Investigators

Jonathan Clark, Gregg Suaning, Nigel Lovell, Hubert Low, Shaheen Hasmat

Project Title

BLINC (Bionic Lid Implant for Natural Closure)

Institutions Involved

Chris O'Brien Lifehouse
University of Sydney
University of New South Wales

Summary of the Project

The BLINC device is an innovative and implantable bionic solution for facial paralysis.

Facial paralysis affects millions of people worldwide. It is a debilitating condition that results in severe physical and social consequences with limited scope for effective treatment. Facial paralysis occurs from damage to the facial nerve. The most important function of the facial nerve is eyelid closure, which serves to protect the eye. Various surgical techniques have been devised to restore function of the eyelid in patients with facial paralysis; however, they all fail to close the eye spontaneously, synchronously and facilitate effective lubrication, which is critical to a healthy, pain-free eye.

Implantable bionics is a growing field that already provides effective therapies for countless people who would otherwise suffer the debilitating effects of neural and cardiovascular diseases. Here, we seek a bionic therapy for the correction of eye closure in facial paralysis. The BLINC project seeks to restore synchronised eyelid closure through a fully implantable and completely airtight encapsulated electromagnetic actuator (a type of motor) controlled by external sensors and transcutaneous, battery-free energy. The device is designed to produce functional, therapeutic and cosmetically acceptable eyelid closure.

Goals/Aims and How it Aims to Benefit Head & Neck Patients with Cancer/Pathology

Although the most common cause of facial paralysis is Bell's palsy, the BLINC device has been designed to initially be used in patients undergoing major cancer surgery.

During surgery for parotid (salivary gland) tumours, the facial nerve is at significant risk of damage, and the surgery that removes the cancer can lead to facial paralysis. This can affect a person's ability to close their eye. Eyelid closure serves to protect the eye by sweeping tears across the cornea, enabling its lubrication and hydration. Without proper lubrication, the eye becomes painful, inflamed and blindness can result. In addition, facial paralysis affects essential social interactions by altering the perceived normality, trustworthiness and intelligence of the patient. Australia has the highest incidence of malignant parotid tumours worldwide, due to metastases from skin cancer.

Aims:

BLINC aims to restore synchronous, spontaneous and natural eyelid closure for people affected by facial paralysis.

The team has produced functional prototypes that achieve lid closure in synthetic and animal models, and have determined the necessary surgical attachment points, timing and energy requirements of the device. We are now aiming to advance this work and prepare for first-in-human clinical trials and the clinical application of this technology. This involves:

Fabrication of a biocompatible BLINC device
Before *in vitro* tests can commence, a robust, biocompatible implantable device needs to be manufactured.

Durability testing
The BLINC device will be cycled for 50 hours (30,000 blinks) in animal models to test the design and its compatibility in a biological model.

Safety and efficacy in animal models
Following refinement of the device design, implantation technique and device fixation strategy, a staged programme will be carried out to assess the performance of the implanted device.

Benefit to patients:

The BLINC device is a groundbreaking innovation that will transform the physical health and psychosocial outcomes of those effected by facial nerve damage.

Exposure of the eye in patients with facial paralysis results in pain, tearing and psychological distress. Without meticulous care, corneal damage can ultimately lead to blindness. Effective restoration of eye closure would reduce the suffering of patients with this debilitating condition. This technology will also contribute to reversing the psychosocial stigma attached to the loss of facial expression. These outcomes will ultimately lead to the expansion of implantable bionics as part of the multimodal treatment of patients with facial paralysis