

Autogenic Feedback Training Exercise: Controlling Physiological Responses to Mitigate Motion Sickness

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Abstract

During space travel approximately 50% of the crew experience symptoms of motion sickness that can range from mild forms of nausea or dizziness to severe malaise and vomiting¹. Developing an effective treatment for these symptoms has become a priority of the National Aeronautics and Space Administration (NASA). Autogenic-Feedback Training Exercise (AFTE) is a nonpharmacological countermeasure for mitigating motion sickness. It involves training subjects to control physiological responses in high stress environments². The primary goal of this experiment is to evaluate the effectiveness of AFTE for increasing tolerance to motion sickness in high stress environments.

Introduction

AFTE is a 6-hour behavioral training procedure that combines biofeedback with Autogenic Therapy (AT). Earlier studies have shown AFTE:

- lessens the symptoms of motion sickness in 80% of participants²
- enables participants to control up to 20 physiological responses

The primary objective of this experiment is to evaluate the effects of AFTE for mitigating symptoms and increasing tolerance to motion sickness stimuli in a rotating chair.



Figure 1: Subject X50 during AFTE session

Materials and Methods

Participants: Ten healthy men and women participated in this study.

Materials: Physiological data were collected with a FlexComp data encoder (Thought Technology); a wrist-worn biosensor (Empatica-E4), a finger cuff optical sensor (SomnoMedics- SOMNOtouch); and an impedance cardiograph (Mindware Mobile). Measures included: ECG, respiration, peripheral blood volume and skin temperature, muscle activity of the forearms and calves, skin conductivity, blood pressure, stroke volume and cardiac output.

Motion Sickness Test: Symptoms were elicited using a rotating chair and participants were blindfolded during the test. The test began with a 10 minute baseline (no rotation) followed by rotation to 6 rpm where the chair speed was held constant for 5 minutes and participants performed head movements at 45 degree angles. Motion sickness symptoms were recorded by an observer at 5 minute intervals throughout the test. The chair speed was increased by 2 rpm every 5 minutes until severe malaise² was reached or the subject requested to stop. The test was followed by a 10 minute post-test baseline. The test was repeated once a week after 2, 4, and 6 hours of AFTE.

Autogenic-Feedback Training Exercise: Subjects were trained to control physiological responses using visual and auditory feedback and self-suggestion AT exercises provided by the trainer. Each training session was 30 minutes in duration and included alternating 3 minute trials of relaxation (e.g., decrease heart rate) and arousal (e.g., increase heart rate). Subjects were given 12 training sessions over a 3-week period.

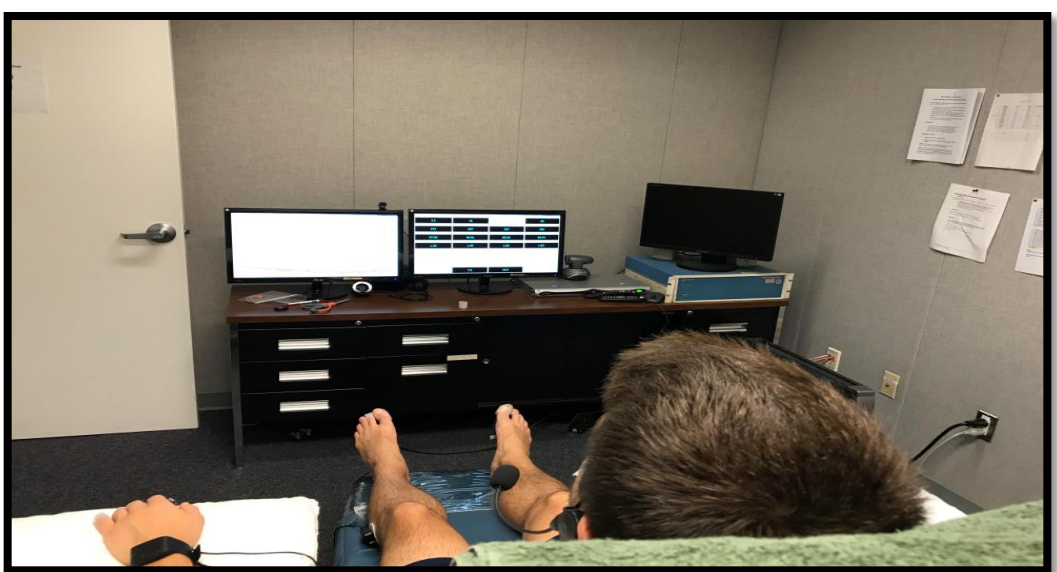


Figure 2: Subject receiving biofeedback

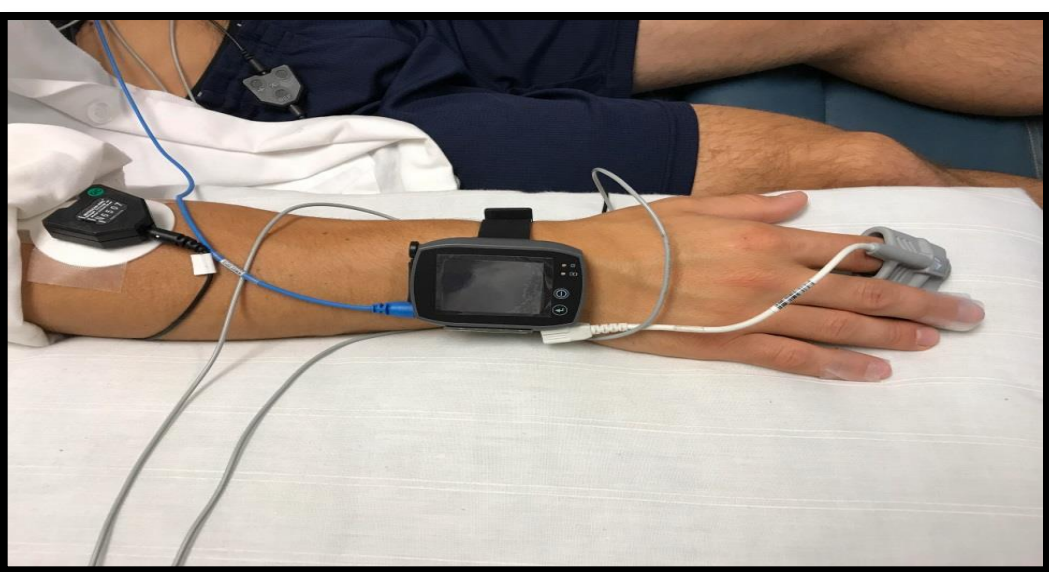


Figure 3: Subject wearing SOMNOtouch



Figure 4: Trainer guiding AFTE session

Results

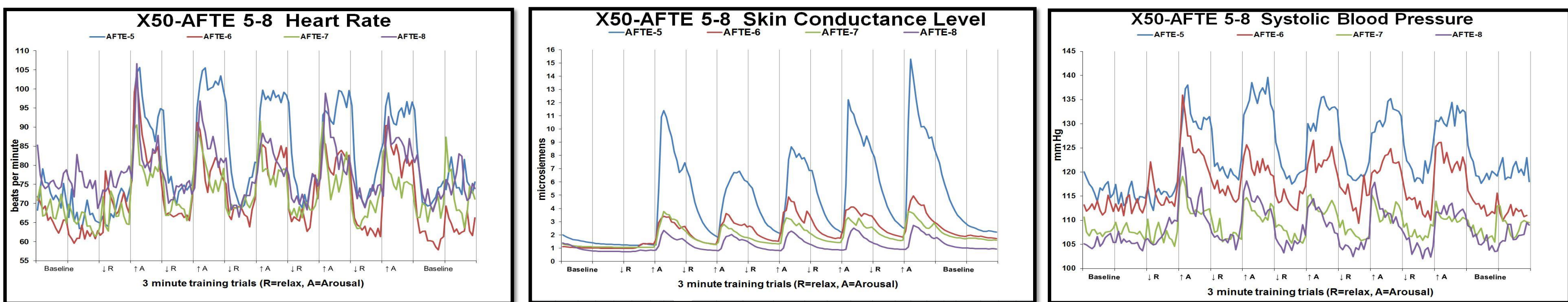


Figure 5-7: Heart rate, skin conductivity, and systolic blood pressure during training sessions (A=arousal trials, R=relax trials)

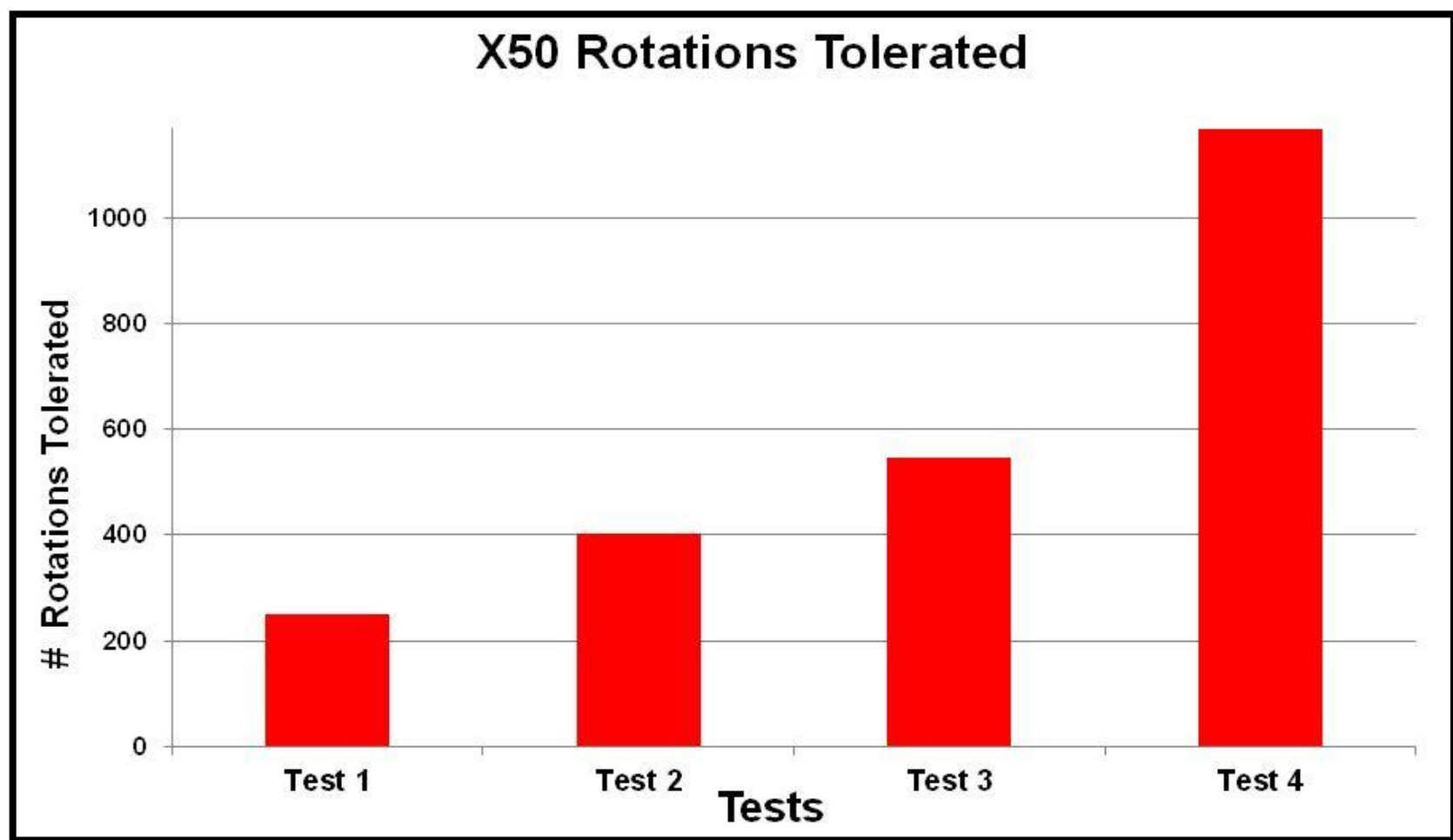


Figure 8: Rotations tolerated during motion sickness tests

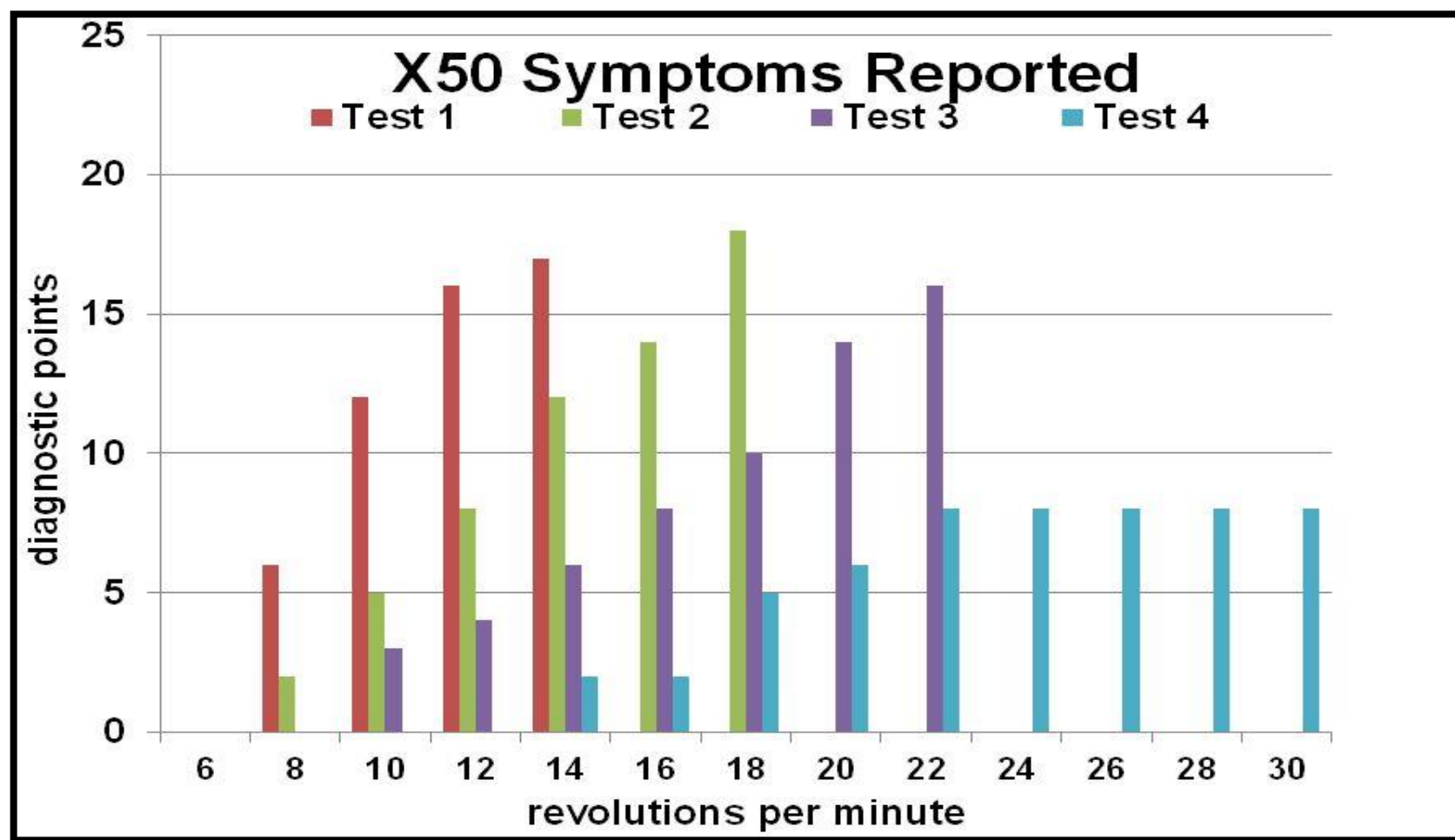


Figure 9: Motion sickness symptoms reported during each test

Conclusion

Preliminary results of one participant indicate that AFTE is an effective method for mitigating motion sickness symptoms. This subject showed good physiological control of heart rate, skin conductance, and blood pressure during the AFTE sessions. After 6 hours of training the subject increased his run time by 40 minutes and rode the rotating chair to the maximum speed of 30rpm. The subject also reported fewer motion sickness symptoms as training progressed. During his first rotating chair test he reached 17 points with frank sickness, however on his final motion sickness test he was able to decrease his symptoms to 8 diagnostic points.

Future Directions

Other potential applications of AFTE may include:

- Treating air sickness in military personnel
- Treating patients suffering from vestibular disorders and patients receiving chemotherapy

References

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