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Acute compartment syndrome (ACS) is a condition that occurs in 7.4 out of every 100,000 people. It results from a traumatic injury that causes an increase in the pressure of a muscle compartment and inhibits blood-flow to affected muscle tissue. Left untreated, ACS can lead to cell anoxia, muscle ischemia and muscle death. The current gold standard of diagnosis is to measure intracompartmental pressure using a Stryker Intra-Compartmental Pressure Monitor. If the pressure is above a certain threshold, the patient is diagnosed with ACS and clinicians perform an emergency fasciotomy to prevent muscle death; however, there is evidence that current diagnostic methods return a 35% false-positive rate, which results in unnecessary fasciotomies. Furthermore, patients receiving fasciotomies typically require five additional weeks to recover from their injuries and carry an increased risk for both scarring and infection. Therefore, there exists a need for an accurate diagnostic tool that confidently diagnoses ACS to prevent unnecessary fasciotomies.

It has been shown that ACS leads to a decrease in pH in the affected compartment. Thus, we propose to measure the pH of the compartment and compare it to healthy physiological pH, which would be consistent across all patients. Ion-sensitive field effect transistors (ISFETs), a miniturizable and precise technology, measure pH using a hydrogen-sensitive membrane that alters the voltage output from the device in a pH-dependent manner.

There is currently no comparable device on the market. ISFET sensors have historically been used in limited *in vivo* applications, such as measuring the pH in the esophagus. By creating an ISFET probe that can be inserted into muscle tissue, we seek to apply this technology in a novel way. Our prototype will consist of a 3 mm-wide ISFET sensor wire-bound using 25 μm copper wire to an extension of RG59 BNC cable. This will be connected to a mono-audio cable and monitored via Audacity®. In the future, the ISFET and cable will be encased in PEEK and inserted into a muscle compartment to quantify intracompartmental pH. Doctors will compare this reading to a threshold, below which they will diagnose the patient with ACS.

We will validate this device by characterizing its behavior in both buffer and meat solutions, including temperature dependence, response time and drift. We will compare these behaviors to those of an industrial ISFET probe meant for use in meats, and believe we will find that our sensor, while not as accurate as the industrial, follows a similar linear trend in pH measurement. The device will be able to report the pH of meat every 15 minutes. Unfortunately, the probe will not yet fit inside a 16-gauge needle, as required by our client. Future work will involve shrinking the device down to the appropriate size and improving its accuracy using custom-made ISFET sensors, and encasing the device PEEK so that it can be reused.

If successfully commercialized, this ISFET technology has the potential to be implemented in hospitals worldwide due to pH being a significantly more indicative marker of ACS compared to intracompartmental pressure. While the cost of the ISFET probe, estimated to be approximately $100 per test, exceeds that of the Stryker Pressure Monitor at approximately $60 per test, the ISFET probe's economic viability is aided by the fact that it will substantially reduce the number of fasciotomies, which cost between $3,000 - $5,000 per procedure alone.