

Abstract

Sense is the first **home-based** solution for the **early** detection of lymphedema. We envision our device to enable clinicians to intervene at the earliest warning signs of the disease, enabling improved clinical outcomes and significant cost savings.

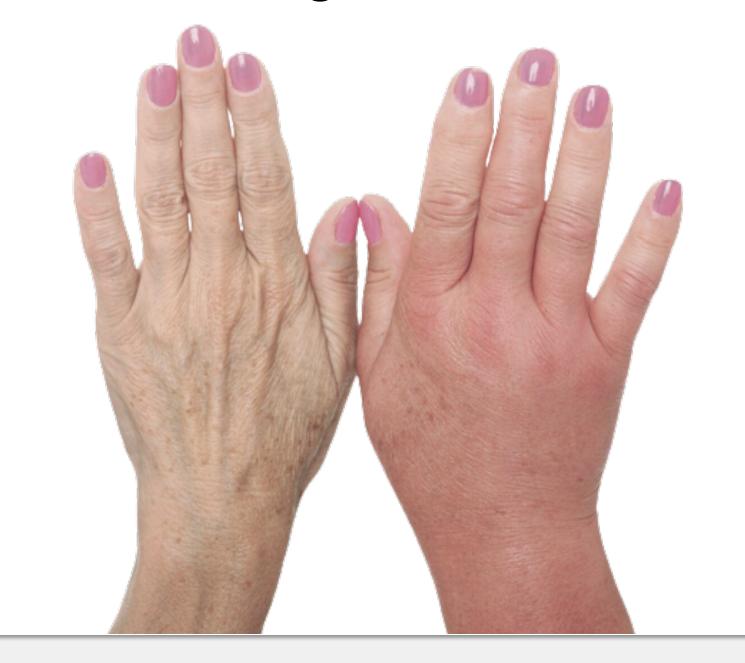
What is Lymphedema?

Lymphedema is a disease commonly caused by breast cancer treatment that results in extreme limb swelling and pain.

1 in 8 women 20%

are diagnosed with breast cancer in the United States.

of breast cancer patients develop lymphedema.



Introduction

When the lymphatic system becomes damaged, lymphedema may develop, becoming completely **debilitating** if left untreated.





Stage 0

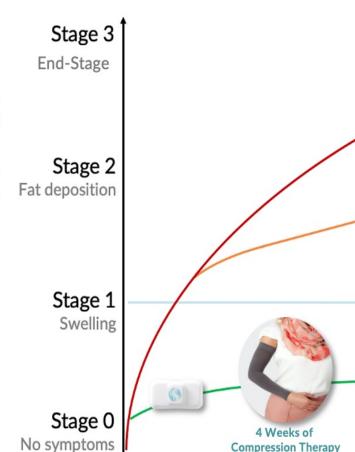
Stage 1

We are repurposing existing technology developed by our partners at **Baxter International, Inc..** We are using two measurements, bioimpedance spectroscopy and near-infrared spectroscopy, to detect changes in underlying fluid and tissue composition.

How LymphaSense Helps

_ymphaSense is a simple patch that measures fluid buildup over time, so patients and their doctors can detect the disease before it is too late.

With earlier detection, patients can start treatment faster, and the disease progression can be slowed or even halted.





An Early Detection Sensing Device for Lymphedema

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Stage 2 Stage 3



Symptom Developmen Early Intervention

Objectives

Need Statement:

Doctors need a way to detect lymphedema before symptoms develop in order to enable early treatment to reduce the development of chronic lymphedema.



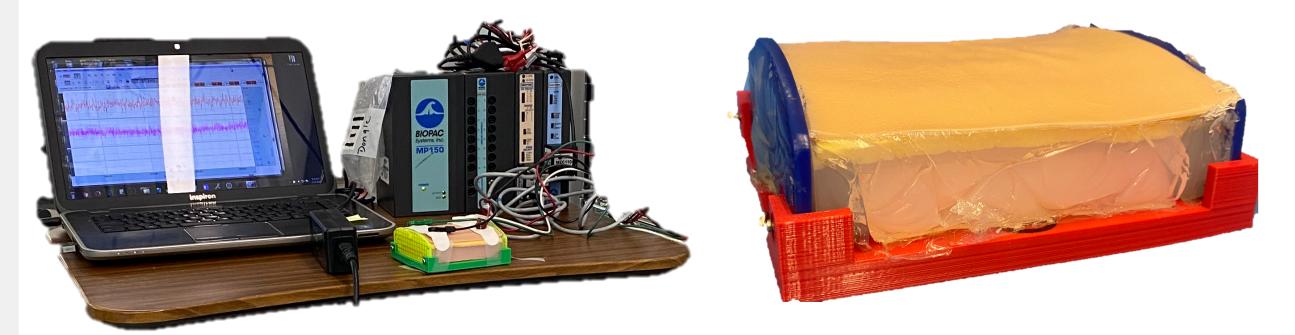
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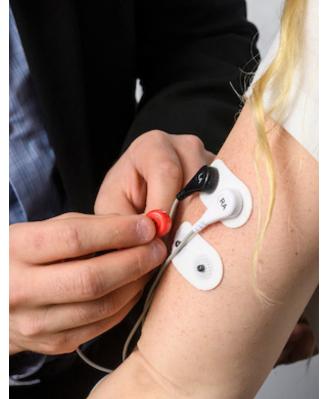
The objectives of this project were to create an accurate and affordable solution that streamlines care for patients by using it in their own homes.

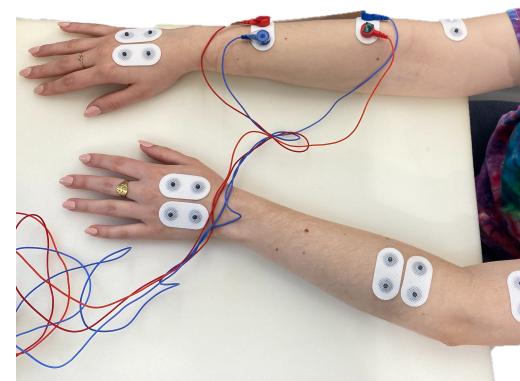
Methods

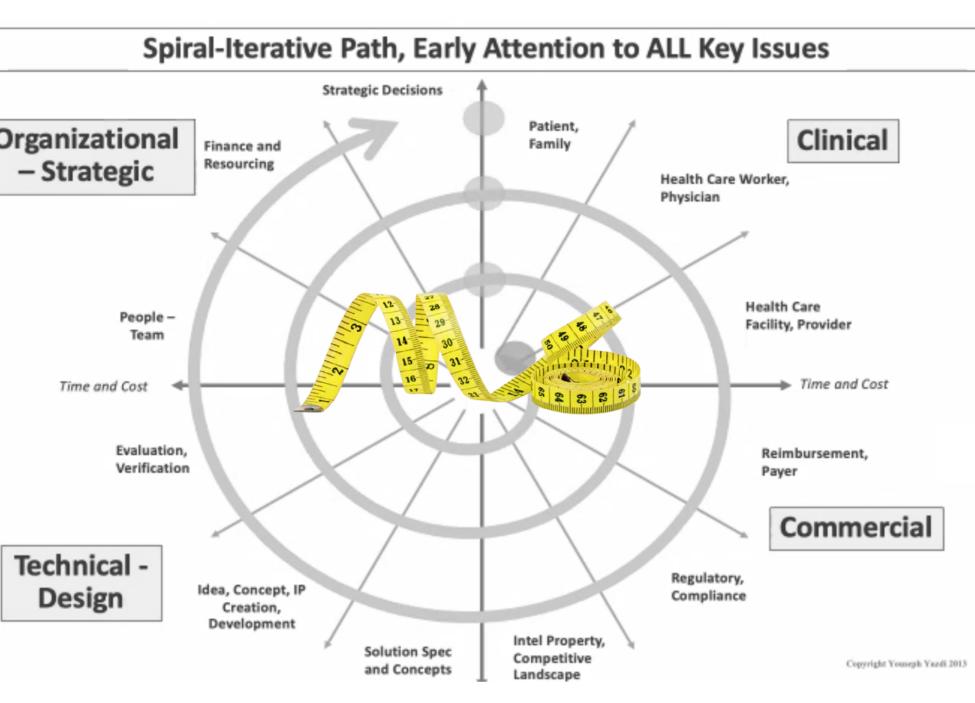
We have developed a modular bench-top model of lymphedema where we can alter different patient and device factors to evaluate potential failure modes.

Our **clinical study** set to run this spring at Johns Hopkins Hospital to validate the combination use of NIRS, Bioimpedance Spectroscopy, and Tonometry in lymphedema patients.

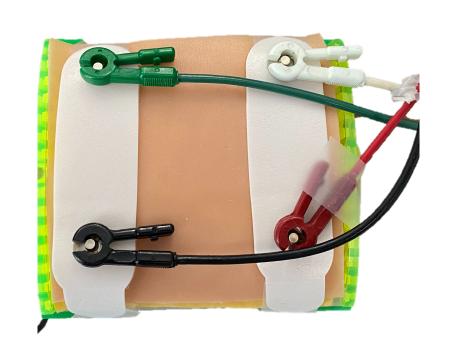


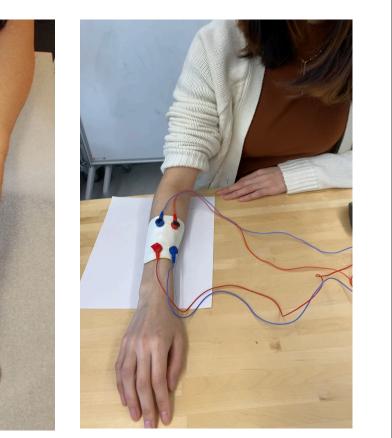






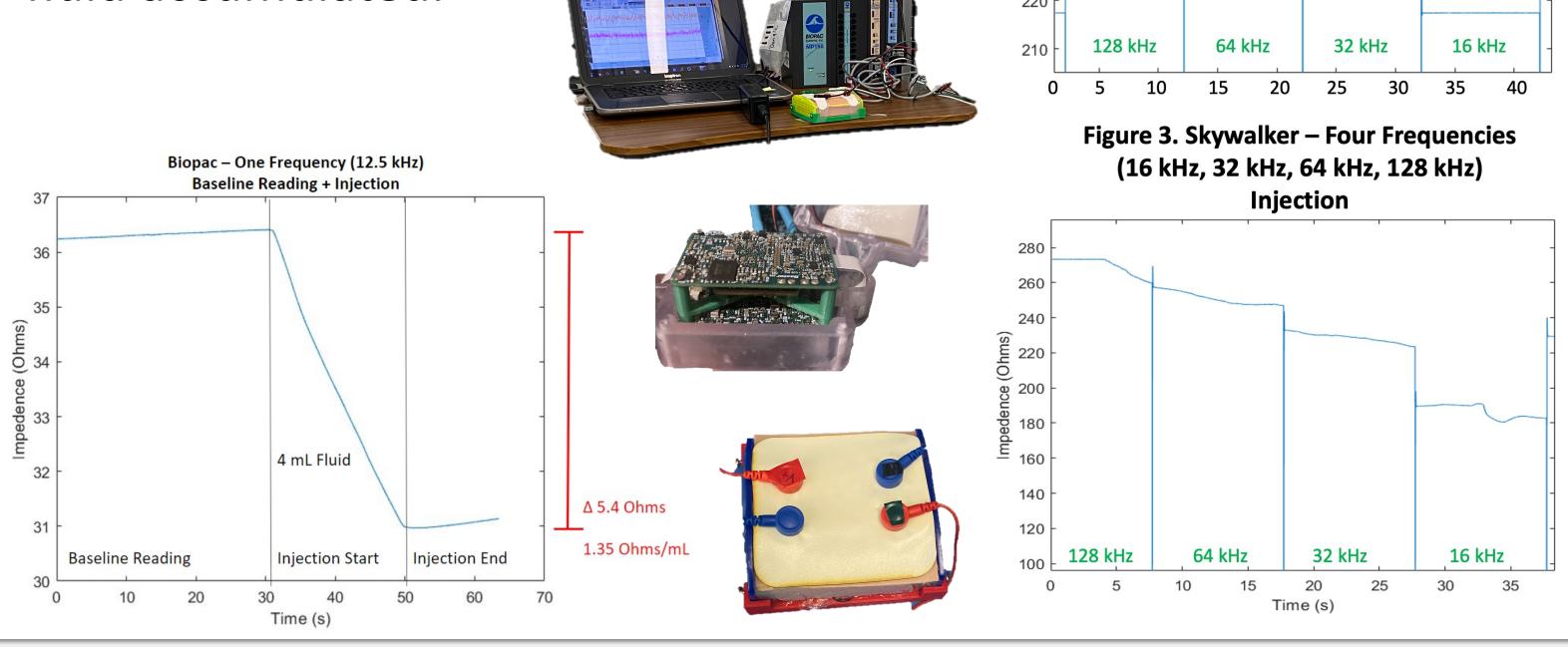






Results

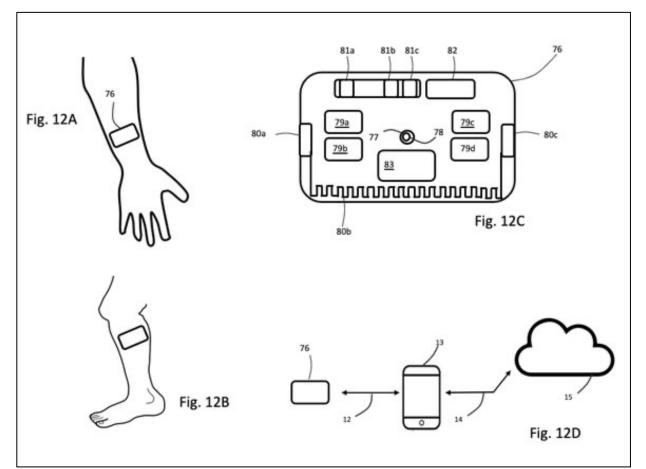
Benchtop testing has shown corroborating results, able to **detect precise changes** in interstitial **fluid buildup** with a resolution of about **1 ohm per mL** of subcutaneous fluid accumulated.



Conclusions

We designed LymphaSense to be an early detection device comprised of a simple sensor and single-use electrodes. Further development will focus on integrating additional sensors into our measurement index, fine-tuning the desired **specificity** and sensitivity, and developing corrective algorithms.

Wireless, Internet-Based System For Monitoring Lymphedema





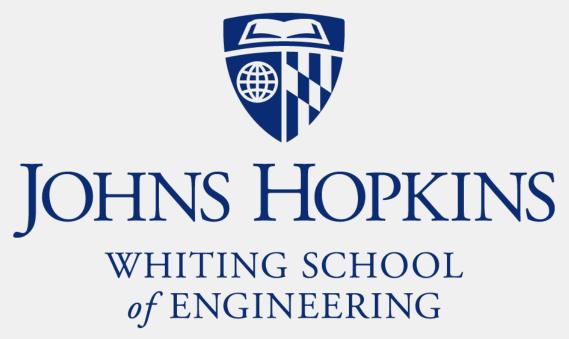




Figure 2. Skywalker – Four Frequencies (16 kHz, 32 kHz, 64 kHz, 128 kHz) **Baseline Reading**

