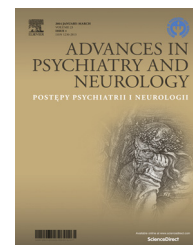


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## Case report/ Kazuistyka

# Can Neurofeedback Decrease Anxiety and Fear in Cancer Patients? A Case Study

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## ABSTRACT

**Introduction:** Anxiety and depression are very widespread among cancer patients. The state of anxiety covers a wide range of symptoms connected to fear, restlessness and changes in the autonomy of the patient. Neurofeedback is a behavioral technique of operant learning, in which participants learn to effect the electric activity of their brain, through a dynamic process of visual and auditory feedback. This training seeks to change the frequency of subjects' electroencephalogram (EEG), something achieved by the majority of participants. Neurofeedback is a technique which has been successfully used in recent decades as a tool for treating a number of clinical cases. Amongst the clinical cases studied are autism, epilepsy, chronic pain, cases of major depression and also the effects of cancer upon different psychological parameters and the quality patients' lives. Pelvic cancer and its medical treatment seem to increase anxiety and depression, which affect patients' daily lives. **Case study:** In the case study, 20 sessions of Neurofeedback were applied to a patient with pelvic cancer and anxiety (state anxiety): the SCL-90 scale for the measurement of psychometric traits was applied before and after each session. **Conclusion:** Important improvements were noted to this patient on the above scales, issued during the sessions and within each session, before and after the intervention.

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## Introduction

Cancer is one of the main causes of death in the developed countries as well as in the developing ones. Increases in deaths from cancer is correlated to the aging of a population, the choice of an endangered life-style including things such as smoking, lack of physical exercise and the adoption of Western' diet [1, 2]. Despite the increase in the incidence of cancer, the life expectancy of cancer patients has increased in recent years, due to the more timely diagnosis and advanced treatments of the disease [3].

A cycle of treatment for a cancer patient might include a surgical operation, chemotherapy, radiation therapy, hormonal therapy and the pharmaceutical treatment necessary to treat the symptoms of the disease [4]. Treating cancer, however, involves more than bodily symptoms, since Prince et al. and their associates [5] note that anxiety and depression are very widespread and disastrous for the lives of cancer patients, aggravating the perception of symptoms, morbidity and lethality rates. Thus, they conclude that there can be no health without mental health [6]. Throughout treatment and after the completion of the medical intervention as well, the problems which cancer patients confront are not only of a bodily nature, such as pain, weakness and difficulty in movement [7], but are also of a psychological nature. According to research, cancer patients are diagnosed with high rates of depression, anxiety, sleep problems, loss of weight and with an overall low rate of quality of life [8, 9].

Anxiety covers a wide range of symptoms connected to fear, restlessness and changes in the autonomy of the patient. This higher prevalence of anxiety disorders in cancer patients in relation to the general population could be a result of the following factors: to begin with, although stress might be a physiological adjustment response to the diagnosis of a serious disease, it may also be uncontrollably increased throughout its course due to a great number of new situations that the person is called to tackle. There seems to be a two-way relationship between the neurobiological mechanisms of anxiety and the disorders of the immune system. Given this, even the effect of the pharmaceutical treatment seems to bring about unavoidable anxiety symptoms in patients [10]. At the same time, results from research on cancer patients by Kangas, Milros and Bryant showed that 28% of the participants fulfilled the criteria for acute stress disorder (ASD) and that 22% fulfilled the criteria for PTSD during the first interval after their diagnosis, whereas after 12 months the percentage of PTSD reached 14% [11]. In addition, the prevalence of panic disorder (PD), which is characterized by repeated and spontaneous panic attacks and persistent restlessness concerning additional episodes, corresponded to an 8.7% of the cancer patients. Its diagnosis however, is difficult to perform, since patients and doctors often consider those panic attacks to be a result of the pathological state of the body [10].

The research data, supports the idea that psychological discomfort influences the biological activity via neuronal or hormonal secretions of cancer cells and decreases the effectiveness of treatment [12]. Additionally, it is worth

noting that there is a high correlation of psychological discomfort with disability, morbidity and mortality [13]. The need for a therapeutic intervention becomes indispensable when it comes to the mental health of cancer patients. Neurofeedback is a behavioral technique of operant learning [14] which can be successfully applied to patients diagnosed with anxiety disorder or disorders of affect, as these often occur in cancer patients [15]. More specifically, Neurofeedback is a pioneer method belonging to the field of Neuroscience and which aids in the treatment of pathologies connected to brain malfunction.

During the application of this method, participants learn to influence the electric ability of their brain [14] through a dynamic process of visual and auditory feedback. This training of subjects seeks to change the frequency of their Electroencephalogram (EEG) wave bands, that is to train each patient to adopt a different Electroencephalogram wave band pattern, included within the range of frequencies set as a target each time. The patient – with the assistance of the therapist – is expected to train his or her brain to function in a more efficient way and then to establish this preferable function. According to recent studies, Neurofeedback decreases the symptoms of anxiety and depression in the majority of participants [16], whereas in healthy clients it seems to improve cognitive abilities, especially in people occupied in musical activities [15]. In the current research and given the demands of the era, the influence of Neurofeedback will be examined upon the levels of a pelvic cancer patient's anxiety.

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## Methodology

In our research, we applied 20 sessions of Neurofeedback of delta (1–3 Hz) and theta (3–7 Hz) frequencies to a middle aged patient (54 years old) diagnosed with pelvic cancer in the zone of the prostate. We decided to carry out 20 sessions of Neurofeedback within a period of six months, tracking the improvement that occurred in this patient, through questionnaires, EEG wave band graphs and a clinical interview. The Neurofeedback sessions were performed one year after the removal of the cancerous tumour and after the completion of radioactivity therapy. We performed measurements before and after each session with two self-report scales: the "SCL-90" and the State-Trait Anxiety Inventory [STAI] [17]. Neurofeedback seemed to improve cases even of people who did not present with positive results even at higher frequencies [18]. The main aim of the current clinical case was to distinguish the positive impact of Neurofeedback upon the anxiety and fear experienced by cancer patients. The lack of a control group, however, is the main restriction of this presentation. The study protocol was approved by the Spin-off company Synchronal Amphiaraia, Scientific Committee, University of Crete.

### Neurofeedback procedure

We applied 4 Neurofeedback protocols in each session, which lasted 40–10 min for each different protocol. The

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