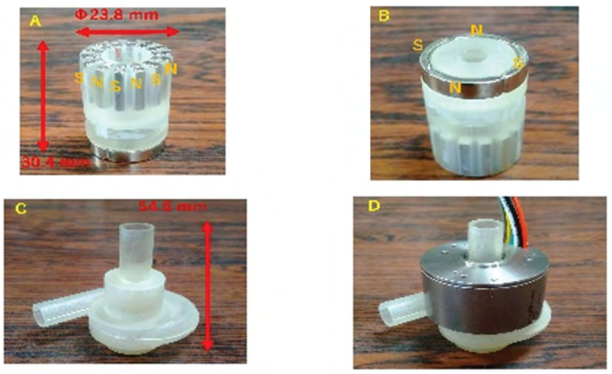

Figure 2. (A) Top view of the impeller, (B) Bottom view of the impeller, (C) Pump housing, (D) Hybrid pump

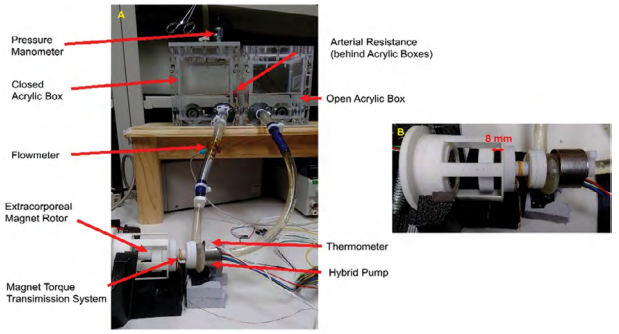

Figure 3. (A) Front view of the test loop, (B) detailed view of the hybrid pump and extracorporeal magnets

CARD8

A Gas-Exchange-Area-Adjustable Oxygenator for Extremely Preterm Infants

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Purpose: Worldwide, 600,000 infants are born extremely premature (EP) each year. Supporting the immature lungs of these smallest patients today using mechanical ventilation can cause severe lung damage. Extracorporeal gas exchange (ECMO) used as an "artificial placenta" is expected to provide an alternative treatment to allow full maturation of the lungs. The long-term application for patients doubling their weight every six weeks, requires a new type of "growing" oxygenator.

Materials & Methods: We developed a gas-exchange-area-adjustable oxygenator that allows to operate at two different size stages without changing the device nor increasing the flow resistance. Our prototype houses two concentric oxygenator-chambers of equal gas exchange area. When the outer chamber is in operation, the oxygenator provides the required gas exchange area for a 24-week infant. Single-chamber operation allows adaequate gas exchange of volume flows from 50 - 125 ml/min while double-chamber operation then covers flow-demands from 125 - 200 ml/min. Both operational modes in combination can cover the needs of infants from 24 to 28 weeks postmenstrual age. We performed gas-transfer measurements of the prototype in accordance with ISO 7199 and FDA guideline.

Results: Gas transport performance for the outer cylinder operating at V_{blood} = 50 mL/min (24 week premature infant) is V_{O2} = 1.8 mL/min (= 36 $mL_{O2}/L_{blood\ flow}$). At a flow of V_{blood} = 125 mL/min the second chamber was switched on and the gas transfer performance increased by 50.1 %. Both chambers have a gas transport performance of V_{O2} = 4.19 ml/min at V_{blood} = 150 ml/min (= 28 $mL_{O2}/L_{blood\ flow}$)

Conclusion: It could be demonstrated that the gas-transfer of the newly proposed volume-adjustable oxygenator design is sufficient to increase the gas transfer performance while increasing the blood volume flow. We consider this a first milestone for oxygenation of growing EP infants without the need to replace the extracorporeal circuit, avoiding the associated risks.