Lung Link: Improved Artificial Lung Conduits

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Clinical Problem

- Lung Disease takes nearly 335,000 lives each year in the Unites States alone and is a growing problem [1].
- The waiting list for lung transplants contains thousands of people, and most patients have to wait 1-2 years to find a suitable donor [2].
- A new artificial and portable assistance device for the lung would aid extend patients lives until a donor organ is available.
- Currently, Dr. Keith Cook and team have designed a prototype to fit this need.

Methods

Area of Need	Experimentation Method	Description
Tube Kinking	Comparative Study of Mechanical Strength	Compare effects of applied forces to coated PVC and PVDF grafts.
Tissue In-Growth	Live/Dead Assay: Cell Viability Test of Materials	Determine cell viability after 72 hours on varying proposed materials.
Gas Exchanger Connection	Liquid Flow; Connection to Exchanger	Determine flow capability through Quick-Connection.

Conclusions

- A PVDF coating is inferior to PVC in terms of mechanical strength.
- Thin Rayon Polyester Blend is a superior material for wrapping the conduit due to increased tissue viability and proliferation.
- A Colder quick-connect device will allow for easy replacement of the gas exchanger without introducing any increased thrombosis risk.
- Future work will include animal testing to determine the conduit's *in vivo* functionality and testing additional coating materials.

Description of Design

The areas of concern of previous prototype improved in current prototype are:

Tube Kinking: Polyvinyl chloride (PVC) currently coats the graft material attaching to the heart improving mechanical strength. PVDF was tested as an alternative and proved ineffective.

Tissue In-Growth: Thin porous rayon-polyester blend material is sewn to the conduit at the exit of the body replacing the previous felt material.

Gas Exchanger Connection: A quick-connection system is implemented at the distal end of the conduit for a quick and easy replacement of the gas exchanger portion.

Results

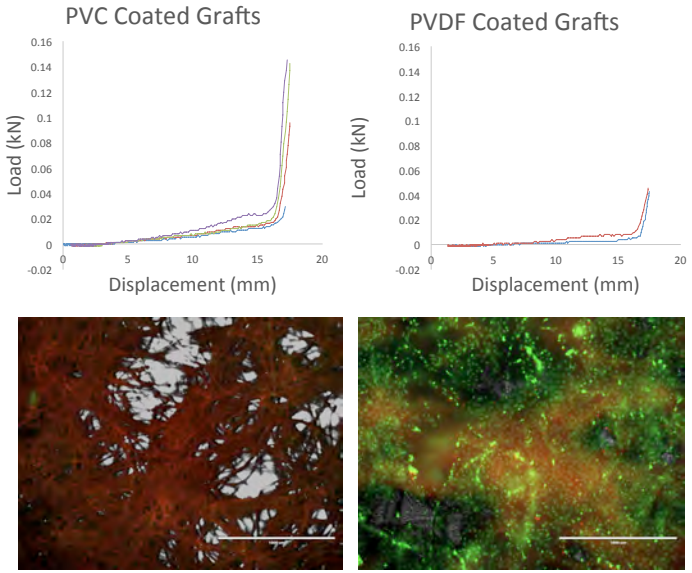
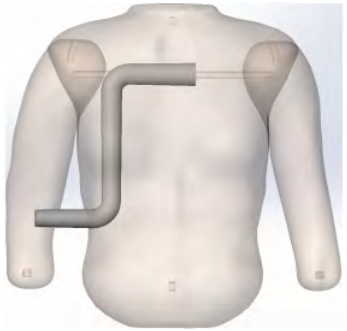


Figure 1: Live/ Dead Assay Results including previous prototype's Felt (Left) and Thin Rayon Polyester Blend (Right). Cells stained green are living, while cells stained red are dead. Image analysis showed that the Thin Rayon Polyester Blend resulted in the highest cell viability.

Prototype Design



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References

[1] "Estimated Prevalence and Incidence of Lung Disease (April 2013)." American Lung Association.

[2] "Transplant Waiting List." *Stanford Hospital & Clinics*. Stanford University, 2014. Web. 05 May 2014.