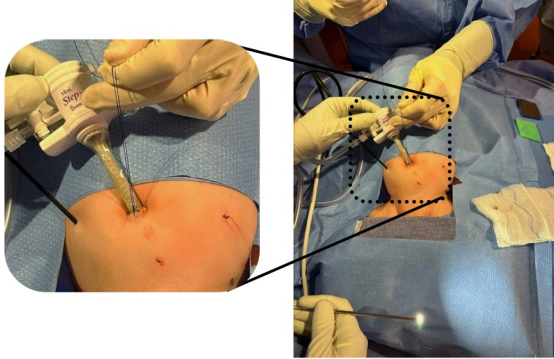


Background

- Surgical setup for babies can be challenging and lead to complications or fatalities
- Improving the ability for surgeons to operate with better tools will improve outcomes and reduce newborn fatalities



Laparoscopy: An operation performed in the abdomen or pelvis using small incisions with the aid of a camera
Insufflation: Inflation of the thoracic cavity during an operation to 10-12 psi. Allows surgeons to visualize surgical site via camera

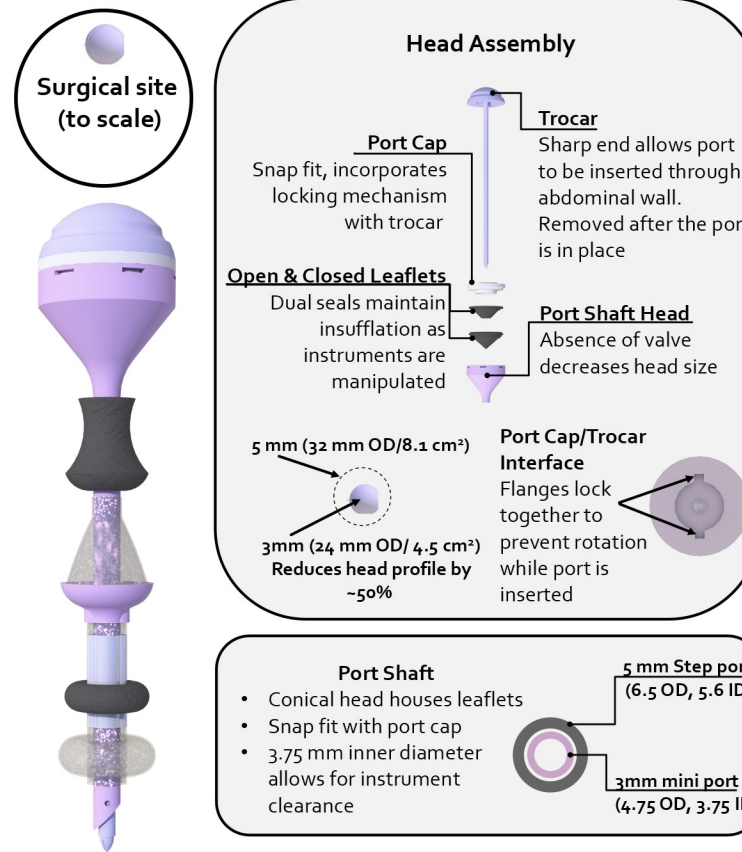
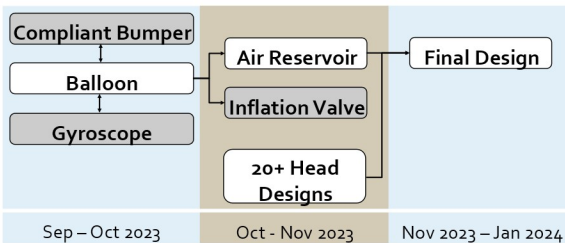
Current Ports



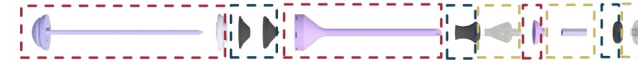
- Crowding of surgical field**
Current large port heads hinder visibility and instrument maneuverability
- Sealing and insufflation**
Port must maintain insufflation while accommodating motion of 3mm instruments
- Dislodgement of port from cavity**
Existing designs fail to secure port adequately: surgeons suture ports in place

Goal: Develop a 3mm port with a retention mechanism for use in laparoscopic procedures

Design Approach



Material Selection

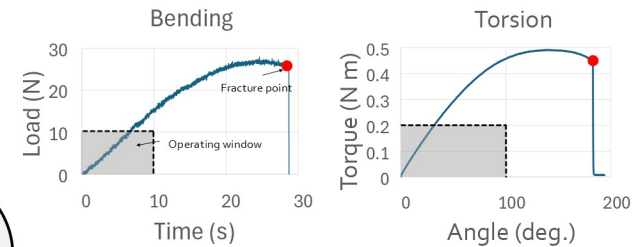


- Components fabricated on FormLabs 3B printer**
- Material properties similar to FDA-approved resins
 - Resins with wide variety of material properties available

- Rigid:** FormLabs Clear resin
- Trocar, port cap, shaft, balloon holder
- Flexible:** FormLabs Flexible resin (durometer rating 50A)
- Leaflets, bumpers, upper balloon
- Soft:** Silicone (durometer rating 20A-35A)
- Lower balloon

Testing

- Chose tests to simulate typical operating conditions on port shaft
- Tension
 - Bending
 - Torsion
- Balloon identified as essential component
- Pressure tested in a pool to simulate loss of insufflation
 - All balloons survived pressure testing



Results

- Crowding of surgical field**
Reduced head area profile by roughly 50%.
- Sealing and insufflation**
Leaflets maintain insufflation, while removal of valve further decreases head size
- Dislodgement of port from cavity**
A novel retention mechanism allows for user to apply retention without secondary tooling, reducing port dislodgement.



"It feels familiar"

-Dr. Diaz-Miron