PROPOSAL OF A CAPSULE-TYPE POSTURE MAINTENANCE MECHANISM THAT CAN BE OPERATED BY AN EXTERNAL MAGNETIC FIELD FOR THE PURPOSE OF MAINTAINING THE POSTURE OF CAPSULE-TYPE EXAMINATION DEVICES IN THE SMALL INTESTINE.

No.2181257 Yusuke Nakamura

(Supervised by Prof. Masaya Watada)

ABSTRACT

Malignant neoplasms are the leading cause of death in Japan, and the incidence of intestinal neoplasms is the highest, at about 16%, compared to other parts of the body. However, malignant neoplasms of the intestine have a 90% or greater chance of being completely cured by early detection. Therefore, we focused on endoscopy, a common intestinal examination. Among them, we focused on capsule endoscopy, which is considered to cause less pain to patients. Capsule endoscopy is expected to expand its use during examination. The realization of "diagnosis to treatment" by capsule endoscopy can solve the pain caused by videoscope endoscopy. In order to realize "diagnosis to treatment," it is necessary to develop a capsule-type examination device equipped with a posture maintenance mechanism. Therefore, the purpose of this study is to propose a capsule-type posture maintenance mechanism. The concept of this mechanism is "a posture maintenance mechanism capable of two actions by one power source using an external magnetic field," the two actions being a screw action by rotational motion around the bowel axis and a mechanism opening and closing action. A mechanism that can operate each motion independently is required. The proposed mechanism has three panels that can be simultaneously deployed like an umbrella against the flow of intestinal mucus. For panel deployment, the torque of the mounted magnets is transmitted to the panels by a slider crank mechanism and a link mechanism. This mechanism aims to realize the two operations described above using the rotational motion of the magnets by the application of a magnetic field. The magnetic field is applied using a 3-axis Helmholtz coil. The minimum torque required for the magnet is calculated and the magnetic field application simulation is performed using JMAG-Designer to verify the magnetic flux density that can be output. The minimum required magnetic flux density BSmin = 9.9 x 10-4 [T] for the screw torque Txmiin = 9.2 x 10-4 [Nm] and the minimum required magnetic flux density BMmin = 90.3 x 10-4 [T] for the mechanism opening and closing torque Tymin = 10.6 x 10-3 [Nm]. Therefore, this mechanism is considered to be capable of operating with a 3-axis Helmholtz coil that satisfies the minimum required magnetic flux density for each operation.