

Freeing the LVAD patient from drivelines using wireless resonant electrical transfer.

Benjamin Waters, Alanson Sample, Joshua Smith, Pramod Bonde

Background: Technological innovation of smaller, frictionless, single moving part has an advantage over earlier large pulsatile Ventricular Assist Devices (VAD) prone to mechanical failure. Drivelines limits the potential of newer pumps and act as source for infection, increased morbidity, and re-hospitalizations. Older TETS based technologies are hampered by power delivery over few millimeters, mis-alignment and poor efficiency. The Free-range Resonant Electrical Energy Delivery (FREE-D) wireless power system uses magnetically coupled resonators to efficiently transfer power. We previously demonstrated the efficiency of such system. In the current investigation we have vastly improved the distances to a room sized transmission of electrical energy wirelessly.

Methods: The axial pump was set at 9600rpms. The experimental set-up (Fig 1) consisted of a single turn drive loop and multi-turn spiral coil as a transmitter (Tx) and receiver coil (Rx) attached to the hardware and software for a close wavelength tuning. To achieve a seamless wireless delivery in any room size, we introduced a third relay coil. This relay coil can be installed throughout a room (walls, beds, couches, chairs, etc.), while a single relay coil could be built into a jacket worn by the patient, which would always be within range of the Rx coil implanted in the patients body.

Results: The power was delivered over a one meter distance without interruptions or fluctuations (Fig 1) with coil, rectifier and regulator efficiency over 80% and overall system efficiency of 54%. The axial pump worked well throughout the 8 hours of continuous operation. The distance can be doubled by having same set-up on the opposite side.

Conclusion: A tether free operation of a VAD can be easily achieved by FREE-D system in room size distances. Besides improving quality of life it has the potential to make the VAD therapy more acceptable from the patient perspective.