PROPOSAL OF SELF-PROPELLED MECHANISM FOR CAPSULE ENDOSCOPE THAT ENABLES SIMULTANEOUS EXAMINATION OF THE SMALL AND LARGE INTESTINES

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ABSTRACT

In this study, We will develop a self-propelled mechanism for capsule endoscope. Malignant neoplasm is the most common cause of death in Japan. In particular, malignant neoplasms occurring in the large intestine tend to increase year by year. In recent years, capsule endoscopy has been used for the purpose of minimally invasive examinations for patients. However, because capsule endoscopy moves only by the peristaltic movement of the intestine, it is easy to overlook lesions.

In this study, we proposed a new self-propelled mechanism that can move forward, backward, left and right even from the outside with the aim of reducing the oversight of lesions in capsule endoscopy. In addition, we aimed at a mechanism that can simultaneously examine the small and large intestines even when the suspected area is unclear.

In this study, we will develop a self-propelled mechanism to be installed in a capsule endoscope, assuming that real-time examination is possible using an external magnetic field. Specifically, we changed the shape from a capsule to a sphere, and designed it with a double structure. A ball caster is used between the two layers to prevent the inner mechanism from rotating, reducing rolling friction to the utmost. In the self-propelled principle, a magnetic field is applied to a magnet mounted on the inner mechanism, and the force that collides with the inside of the capsule is transmitted to the outer mechanism that contacts the intestinal wall, causing the capsule to roll and propel itself.

In order to confirm the operation of the newly proposed capsule endoscope, we created a simple function tester and conducted verification experiments. In the experiment, we evaluated the posture maintenance and propulsion principle using slow-motion videos. From the results, it was possible to reproduce the proposed operation. In addition, the collision force required for propulsion was derived by simulating the time relationship between the propulsion distance from swallowing to ejection. From the result, it was possible to estimate that the propulsion within the target time was possible.

As a result of this research, it is possible to move left and right in addition to front and back, which is expected to improve the observation range of examinations. It is believed that this study has reduced the number of lesions overlooked and enabled examination of the small and large intestines at the same time.