How Can Vibration Detection Used to Determine Joint Health Monitoring?

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The purpose of our research was to facilitate the creation and utilization of a noninvasive monitor to detect joint dysfunction since there are very few quantitative technologies in the market to use without medical supervision. As many as 40 million adults in the U.S. suffer from osteoarthritis, and an at-home medical diagnosis can provide for a more effective treatment. Our solution is a wearable monitor that analyze joint sounds through vibration waveforms in order to detect the abnormalities in joints. We believe that in an arthritic joint, the articulating surface is rough from degradation, and therefore, produces a greater friction force. In order to prove that we can use accelerometers for these wearables, we first had to prove that there is a relationship between the friction in joints and the vibrations that they create while in motion. Our ramp was labeled in the same way as a ruler, so in each trial in which we manipulated each variable, we collected distance and time data from the path of the disk and subsequently created velocity and acceleration graphs. We repeated all these steps with the addition of accelerometers to the ramp. Upon putting the two sets of data in a bar graph, the friction force from the traditional method and from the accelerometer method looked nearly identical. With further statistical comparison through a two-sample t-test, we found a p-value greater than our significance level of 0.05, which also ruled the two data sets to be similar.

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