofeedback Protocol Feasible and
Improved Self-Reported Cognition and Fatigue Symptoms**

Marian Luctkar-Flude, PhD, MScN, RN

School of Nursing, Queen's University, Kingston, ON, Canada

Jane Tyerman, PhD, RN

School of Nursing, Trent University, Peterborough, ON, Canada

Dianne Groll, PhD, RN

Depts. of Psychiatry & Psychology, Queen's University, Kingston, ON, Canada

Janet Giroux, MSc, RN

Oncology, Kingston Health Sciences Centre, Kingston, ON, Canada

Purpose:

Cancer-related fatigue and postcancer cognitive impairment or “chemobrain” are distressing symptoms that may persist for months or years following completion of cancer treatment. Cancer survivors with unmet needs often turn to Complementary and Alternative Medicine (CAM) therapies. Neurofeedback is a mind-body technique that utilizes real-time biofeedback of EEG activity to train individuals in self-regulation with results similar to meditation (Brandmeyer & Delorme, 2013). Self-regulation is related to neuroplasticity, the capacity of the brain to develop new neural pathways in response to stimuli, and neural efficiency, a decrease in the amount of energy dedicated to performing a given task (Cannon, 2015). Neurofeedback is non-invasive, drug-free and reported to help with a variety of symptoms including pain, fatigue, depression, anxiety, sleep problems and cognitive decline. Thus, neurofeedback may be an effective CAM option for cancer survivors experiencing persistent symptoms such as post-cancer cognitive impairment and cancer-related fatigue. The purpose of this study was to determine the feasibility of a randomized controlled trial investigating the effect of neurofeedback on post-cancer cognitive impairment and cancer-related fatigue in a sample of breast cancer survivors.

A few studies have examined the effect of neurofeedback on persistent symptoms in cancer survivors. Results of an integrative review suggest neurofeedback could be effective to manage cancer pain (Prinsloo et al., 2014). A systematic review provides preliminary evidence of use neurofeedback to manage fatigue and cognitive impairment (Luctkar-Flude & Groll, 2015). One study in this review demonstrated the feasibility of neurofeedback in a sample of breast cancer survivors who showed significant improvements in cognition, fatigue, psychological symptoms and sleep (Alvarez et al., 2013). A randomized controlled trial conducted in the U.S. demonstrated improvement in chemotherapy-induced peripheral neuropathy symptoms following neurofeedback therapy (Prinsloo et al., 2017). Interviews with a sample of neurofeedback providers and some of their clients who were cancer survivors revealed a number of benefits of neurofeedback including two powerful themes “transforming lives” and “regaining control” which depict the positive impact on quality of life of cancer survivors (Luctkar-Flude et al., 2018). Thus, there is a need to determine which neurofeedback systems and protocols are safe and most effective for different populations of cancer survivors with persistent symptoms.

Methods:

Breast cancer survivors were recruited for this pilot wait-list controlled study. Participants received 20 NeuroOptimal™ sessions over a ten-week period. Primary study outcomes were cognitive impairment measured by an objective neurocognitive assessment, CNS Vital Signs, and a standardized patient-reported measure, the FACT-Cognition Scale. Secondary outcomes included fatigue as measured by the FACIT-Fatigue. Participants were also invited to participate in a semi-structured interview exploring their experience with neurofeedback and its impact on their quality of life.

Results:

Twenty women met inclusion criteria, 16 enrolled and completed the neurofeedback protocol; 12 completed all five study surveys, and 4 did not complete the follow-up survey. Mean scores for the Total FACT-CoG increased significantly [$F(1.346, 18.845) = 6.192, p = .006$] over the treatment period as compared to the wait-list period, with a medium effect size (partial eta squared = .307). Mean scores for the FACIT-Fatigue increased significantly [$F(2, 28) = 10.953, p = .000$] with a medium effect size (partial eta squared = .439). Results of the CNS Neurocognition Index demonstrated no significant differences between pre and post-neurofeedback scores increased non-significantly [$F(1.021, 10.213) = .554, p = .477$]. Qualitative feedback indicated that neurofeedback had a positive effect on post-cancer cognitive impairment, cancer-related fatigue and quality of life.

Conclusion:

The 20-session neurofeedback protocol tested in this study was feasible to implement and acceptable to cancer survivors. Statistically significant improvements in perceived cognition and fatigue levels support the need for further trials of neurofeedback in cancer survivors. Results of this pilot study have identified challenges to patient recruitment that will inform development of an RCT protocol.

Title:

Innovations in Cancer Recovery Care: Neurofeedback Protocol Feasible and Improved Self-Reported Cognition and Fatigue Symptoms

Keywords:

cancer-related fatigue, neurofeedback and post-cancer cognitive impairment

References:

- Alvarez, J., Meyer, F.L., Granoff, D.L., & Lundy, A. (2013). The effect of EEG biofeedback on reducing postcancer cognitive impairment. *Integrative Cancer Therapies, 12*, 475-487.
- Brandmeyer, T., & Delorme, A. (2013). Meditation and neurofeedback. *Frontiers in Psychology, 4*, 1-3.
- Cannon, R.L. (2015). Defining neurofeedback and its functional processes. *NeuroRegulation, 2*, 60-69.
- Luctkar-Flude, M., & Groll, D. (2015). A systematic review of the safety and effect of neurofeedback on fatigue and cognition. *Integrative Cancer Therapies, 14*, 318-340.
- Luctkar-Flude, M., Tyerman, J., & Groll, D. (2018). Exploring the use of neurofeedback by cancer survivors: Results of interviews with neurofeedback providers and

clients. *Asia Pacific Journal of Oncology Nursing* [epublished ahead of print]. doi: 10.4103/apjon.apjon_34_18

Prinsloo, S., Gabel, S., Lyle, R., & Cohen, L. (2014). Neuromodulation of cancer pain. *Integrative Cancer Therapies*, 13, 30-37.

Prinsloo, S., Novy, D., Driver, L., Lyle, R., Ramondetta, L., Eng, C., McQuade, J., Lopez, G., Cohen, L. (2017). Randomized controlled trial of neurofeedback on chemotherapy-induced peripheral neuropathy: A pilot study. *Cancer*, 123, 1989-1997. doi: 10.1002/cncr.30649

Abstract Summary:

Sixteen breast cancer survivors with persistent cognitive impairment and fatigue completed 20 sessions of neurofeedback and reported statistically significant improvements in perceived cognition and fatigue levels. These results support the need for further trials of various neurofeedback protocols in different populations of cancer survivors to manage debilitating symptoms.

Content Outline:

Introduction

- Background information about neurofeedback
 - CAM therapy
 - Non-invasive, drug-free form of brain training reported to help with symptoms such as pain, fatigue, depression, anxiety, sleep disorders and cognitive decline
- Brief description of preliminary work completed
 - Systematic review
 - Survey study
 - Interview study

Body

- Description of pilot feasibility study investigating effect of a 20-session protocol of NeuroOptimal neurofeedback on post-cancer cognitive impairment and cancer-related fatigue in a sample of breast cancer survivors with persistent symptoms
- Description of the methods and protocol for this mixed methods wait-list control study
- Description of subjective and objective assessments
- Description of participant characteristics
- Description of quantitative results
 - Primary outcome: post-cancer cognitive impairment
 - Secondary outcome: cancer-related fatigue
- Description of qualitative results
 - Thematic analysis of semi-structured interviews

Conclusion

- The neurofeedback protocol was acceptable to a sample of breast cancer survivors
- Statistically significant improvements in perceived cognition and fatigue levels support the need for further trials of neurofeedback in cancer survivors
- Next steps include the design and implementation of a pragmatic trial of neurofeedback for cancer survivors of other type of cancer to determine who would benefit, optimal timing and optimal protocols for management of late and long-term effects of cancer treatment

- These results have significance for clinical nurses working in oncology and primary care settings who provide cancer follow-up care

First Primary Presenting Author

Primary Presenting Author

Marian Luctkar-Flude, PhD, MScN, RN
Queen's University
School of Nursing
Assistant Professor
Kingston ON
Canada

Author Summary: Dr. Marian Luctkar-Flude is an Assistant Professor at Queen's University School of Nursing with over 30 years nursing experience, including over 15 years as an educator with experience in clinical simulation. Her research focuses on nursing and interprofessional education including novel approaches to pre-simulation preparation such as use of mobile classroom response systems and virtual simulation games.

Second Author

Jane Tyerman, PhD, RN
Trent University
School of Nursing
Lecturer
Peterborough ON
Canada

Author Summary: Dr. Jane Tyerman is a faculty member at Trent University School of Nursing with extensive clinical and teaching experience including 12 years' experience in clinical simulation and interprofessional education. She is currently a Co-President of the Ontario Simulation Alliance (OSA).

Third Author

Dianne Groll, PhD, RN
Queen's University
Depts. of Psychiatry & Psychology
Associate Professor
Kingston ON
Canada

Author Summary: I am currently the Director of Research for the Queen's University Department of Psychiatry, a position I have held for the past 7 years. In this position I am responsible for overseeing the research activities of the Department and performing all the statistical analyses for department members who are unfamiliar with statistics. My research interests are in population health and mental illness.

Fourth Author

Janet Giroux, MSc, RN
Kingston Health Sciences Centre
Oncology
Nurse Practitioner
Cancer Center of Southeastern Ontario
Kingston ON
Canada

Author Summary: Ms. Jan Giroux is a nurse practitioner who leads a cancer survivorship care clinic and sexual health clinic at the Cancer Center of Southeastern Ontario.