

# IMPROVED TREATMENT OF PLAGIOCEPHALY

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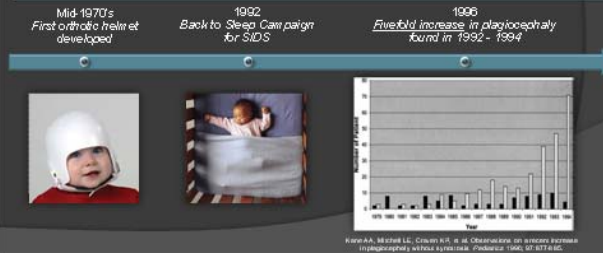
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## Background

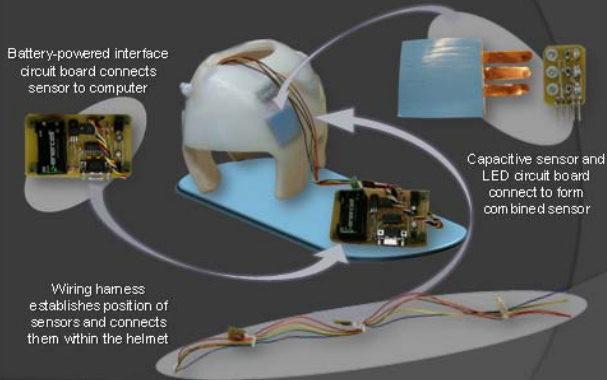
- Asymmetrical molding of the head caused by external forces
- Infant's ages 4 to 18 months undergo corrective helmet treatment
- Currently, there is no quantitative means of measuring the forces an orthotic helmet applies to the skull



## Objectives, Specifications, Constraints & Risks

- OBJECTIVES**
  - To produce a method of measuring contact forces applied by orthotic helmet on the skull
  - To achieve a better, faster, and more complete treatment for plagiocephaly
- SPECIFICATIONS**
  - Battery-powered
  - Sensors < 1" in thickness
  - Aliplast foam is material in contact with head
  - Device in helmet is undetectable to patient
  - Maximum detectable force is 9.21 lb-force
  - Minimum detectable force is 0.385 lb-force
  - Noise is < 0.385 lb-force
  - Sensors must conform to 3D surface
- CONSTRAINTS**
  - Materials should be:
    - Non-toxic
    - Currently used in orthotic helmets
    - Readily available
    - Low cost
- RISKS**
  - Sensors may be destroyed in the process of building the helmet
  - Sensors may be detectable if they are not small enough
  - Sensors may not be sensitive to relevant force range

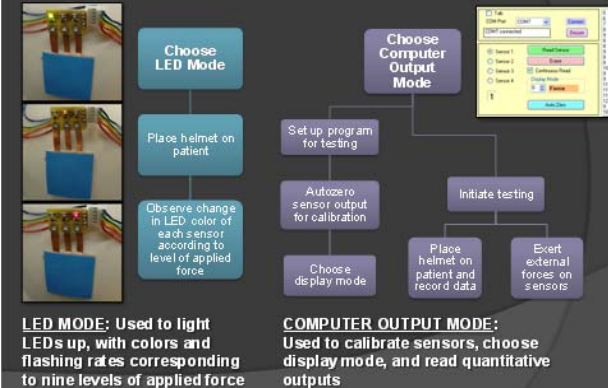
## Device Illustration



## Production Methods

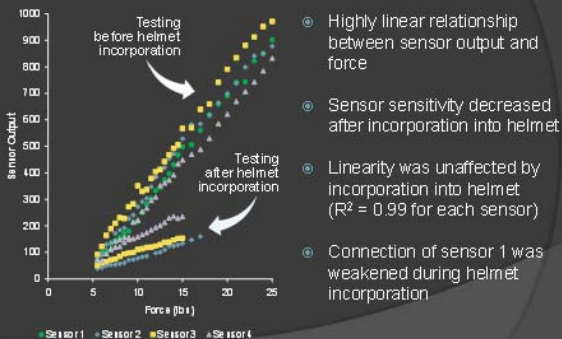


## Operation Block Diagram



## Results:

### Force / Sensor Output Relationship



## Specifications vs. Actual Performance

Specification	Specified	Actual Performance	Test Method
Battery-powered	Has battery	Has battery	N/A
Thickness	< 1" (25.4 mm)	4mm	N/A
Foam in contact with head	Aliplast foam	Aliplast foam	N/A
Patient comfort	Should not be able to detect device in helmet	Could not detect device in helmet	Have consultant try on helmet
Maximum force	9.21 lb-force	≥ 15 lb-force	Apply load with mechanical force transducer
Minimum force	0.385 lb-force	0.128 lb-force	Calculate sensitivity from output force calibration curve
Noise	< 0.385 lb-force	0.193 lb-force	Record output for one minute after system has been at rest for a substantial period

## Conclusions, Recommendations, & Acknowledgements

- CONCLUSIONS**
  - Incorporated force-measuring system into orthotic helmet
  - Designed a system that gives output corresponding to applied force
    - However, sensitivity of system was reduced following incorporation into helmet
  - Strategically designed system so that LEDs are visible through the helmet casing
  - 3D surface did not adversely affect capacitance measurement
    - This is a result of designing and building the sensors on a 3D surface
- RECOMMENDATIONS**
  - Perform clinical studies using helmets with force-measuring system on patients
  - Add more layers to sensors to increase capacitance so that sensitivity will be less affected by system incorporation into helmet
  - When building the system into the helmet, pull the last layer of foam and cut a window for the LED sensors after setting the sensors

ACKNOWLEDGEMENTS  
Special thanks to Dr. Daniel Bogen and Calli Clark for supporting and guiding us throughout the project