CALIFORNIA STATE SCIENCE FAIR
2016 PROJECT SUMMARY

Name(s)
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Project Number
J0324

Project Title
Do I Grind? A Wearable System that Detects Bruxism Ahead of Its Effect on Teeth

Abstract

Objectives/Goals
8-31% of people in the world have Bruxism (Teeth Grinding) as a clinical disorder. 92% of people have had bruxism at least once in their life. Even though bruxism is not deadly, it has nasty effects: worn enamel, cracked teeth, joint problems, and even loss of teeth. People do not realize that they have bruxism until it is too late. They only realize the fact after the lasting damage has been done: the tooth enamel has been worn down or the tooth has fractured. If there was an easy-to-use device to detect bruxism early, a huge problem would be solved; people would save their teeth and money.

Methods/Materials
I created a wearable that can detect bruxism by just having the person wear it on the chin for three nights. Firstly, I programmed TinyDuino, an Arduino circuit board with a BMA 250 accelerometer and micro-SD card to record a series of accelerometer readings. After the readings for the whole night were taken, I analyzed them using a Python program that examined each time window and applied mathematical operations to detect and report bruxism events. I calibrated my program using simulated data and then completed 13 trials on volunteers.

Results
During my trials, my subjects reported that my device was comfortable to wear and allowed them to have a good amount of sleep. After analyzing the trial data with my program and then manually checking all reported events, I found that I achieved 81% accuracy in detected bruxism, with a false positive rate of 29% and false negative rate of 15%. Also, my test results and diagnosis matched the results of a top-of-the-line EMG device that was used on two volunteers.

Conclusions/Discussion
Most of the people who have bruxism do not realize that they have it until their teeth are already permanently damaged. My results show that it is indeed possible to make a low-cost, easy-to-use bruxism detector that millions of people can use at home to detect bruxism early, and thus save their teeth and money. My detection method is 81% accurate today, but I can improve it by training a predictive algorithm with larger trial dataset. I can also make a device that detects other sleep disorders like Sleep Apnea or Acid Reflux. In general, I can make a device that improves the thing we love the most: sleep!

Summary Statement
I have created a novel wearable system that can be used by millions of people to accurately detect bruxism before the disorder inflicts lasting damage on their teeth and health.

Help Received