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Abstract

The purpose of this research study is to analyze the relationship between anxiety and muscle activation in undergraduate trumpet players. sEMG will be used to measure three muscle groups: the upper trapezius, sternoclidomatoid, and masseter. This data will be analyzed along with State Trait Anxiety Inventory anxiety reports of each subject, and with VAS data of perceived anxiety after performing the repeated playing trials. Through covariate data obtained from the anxiety reports and an anxiety-induction experimental protocol, we hope to discover what effect anxiety will have on general muscle activation and fatigue in trumpet players. We hypothesize that subjects with higher anxiety levels will display greater levels of muscle activation and fatigue over the course of playing the trumpet as compared to subjects with lower anxiety levels. Preliminary data analysis has shown that there is no significant difference in VAS scales between the anxiety-induced group and the control group; the rest of the data analysis is still in progress.

Introduction

Studies have shown that up to 64% of performing musicians suffer from musculoskeletal disorders caused by or related to the rigors of playing their instrument (Lederman, 2003). This significant percentage makes it clear that more preventative measures must be taken. Current therapies that specifically help musicians deal with muscle complications are limited. For example, most musicians turn to the Alexander technique if suffering from muscle problems, which uses kinesthetic awareness to correct body alignment and movement, and thus helps the patients unlearn bad habits in their playing (Conable, 1998).

Biofeedback therapy with the use of sEMG can train musicians to use their muscles in a more efficient manner, yet it is still not a common or well-known form of therapy (Riley, 2011). Even players who do not experience pain and discomfort can benefit from this research, as they may be unknowingly utilizing an inefficient combination of muscles, therefore inhibiting their playing potential.

To gather our physiological findings, we will use sEMG equipment to measure the degree and frequency of the muscles' activation in trumpet players. The use of sEMG data, State-Trait Anxiety Inventory, VAS perceived anxiety scale, and general trumpet background questionnaire will aid us in making psychological and physiological assessments. We will use these results to show correlations between the psychology and physiology of trumpet playing, and to suggest possible future studies.

Methods

•Using REDCap, the subjects fills out a questionnaire on his/her trumpet playing background and Mindgarden's standardized STAI to measure general anxiety levels. These questionnaires will be completed on the subject's own time prior to the study visits; the links to the surveys will be emailed to them.
•The subject is given five days to practice two short etudes (composed specifically for this experiment).
•The subject has a ten-minute trumpet warm-up in a practice room separate from the researchers.
•The researches place the electrodes on the subject's right upper trapezius, sternocleidomastoid, and masseter.
•For the sEMG measurement of baseline activity, the subject holds the trumpet in a relaxed playing position for five seconds. For the sEMG measurement of maximum muscle activity, five seconds of data will be recorded for each of the following exercises: shrugging of the shoulder against the tension of an exercise band (trapezius), resisting the gentle push of a researcher's hand on their forehead (sternocleidomastoid), and clenching of the teeth (masseter).
•Group A will be instructed to play the two excerpts as accurately as possible, without missing any notes, and will be informed that the researchers will be evaluating the number of errors that are made. Group B will be instructed to play the excerpts as relaxed as possible, without worrying about accuracy. Each participant will play the excerpts three times each, with ten seconds of rest in between, totaling six 30-second playing trials.
•The subject rates the anxiety that they felt during the playing trials on a VAS scale.

Data Analysis

Two variables will be examined for the sEMG data: the magnitude of contraction, and the fatigue rate of each muscle. Since there are 3 muscles being measured, there will be 6 sEMG variables analyzed for each subject.

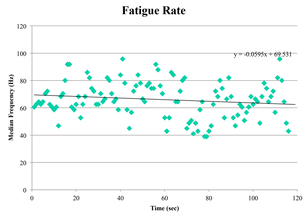
These 6 sEMG variables will be compared across the Anxiety-Induction group (A) and the Control group (B), to see if there is a difference in muscle activity. A Generalized Linear Model using repeated measures will be used to analyze each group's EMG data, which will be done using SPSS. Covariates will also be used, including females versus males, anxious VAS scales versus non-anxious VAS scales, and anxious STAI scales versus non-anxious STAI scales. Using a P value of .05, we will analyze whether or not the difference between the various groups are significant. The STAI scores will also be used as a covariate for the VAS scales, to see if anxious or non-anxious personalities affect the VAS scores. We will use these data analyses to answer the following questions:

1.) Does the Anxiety-induced group differ in muscle activity and VAS scales from the control group?
2.) Are the VAS scale perceptions consistent with the sEMG metrics?
3.) Do the STAI scores have an effect on the VAS scores and muscle performance?

Electrode placement on the upper trapezius, sternocleidomastoid, and masseter.

Closeup of electrode placement on the masseter and sternocleidomastoid

Appendix



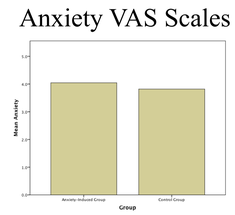
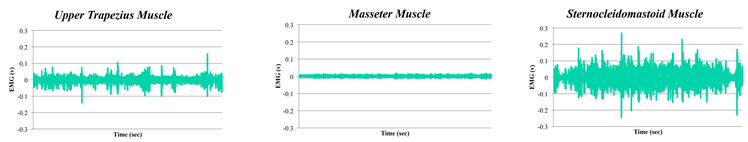


Figure 1: Means of Anxiety Induced Group and control group



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