Ultra-Slim Configuration Advances Upper Endoscopy and Colonoscopy

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Introduction

Upper endoscopy and colonoscopy permit the direct evaluation of the mucosal surface of the gastrointestinal (GI) tract and the effective treatment of many conditions that were previously only treated by surgery. However, patient discomfort and longer procedure duration can increase the probability for complications and make it less likely that the procedure’s goals will be met. Additionally, the formation of loops during the procedure, redundant colons, difficult or complex flexures, and the presence of strictures are all factors associated with increased patient discomfort.

Innovations in endoscopy equipment hold the potential to improve the experience for the patient and physician, and to extend what is clinically feasible using an endoscopic approach. A new generation of ultra-slim endoscopes from the Olympus EVIS EXERA III platform advances visualization, scope maneuverability, and workflow. The new instruments are appropriate for any patient, but may especially benefit patients with altered anatomy, diverticular disease, or strictures.

Common Procedures, Common Challenges

In esophagogastroduodenoscopy (EGD), reducing endoscope diameter addresses 2 specific needs. First, strictures or lesions may prevent the endoscope from reaching the intended location. Second, transnasal EGD (TN-EGD) requires a scope with a diameter less than 6 mm. Therefore, reducing scope diameter may influence utility, and in some conditions equipment traits can make the difference between a successful procedure and failure to obtain a specimen or relieve a stricture. In the United States, EGD is typically performed by mouth in patients under conscious or moderate sedation. However, slimmer scopes may reduce or eliminate the need for anesthesia during procedures. Direct comparison of unsedated TN-EGD and sedated or unsedated transoral EGD (TO-EGD) demonstrated a lower rate of gag reflex and smaller changes in arterial oxygen saturation and pulse rate in patients who underwent TN-EGD. Overall, TN-EGD is a more comfortable and tolerable procedure for the patient and may result in a safer and more useful examination. Additionally, unsedated upper endoscopy reduces sedation costs and can increase patient satisfaction.

Colonoscopy also presents challenges related to equipment size and capability. In many cases, obtaining a complete colonoscopy, extending to the cecum, may be difficult. Altered anatomy as a result of colorectal cancer, diverticula, prior surgery, or inflammatory bowel disease is associated with incomplete procedures. Strictures, lesions, and inflamed tissue create narrowing and may prevent passage of a standard-sized endoscope. In situations where conventional colonoscopes are too large, some endoscopists use pediatric instruments or other endoscopes, although these instruments may be too short or floppy to reach the cecum. In addition to anatomic impediments, endoscope looping may occur during colonoscopy. Looping deforms the wall of the colon, causing pain to the patient, and can result in loss of control of the endoscope and perforation of the colon. The primary challenge of colonoscopy derives from the necessity of pushing the endoscope through the colon, which is too flaccid to resist or redirect the force. Carefully chosen scope maneuvers, including pulling back as needed and reducing bends in the scope as they occur, decrease colon stretching and reduce procedural pain. However, endoscopists are often unaware of loops forming and subsequent perforation of the colon. Direct visualization of the endoscope during the procedure improves loop detection and resolution.

Advances in Scope Technology

The newest-generation colonoscope (PCF-PH190L/I) and upper endoscope (GIF-XP190N) employ innovations in 3 areas: physical dimensions, angulation range and bending design, and optical system. The slim diameter of the colonoscope (9.5 mm) makes insertion easier under all conditions, but is especially valuable for difficult
cases of stricture or lumen narrowing. The ultra-slim gastroscope is suitable for TN-EGD, with a distal end outer diameter of 5.4 mm and an insertion tube diameter of 5.8 mm (Figure 1).\textsuperscript{4,11} In addition, this is the first ultra-slim gastroscope with electrosurgery compatibility from Olympus.\textsuperscript{11} The colonoscope and gastroscope have working channels of 3.2 and 2.2 mm, respectively.\textsuperscript{10,11} Therefore, although the scopes are ultra-slim, they have ample working channels, allowing for increased suction volume and a greater variety of device selection.

The optical system of the Olympus Ultra-Slim EVIS EXERA III scopes has 3 new features that enhance performance: 2 light guides that increase brightness and reduce device-use shadows, increased viewing angle (140 degrees for both the gastroscope and ultra-slim colonoscope), and narrow band imaging (NBI) capability.\textsuperscript{10–12} NBI uses wavelengths in the blue-green range to visualize tissue and enhance mucosal and vascular pattern observation.\textsuperscript{13} The EVIS EXERA III colonoscope features 2 distinct insertion tube technologies that together constitute Olympus’ proprietary Responsive Insertion Technology: High Force Transmission and Passive Bending (Figure 2).\textsuperscript{12} Physicians move endoscopes through the colon by pushing, pulling, and applying torques. High Force Transmission transfers physician-applied forces in a 1:1 ratio with a minimum loss of force. High Force Transmission is beneficial in situations where the colon has many bends or where loops have formed in the endoscope, and allows operators to use less force, reducing physician effort and stress.\textsuperscript{14} Physician fatigue has been identified as a potentially significant variable in adenoma detection.\textsuperscript{15} Additionally, Passive Bending helps move scopes through flexures more easily. The Passive Bending segment is located behind the tip and active bending segment of the instrument. When the scope contacts the colon wall, the Passive Bending segment senses the change in pressure and bends in the direction of the lumen, creating a gentle curve that allows the scope to slide forward around flexures. ScopeGuide reveals endoscope

### Table. Features of Olympus Ultra-Slim EVIS EXERA III Colonoscope And Upper Endoscope

<table>
<thead>
<tr>
<th>Feature</th>
<th>Colonovideoscope (PCF-PH190L/I)</th>
<th>Gastrointestinal Videoscope (GIF-XP190N)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Physical dimensions, mm</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Distal end outer diameter</td>
<td>9.7</td>
<td>5.4</td>
</tr>
<tr>
<td>Insertion tube outer diameter</td>
<td>9.5</td>
<td>5.8</td>
</tr>
<tr>
<td>Working length</td>
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<td>1,100</td>
</tr>
<tr>
<td>Channel inner diameter</td>
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<td>2.2</td>
</tr>
<tr>
<td>Optical system</td>
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<td></td>
</tr>
<tr>
<td>Narrow band imaging</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Enhanced image quality</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Field of view, degrees</td>
<td>140</td>
<td>140</td>
</tr>
<tr>
<td>Brightness</td>
<td>2 light guide lenses</td>
<td>2 light guide lenses</td>
</tr>
<tr>
<td>Angulation range, bending section, degrees</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Up</td>
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<td>210</td>
</tr>
<tr>
<td>Down</td>
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<tr>
<td>Right</td>
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</tr>
<tr>
<td>Left</td>
<td>160</td>
<td>100</td>
</tr>
</tbody>
</table>

Adapted from references 11 and 12.

*Figure 1.* Olympus GIF-XP190N EVIS EXERA III gastrointestinal videoscope.

Image courtesy of Olympus.
position in real time and alongside the endoscopic view on the same monitor. The real-time image of the insertion tube shows the location and shape of the instrument. Loops can be identified as they form, and a hand coil allows the precise location of the scope to be identified for applying hand pressure accurately and effectively. ScopeGuide can be enabled with the PCF-PH190L/I colonoscope through the use of the MAJ-1878 ScopeGuide probe passed through the instrument channel.

**Keys to Success in the Clinic**

**Ultra-Slim Advantages in Upper Endoscopy**

Sedation requirements are typically reduced when using the slimmer scope for TN-EGD instead of TO-EGD, benefiting the patient and reducing the likelihood of complications. Reduced use of anesthesia also may shorten the procedure time. Kadayifci and colleagues performed a prospective, randomized clinical study in 100 patients scheduled for upper endoscopy to investigate the potential of minimal sedation in this procedure. All patients had undergone an unsedated TO-EGD within the past 12 months. Half of these patients underwent unsedated TO-EGD using a traditional endoscope and the other half underwent unsedated TN-EGD using an ultra-slim scope. The investigators found that 82% of patients reported the TN-EGD procedure to be much more tolerable than their previous TO-EGD endoscopy.7

Furthermore, Kawai and colleagues used an ultra-slim transnasal scope to compare the diagnostic performance of conventional white light endoscopy (WLE) with NBI in the detection of esophageal lesions. All 105 patients included in the study underwent TN-EGD and were examined using WLE, NBI, and Lugol staining. Results showed that NBI had almost 100% detection of squamous cell carcinoma and noninvasive high-grade intraepithelial neoplasia. However, WLE only detected 66.7% of squamous cell carcinomas. The investigators concluded that the use of NBI in TN-EGD is useful for differentiating between inflammatory lesions and the early stage of esophageal cancer.18

**Advantages in Colonoscopy**

Studies have demonstrated the advantages of using advanced technology scopes in colonoscopy as well. For instance, Rastogi and colleagues investigated cecal intubation times with the use of scopes incorporating both Passive Bending and High Force Transmission technologies. Using a post hoc analysis of 2 prospective trials including 1,077 patients, the investigators found that mean cecal intubation times were significantly shorter when using instruments with Passive Bending and High Force Transmission technologies than without \((P=0.005)\). The investigators suggest that by reducing intubation times, clinician fatigue and patient discomfort also may be reduced during the insertion phase of colonoscopy.19

**Conclusion**

Clear observation of the GI tract is an absolute requirement for disease surveillance and treatment; innovations in endoscopy...
equipment aid physicians in providing optimal care to patients with minimal patient discomfort. The optical system of EVIS EXERA III provides greater brightness, increased viewing angle, and push-button availability of NBI. The slimmer profile of both gastroscope and colonoscope, combined with an ample working channel, supports TN-EGD for upper endoscopy patients and permits mobility around strictures and inflamed areas of the GI tract. Electrosurgery functionality supports therapy. Finally, the greater ease of use of the instruments, due to proprietary Responsive Insertion Technology, aids insertion and completion of procedures and protects physicians with high-volume practices. Added value is derived from the possibility of reduced use of anesthesia during procedures, which may lower the risk for complications, reduce sedation costs, and improve patient satisfaction.20,21

References


Disclosures: Dr. Jang reported no conflicts of interest. Dr. Samarasena reported that he has served as a consultant for Pentax Medical Company and received honoraria from Covidien, Ltd. and Mauna Kea Technologies, S.A.

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