

SPACE LIFE SCIENCES SYMPOSIUM (A1)
Medical Care for Humans in Space (3)

Author: Mr. Marek Novák
Czech Technical University In Prague (CTU), Czech Republic

Dr. Jan Hajer
Charles University, Czech Republic

ENDOSCOPICALLY IMPLANTABLE DEVICES INTO SUBMUCOSA AS THE SOLUTION FOR
LOW-GRAVITY INDUCED GASTROINTESTINAL PROBLEMS

Abstract

The future manned space missions will be challenging not only from technical point of view but medical as well. Although the process of selecting suitable candidates is rigorous, medical complications can still occur during long-term space flight. Gastrointestinal problems are a quite significant group of all medical events among astronauts. One of the main gastrointestinal problems is the gastroesophageal reflux disease (GERD). The gravity normally keeps the acid reflux from developing. However, in low or zero gravity, the acid can press against lower esophageal sphincter easier which may lead to GERD.

We developed a method to address these challenges with a battery-less endoscopically implantable device. A miniature implantable capsule (14 mm x 14 mm x 6 mm) was designed to assess the technology. It is powered wirelessly using inductive coupling with the transmitter coil and features two-lead bipolar electrical stimulation.

The experiments were performed in an animal model and living animals. The device was endoscopically implanted into submucosal space near lower esophageal sphincter. The device stimulates the muscularis propria inside esophagus to prevent GERD. Minimal invasiveness and virtually no bleeding during surgery when compared to today's solutions for neurostimulation make the presented solution a novel approach which could be carried out in space or before space flight without the need for full anaesthesia.

Future work will be focused on implementing different types of sensors and actuators to treat different gastrointestinal diseases which could occur during long-term spaceflight.