

Personalized Rebreathing Device for Hypercapnia Administration

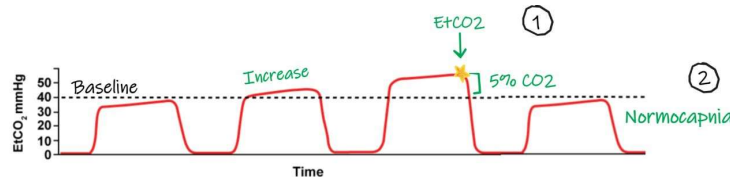
Problem

- **Cerebral vascular reactivity (CVR)** → assess microvasculature response to vasoactive challenges
- **Hypercapnia** → strong vasodilative stimulus, where there is excess CO₂ in the blood
- **Limitations of previous design** → failure to maintain hypercapnia for 30 seconds

Objective: To design a **portable** and **automated** device for **personalized hypercapnia administration**

Design Inputs:

1. Induce hypercapnia
2. Return to normocapnia
3. Portability



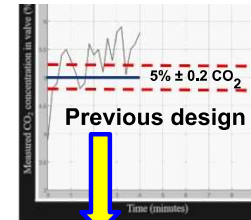
Impact

- **Personalized, easy to use** CVR measurement
- **Safe** for critically-ill
- **Paired** with neuroimaging techniques

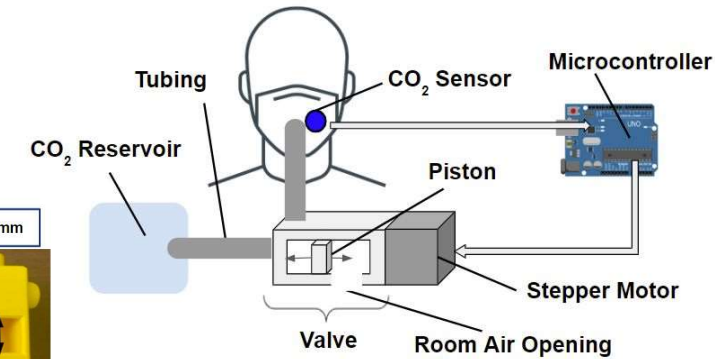
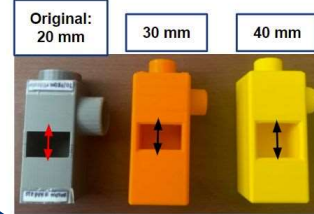
Future Plans

- Improve **air leakage**
- Validate device with expanded demographics and **larger sample population**

Solution Design

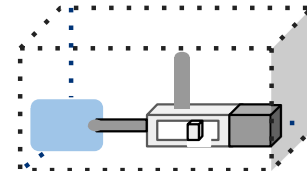
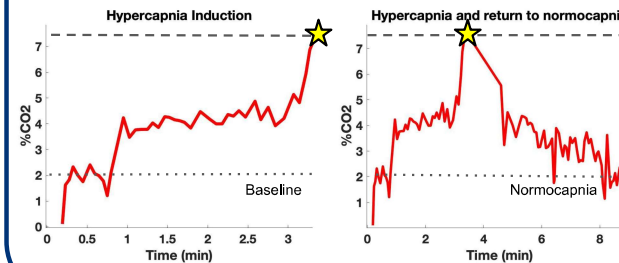


Mechanical Revisions



Testing Results

- ✓ Induce hypercapnia
- ✓ Return to normocapnia
- ✓ Portable



Assembled device fits within 9" x 20½" x 18" and weighs less than 10 lbs