Original Article

The Effect of Neurofeedback on Performance Anxiety in Dancers

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Abstract

A study of three dancers was conducted to assess the results of neurofeedback on performance anxiety. Prior to undergoing neurofeedback, each subject completed the State-Trait Anxiety Inventory Test (STAI) in order to ascertain whether they had a reportable level of anxiety. The STAI clearly differentiates between the temporary condition of state anxiety and the more general and long-standing quality of trait anxiety. The STAI was also administered prior to the start of each neurofeedback session and before each significant dance performance or audition. During the course of the study the subjects also underwent 20 neurofeedback treatment sessions of 30 minutes each. Two of the three subjects completed the study and for each the results indicated a reduction in anxiety levels over the course of treatment.

Dancers are frequently sensitive and driven. They tend to be more introverted, higher in achievement motivation, and more emotional than non-dancers.[1] Furthermore, when compared to singers, musicians, and actors, dancers are the most careful and tender-minded.[1] This sensitivity leaves them vulnerable to the pressures of performing.

Research has shown that the pressure of public performance causes performers to become activated physiologically. According to Fredrickson and Gunnarsson: "String musicians displayed greater neuroendocrine, heart-rate, and subjective activation during public than private performance. During performance in front of an audience heart-rate activation was greater in musicians that had experienced at least one episode of performance related tremor as compared to those who never had experienced tremor."[2] These authors further state that "In phobics fear-relevant cues elicited sympathetic nervous system changes indicative of the defense reaction."[2] Historically performers have tried many different avenues to treat this anxiety, ranging from psychotherapy to medications.[3] One newer alternative treatment is neurofeedback. In many ways neurofeedback works directly with the sympathetic arousal mentioned above.[4]

Neurofeedback is sometimes called "guided assisted meditation." Neurofeedback helps stabilize arousal level.[5] A person's arousal level and regulation of it are linked to brain-body, bio-physiological signals.[6] These signals are measured through brainwaves. The process of neurofeedback helps a person to retrain these brainwaves. This is done through conditioning in which the person being treated seeks rewards.[7] These rewards are given when the video image of a kaleidoscope moves along with an accompanying beep. When the person is receiving this feedback it means that they are in the "target zone," which represents a brainwave state that is optimal.[8] The feedback process is painless and seemingly effortless.

As the person's brainwaves adjust there is a corresponding shift physiologically. This is similar to dropping a pebble in a still pond, for neurofeedback has a ripple effect. As the brain is closely tied to physiological states, adjusting the brainwaves from a highly aroused state to a more moderate state will affect the nervous system.[9] For instance, a highly aroused dancer who is experiencing performance anxiety is in a sympathetic state. When treated with neurofeedback the dancer will find that she feels calmer, more present, and less anx-

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ious, as has been evidenced by the study presented in this article. This is indicative of her being in a parasympathetic state. In this calmer parasympathetic state, one experiences an increased level of well being primarily due to the reduction of physical as well as emotional stress.

One recent study by Gruzelier and Egner[10] examined the effects of neurofeedback on the musical performance of students. It demonstrated that neurofeedback improved their performances. One of the measures used to document the effect was the videotaping of the musicians, pre-neurofeedback and post-neurofeedback, while they performed. These tapes were reviewed by experts in the field of music who all reported that the musicians' performances had improved after neurofeedback, though it remained inconclusive as to whether anxiety was reduced as well. The purpose of the on-going research project described in this paper is to examine how neurofeedback affects performance anxiety in dancers.

Methods

Subjects

The research involved three subjects recruited from the University of California, Santa Barbara as well as from local professional dance companies. All subjects were screened to insure that they were suitable candidates for neurofeedback. To be suitable, a candidate had to have a persistent level of performance anxiety, dance regularly, be available for a series of neurofeedback sessions, and have no other complicating health or psychological issues. The biographical data of the three dancers chosen was as follows: Subject A was a 27-year-old female who performs ballet and modern dance. She had been dancing since she was seven, and had been a professional dancer since she was 18. Subject B is a 52-year-old female hula dancer. At the time of the study, she had been dancing in a local hula dance company for six years. Subject C was a 28-year-old female modern dancer. She had been dancing for five years, and at the time of the study she danced regularly in student performances at the University of California, Santa Barbara.

Testing

The subjects answered a pre-treatment questionnaire to establish the exact nature of their performance anxiety. For this study it was essential that there be a reportable level of anxiety, as measured by the State-Trait Anxiety Inventory Test (STAI),[1] a widely used measure of anxiety. This test clearly differentiates between the temporary condition of state anxiety and the more general and long-standing quality of trait anxiety. It was administered prior to the start of each neurofeedback session, and before each significant dance performance or audition. With 35 being the mean STAI score, each of the dancers had a STAI score well over 50 before the start of treatment. Other forms of measurement include assessment by the researcher from interviews with the participants, and comparison of each participant's brainwave activity from one treatment session to the next.

Treatment

There were 20 neurofeedback treatment sessions for each participant. Each session consisted of a 30 minute treatment, along with 15 minutes before and after to prepare for the session, complete the STAI, and check-in. Neurofeedback uses passive read-only sensors on the scalp to measure the brainwaves of the participants. Two sensors were placed on sites T3 and T4 as defined in the International 10-20 System.[12] A third sensor was placed on the left earlobe. The sensors were attached to the scalp using conductive EEG paste. While the sensors remain in place from session to session, the settings for treatment may be adjusted, depending upon the participant's response. Each participant was given an inter-session checklist to complete and submitted prior to her next session. This checklist helped determine how the participant was responding to the treatment.

Equipment

The equipment that was used was a Dell Inspiron laptop computer, Sceptre 17 inch video monitor, and BrainMaster neurofeedback amplifier. The sessions were all performed at the home office of the researcher. It is a dedicated space which is consistent session to session.

The risks with neurofeedback are minimal. These risks were covered in the informed consent form which was reviewed and agreed to by each of the subjects. The entire research process was reviewed and approved by the Institutional Review Board at Santa Barbara Graduate Institute.

Results

Subject A

The results were very positive. Before treatment this subject was anxious about auditions and workouts, had anxiety when things were less structured, and exhibited a significant amount of negative self-talk. After treatment she became calmer and more coordinated, was less worried about doing things perfectly, was at peace with her level of performance, was more confident, not as reactive, exhibited less negative self-talk, was more able "to go with the flow," and had a better sleep pattern. Subject A stated about the changes she experienced from the neurofeedback: "Before neurofeedback I would not have been so consistent in just following my goal but after neurofeedback, I can act anyway, even if it seems like things aren't perfect or I'm not perfectly prepared."

According to her STAI results, her state anxiety was very erratic. Her anxiety around events fluctuated based upon the nature of the event and the level of stress she was experiencing (her STAI score went from a high of 66 to a low of 44). Her trait anxiety showed a marked

Author: IMPORTANT in "Treatment" section is this "inter-session checklist" a standard study instrument that is readily available? If so, please name it. If not, please describe it in further detail, tell what it contained and how you derived the questions. AND if you developed the form and if it is a short (1 page) perhaps including it in the article as a Figure or Table may be a good idea.

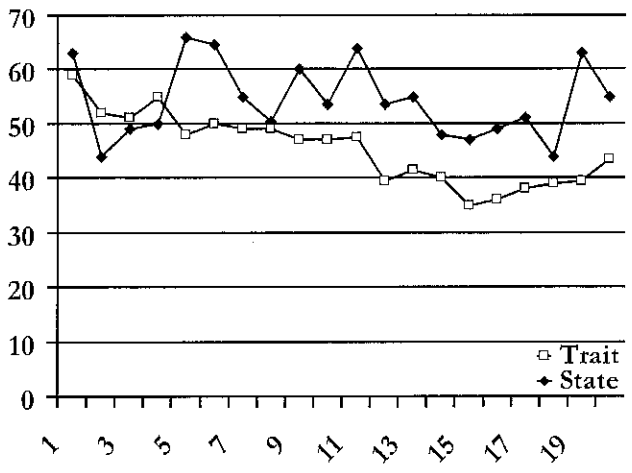

Figure 1 STAI Results for Subject A. The X scale represents the session number. The Y scale represents the STAI score (35 is the norm).

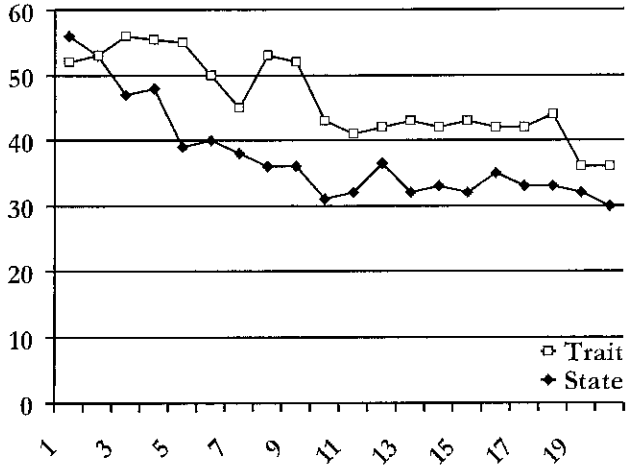

Figure 2 STAI Results for Subject B. The X scale represents the session number. The Y scale represents the STAI score (35 is the norm).

reduction over the course of treatment; her score went from 59 to 43.5 (Fig.1). This is an indicator of more resiliency, along with a better ability to cope in general with stressful circumstances.

Subject B

The results were very positive. Before treatment this subject had anxiety regarding unexpected circumstances such as someone missing a cue or problems with her costume; she was anxious about her age and how she compared to younger dancers; and she complained of poor sleep patterns. After the course of treatments this subject was more accepting of the unpredictability of the process; more accepting of mistakes; felt no need or desire to "control" everything in her environment; had a greater awareness of her needs (was more able to ask for what she needed and to say no to what she did not want); she was able to take more risks; reported better sleep patterns; and was less concerned about her age and limitations. **Subject B** stated about the changes she experienced from the neurofeedback: "I'm enjoying the music more. I'm even enjoying performing while the quirky things happen during performing."

STAI Results: Her state anxiety score showed a very significant reduction (from 56 to 30). Her trait anxiety score went from 52 to 36 (Fig. 2).

Subject C

This subject dropped out of the study after 8 of the 20 schedule sessions. Her results are not included here because her participation was inconsistent and the data is inconclusive.

Discussion and Relevance

The STAI results for Subject A indicate that in general her life is much less filled with anxiety than it used to be. Interviews with her substantiated this. The anxiety which she experienced in her dancing was aggravated by her overall level of trait anxiety. With the reduction in her trait anxiety and increased levels of well being and resiliency she is now more able to deal with stress when dancing. However, she still does experience stress during performing; it is just not debilitating for her physically or psychologically.

The STAI results for Subject B are equally positive, though different. With Dancer B her overall level of trait anxiety remained the same, mostly because she did not experience overwhelming anxiety except when she performed. As the STAI state anxiety scores show, Dancer B had a very significant reduction in anxiety when performing. This was confirmed in interviews; she said that she was much more relaxed about performing than she was before her treatment. Part of the reduction for both dancers is due to the fact that their nervous systems are now more balanced. This can be evidenced by the fact that both are less reactive, sleep better, and have an increased sense of well-being.

The instruments used to assess these changes were fair and accurate. However, the information they provided is limited. To expand this study into the realm of quantitative research more physiological measures should be included, such as blood testing for hormonal changes.

Another limitation is the small number of dancers studied. It is not possible to generalize from the results of this project what the impact of neurofeedback treatment would be upon the general population of dancers. Additionally, follow-up to assess the long-term effect of treatment was not attempted with these subjects due to time limitations; as a suggestion for future studies of the use of neurofeedback in dancers, researchers might be advised to conduct follow-up interviews at 3

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and 12 months.

Despite these drawbacks to the current study, the results seem to indicate that for dancers who are experiencing performance anxiety or who simply have high levels of general anxiety in their daily lives, neurofeedback is a viable treatment option. It is non-invasive and the trend indicated in this limited study seems to suggest that it provides positive results.

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