



كلية المستقبل الجامعة
قسم الفيزياء الطبية
المرحلة الثانية

Medical Physics

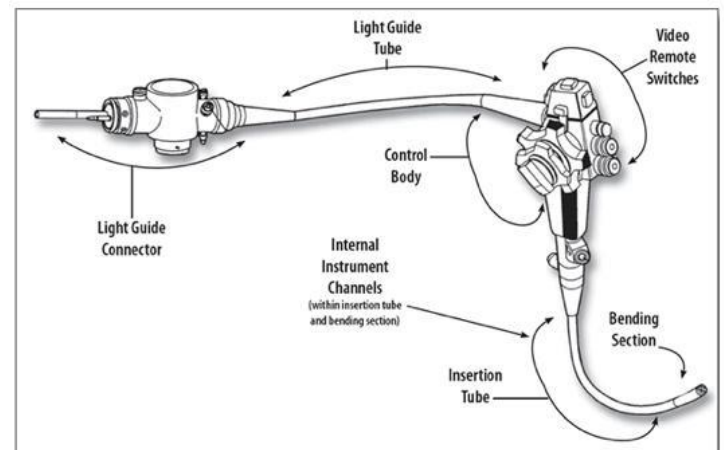
Optics

Lecture Three

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Components of Endoscopy Device:

- 1- A thin, long flexible tube .
- 2- A lens or lens system .
- 3- A light transmitting system (Optical Fiber) .
- 4- The eyepiece .
- 5- Control system .



How Dose Endoscopy Device Work:

Basically, a typical endoscope uses fiber optics, which allow for effective transmitting of light. In this technique (fiber optics) light is transmitted through a flexible fiber of glass (transparent) known as optical fiber .

The optical fiber allows for light to travel through curved paths, which makes one of the best systems to view spaces that would normally be difficult to reach.

Here, total internal reflection makes it possible for light to travel along the fibers with the light rays hitting the fiber walls at an angle (minimum angle of 82 degree) .

Given that individual fibers can be thinner than human hair, fiber optics is one of the best techniques to enter and view different areas of the body.



Endoscopy examination preparations:

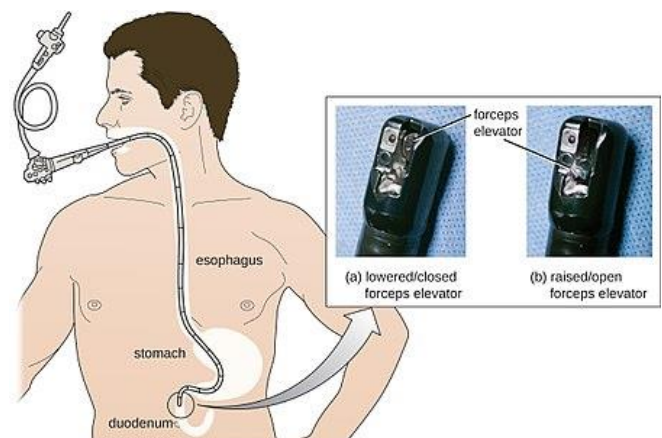
- 1- The procedure does not require an overnight stay in the hospital and usually only takes around 1 hour to complete. The doctor will provide instructions about the preparation for the procedure .
- 2- For many types of endoscopy, the individual needs to fast for around 12 hours, though this varies based on the type .
- 3- For procedures investigating the gut, laxatives may be taken the night before to clear the system .
- 4- A doctor will carry out an examination before the endoscopy. It is important to mention all current medications (including supplements) and any previous procedures .

Main Reasons For Carrying Out An Endoscopy :

Investigation: If an individual is experiencing vomiting, abdominal pain, breathing disorders, stomach ulcers, difficulty swallowing, or gastrointestinal bleeding, for example an endoscope can be used to search for a cause .

Confirmation of a diagnosis: Endoscopy can be used to carry out a biopsy to confirm a diagnosis of cancer or other diseases .

Treatment: An endoscope can be used to treat an illness directly; for instance, endoscopy can be used to cauterize (seal using heat) a bleeding vessel or remove a polyp .



Benefits of Endoscopy :

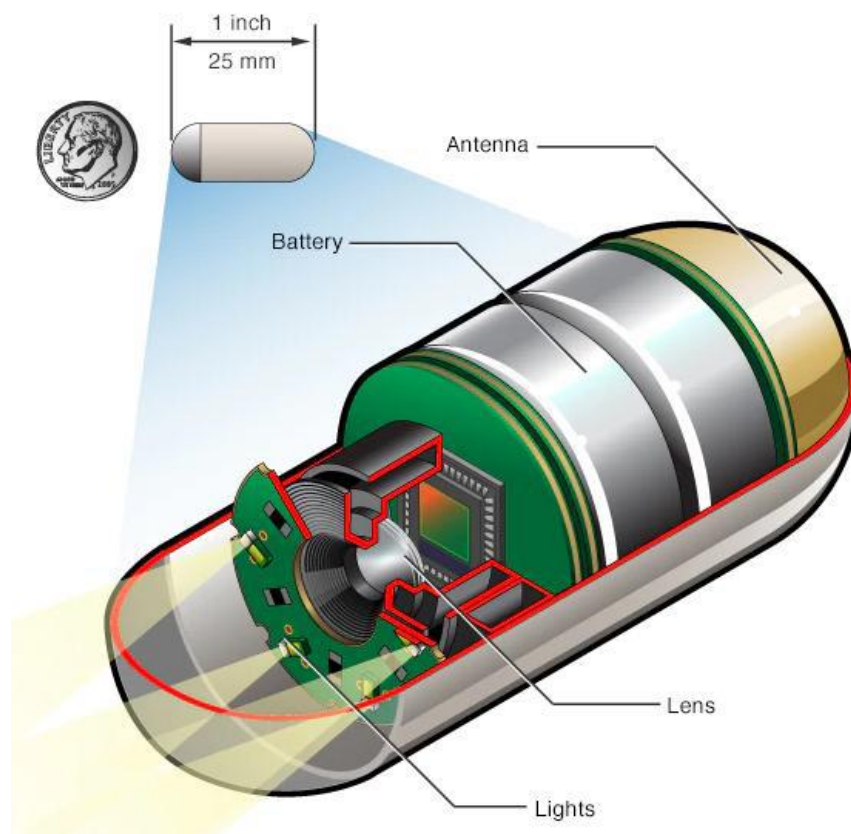
- 1- No prior preparations required of patient .
- 2- Laparoscopic surgery requires only a small incision through which a diagnosis or surgery can be made .
- 3- Using this technique, patients lose less blood during and after surgery and can recover much faster compared with standard surgical procedures.

Risks of Endoscopy :

- 1- Over-sedation, although sedation is not always necessary .
- 2- Feeling bloated for a short time after the procedure .
- 3- Mild cramping .
- 4- A numb throat for a few hours due to the use of local anesthetic .
- 5- Persistent pain in the area of the endoscopy .

Capsule Endoscopy Device :

It is the most important type of endoscopy , Capsule endoscopy was developed in the mid-1990s and involves a wireless camera. The camera is small enough to fit into a capsule (roughly the size of a vitamin tablet) and can, therefore, be swallowed .



As the capsule travels through the digestive tract, it takes thousands of pictures, which are transmitted to a device attached to a wearable belt

Capsule endoscopy is used to image the small intestine, a region that is difficult to image using standard endoscopy. It is also very useful for examining the small intestinal mucosa and diagnosing Crohn's disease. The capsule usually passes through the digestive system within 24-48 hours.



This is a relatively new technique and was given FDA approval for use in the United States in 2001. To date, more than 500,000 capsule endoscopy procedures have been carried out, and nearly 1,000 articles have been published covering its clinical use .

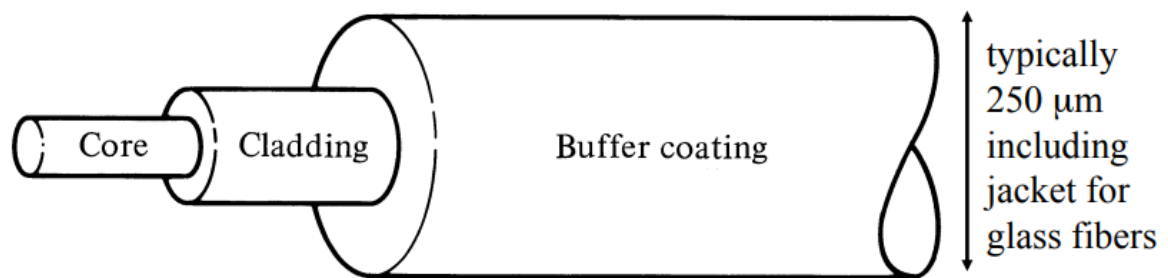


Optical Fiber Structure :

A typical optical fiber consists of a core, a cladding, and a polymer jacket (buffer coating) .

The polymer coating is the first line of mechanical protection

The coating also reduces the internal reflection at the cladding, so light is only guided by the core .



Principle of operation :

- 1- An optical fiber is a cylindrical dielectric waveguide (non conducting waveguide) .
- 2- Optical fiber transmits light along its axis through the process of total internal reflection .
- 3- The fiber consists of a core surrounded by a cladding layer, both of which are made of dielectric materials, to confine the optical signal in the core .
- 4- The refractive index of the core must be greater than that of the cladding .
- 5- Light can be fed into optical fibers using lasers or LEDs .