



**DBS Recharging Vest
Enhancement Project
Team: The Rechargers**

Agenda

- Introduction
- Project Description
- Project Background
- Problem Overview
- Solutions Overview
- Final Solution Selection
- Project Future

Introduction

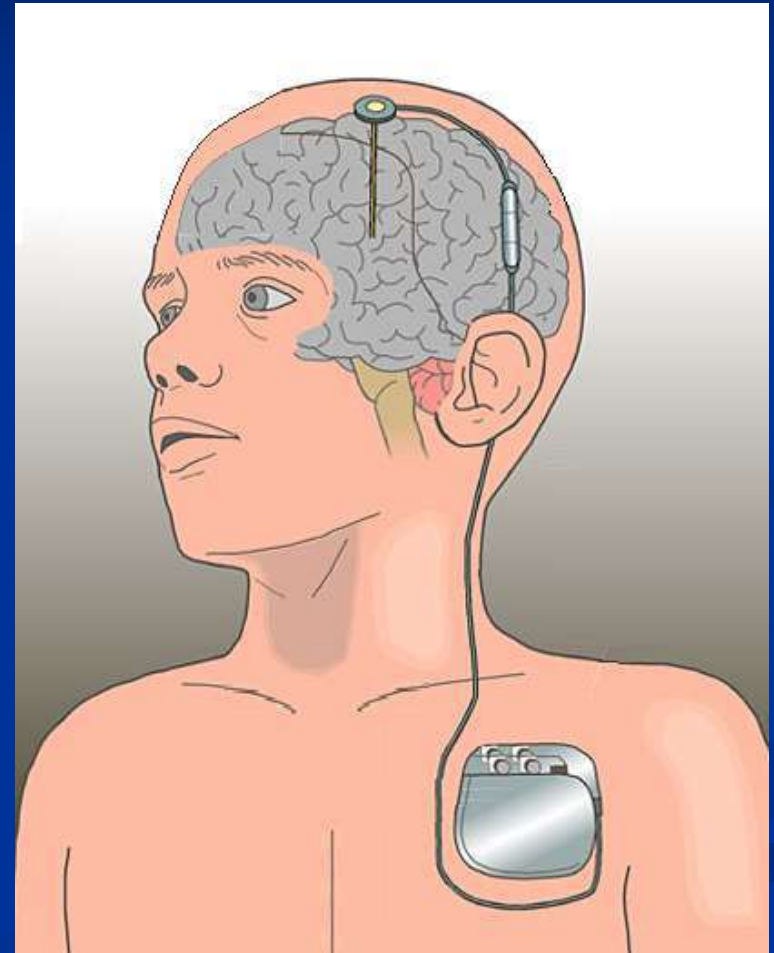
- Team: The Rechargers
- Team Leader: Reid Miller, Senior at Stanford University
- Team Members:
 - Dara Roberts, Freshman at Stanford University
 - Carol Evans, NP, RN-C, MS, Kaiser Permanente
 - Eric E. Sabelman, PhD, Kaiser Permanente
Functional Neurosurgery Bioengineer

Project Description

The DBS Recharging Vest Enhancement Project addresses the problems with the current vest design and will ensure that it is easy for the user to put on independently and wear comfortably.

Deep Brain Stimulation (DBS)

Used for treatment when medication is ineffective

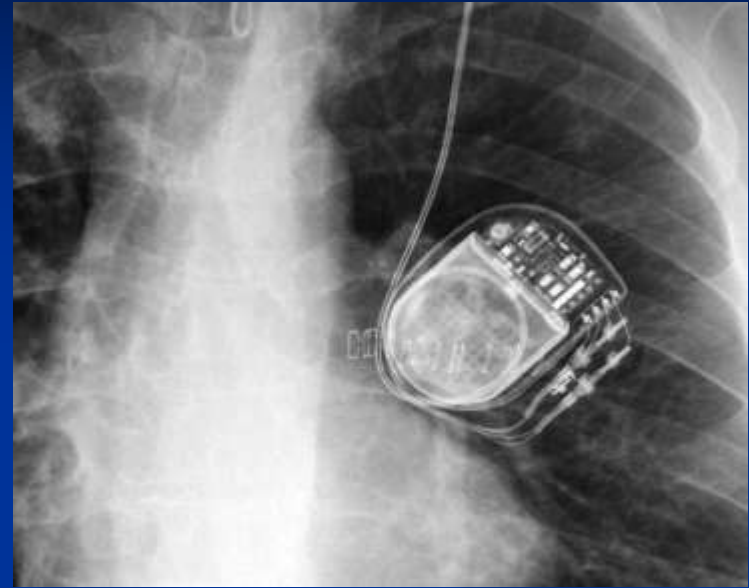


Deep Brain Stimulation



Implantable Pulse Generator (IPG)

- X-ray and a close up picture
- Battery Life up to nine years
- Project goal ensure adequate charging



Background Statement

- Medtronic Deep Brain Stimulator recharged at home by patient
- Vest houses the recharging unit (coil)



Current Medtronic Vest



Magnitude of the Problem

- Recharging unit placed approximately within 1 -2 inches of the implanted device (IPG)
- Deep Brain Stimulation (DBS) patients with arm tremor or dystonia have significant trouble positioning charging coil.
- Problem becomes more severe if battery becomes discharged.

Magnitude of the Problem

- Up to six months before patient gains full benefits
- Current vest provided difficult for person with impaired arm and hand functions to put on.
- Patients report that vest often does not position coil properly.

Interviews with Product Users

- Team could not meet or discuss issues directly with the users of the device
- Extremely difficult to position charger in the proper location
- Users can only perform limited activities during charging
- Sports bra

Statement of Specific Need

- Device that is easier for user to put on / take off
- Design that is better than “a one size fits all”
- Design that keeps the charger firmly in place over the charging area
- Design that is a comfortable fit

Solutions and Their Limitations

- Solution #1
 - Pouch Holder (Plastic)
 - Holds charging coil
 - Attached with sticky pad to skin
 - Limitations:
 - Need to replace sticky pad often
 - Many older patients using charger have skin problem which might not tolerate glue



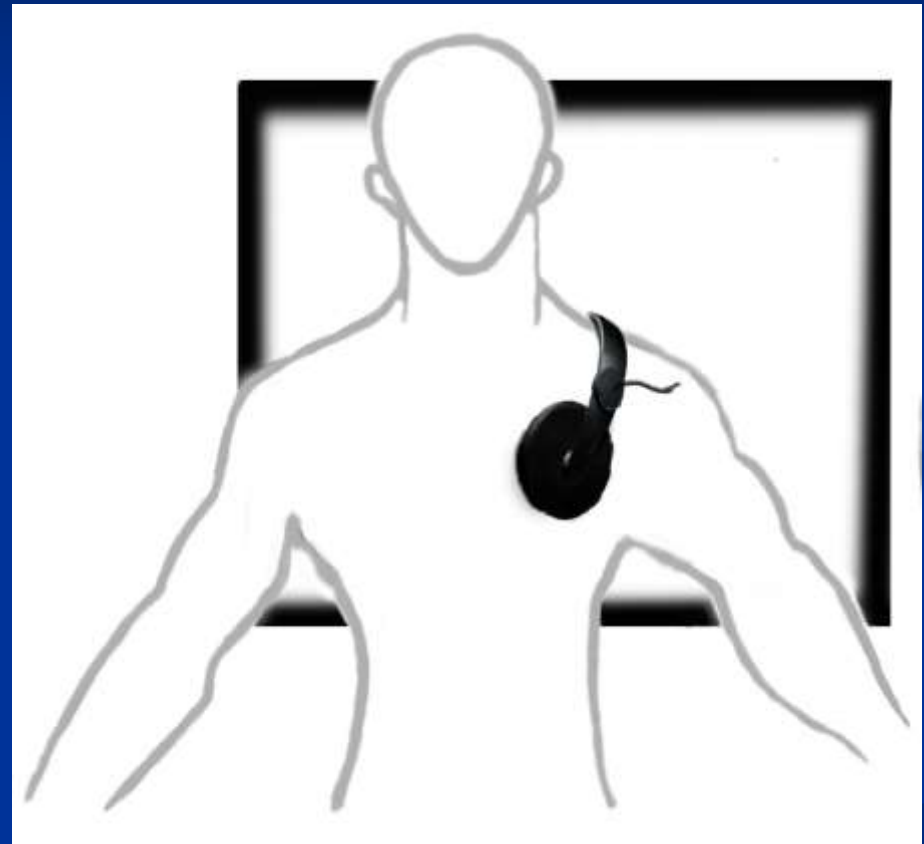
Solutions and Their Limitations

- Solution #2
 - Belt Charger Holder – waist belt with charger inserted. Simple to put on and remove.
 - Limitations:
 - Proper positioning over IPC for charging.



Solutions and Their Limitations

- Solution #3
 - Over-the-Shoulder Holder - Clam shell like holder can be placed on shoulder.
 - Limitations:
 - Excessive movement may move device out of position.
 - Excessive pressure from clamp



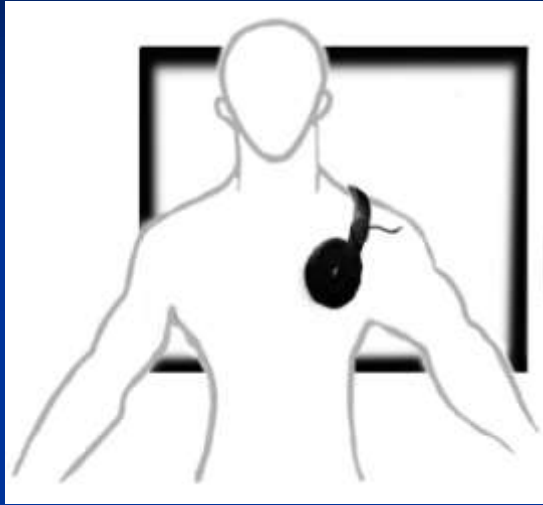
Analysis of Considered Design Alternatives

- Magnets
 - Could interfere with Charging process or operation of IPC
- Molded Plastic Shoulder Plate – Roman Armor
 - Costly – individually molded for each user
- Plastic pouch
 - Could cause skin irritations
- Harness
 - Costly and over-engineered solution. Potential Patent problems
- Stereo Head phones (Clam Shell)
 - Best solution with appropriate enhancements

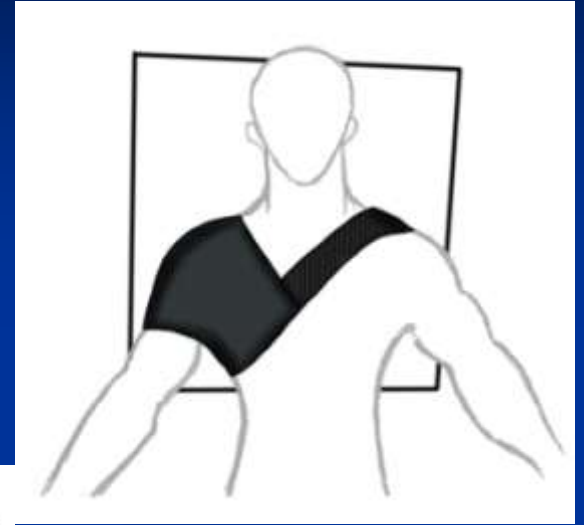
Considered Design Alternatives



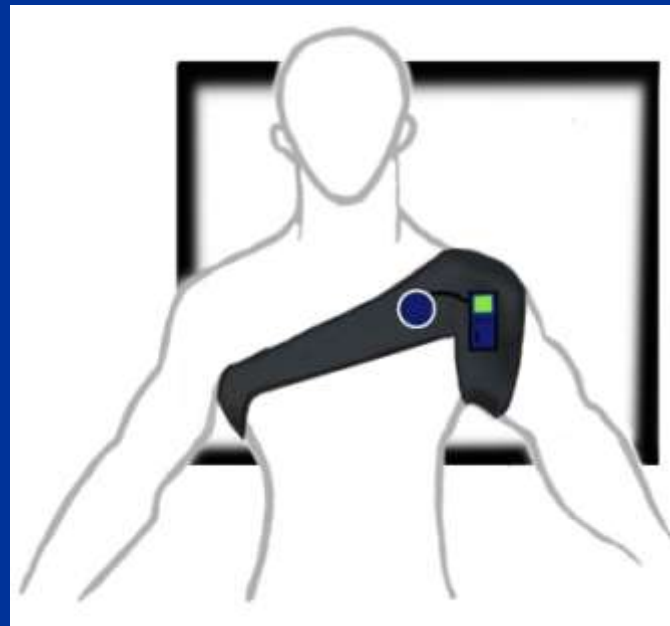
Selected Design Considerations



Phase I Design



Phase II Design



Phase III Design

Vest Prototype II



Vest Prototype II - Modeled

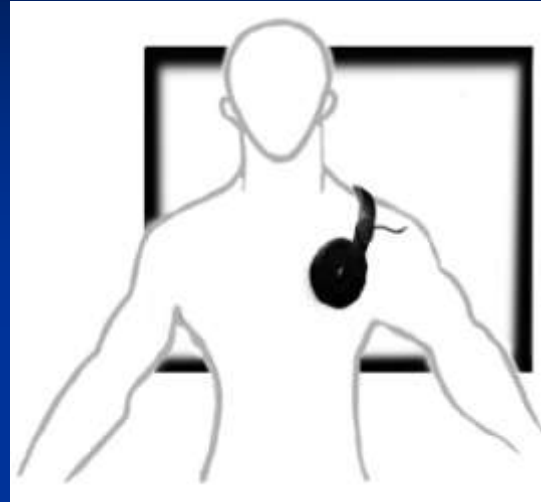


Final Prototype



Prototype Comparisons

Prototype I



Prototype II



Prototype III



Project Future

- Further Develop Prototype Based on:
 - Size
 - Weight
 - Usability
- Test Final Prototype with Actual Users
- Fix Any Defects Discovered
- Produce Production Product
- Find Manufacturer

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