VIDEO CASE REPORT

Novel articulating through-the-scope traction device

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INTRODUCTION

Endoscopic submucosal dissection (ESD) has become a standard approach for treating superficial GI neoplasia, but its adoption remains limited because of its steep learning curve and extensive resource utilization when performed by endoscopists in the earlier stages of the ESD learning curve.[1,2] Furthermore, although traction strategy has emerged to improve clinical outcomes and increase procedural efficiency, current techniques and devices own inherent limitations such as technical complexity, lack of adjustability, or demanding preparation.[3,4] Recently, a single-operator, through-the-scope, articulating traction device was developed (TracMotion, Fujifilm Endoscopy, Tokyo, Japan) to enable an effective traction strategy. Here in this video, we present the application of this device and demonstrate its utility in upper and lower ESD.

OVERVIEW OF THE DEVICE

The traction device consists of 2 interconnected parts: a scope-mounted hand controller and an actuating distal end (Fig. 1). The distal end is equipped with an articulating and rotatable grasper. The combined maneuvering capabilities of articulation and rotation allow 5 degrees of freedom to the device with extension and flexion, clockwise and counterclockwise rotation, advancement, and retraction (Fig. 2). The device is compatible with the 3.7-mm instrument channels, which corresponds to the larger channel of a double-channel endoscope. The hand controller is mounted on the biopsy port with an adaptor. Functioning parts of the controller are the distal pivotable shaft and the thumb handle. The endoscopist operates the controller with the right hand with movements mirroring the maneuvers of the distal end: rotation and advancement are performed by analogous movements of the pivotable shaft while grasping, locking, and flexion are performed by gripping the thumb handle.

CASE PRESENTATIONS

The first case is a 68-year-old woman with a family history of gastric cancer and previous gastric intestinal metaplasia who was found to have a flat lesion in the gastric antrum during a surveillance endoscopy at an outside hospital. Biopsy from the lesion revealed low-grade dysplasia. The upper endoscopy at our center showed a 1-cm Paris IIa lesion with irregular vascular and surface patterns under magnifying image-enhanced endoscopy. Although the lesion was also suitable for EMR, the decision was made to proceed with ESD to obtain an en bloc specimen with a higher chance of R0 resection (Fig. 3). The procedure was performed with the patient under general anesthesia. A double-channel upper endoscope (EI 740-D/S, Fujifilm), an electrosurgical generator (VIO 300D; ERBE, Tubingen,

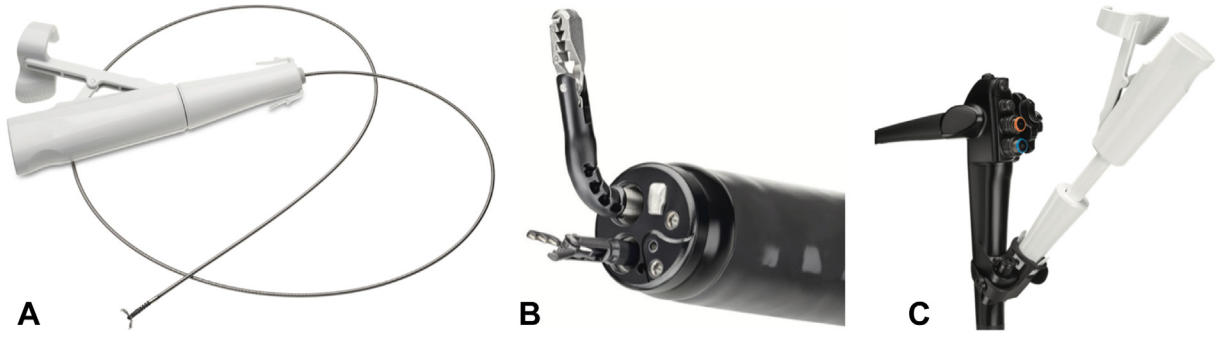

Figure 1. Overview of the traction device. **A,** Device consists of 2 parts, hand controller and distal articulating arm and jaw, which are connected by a cable. **B,** Distal arm has an articulating and rotatable grasper. **C,** The device is inserted through the 3.7-mm instrument channel, and the hand controller is mounted on the biopsy port.

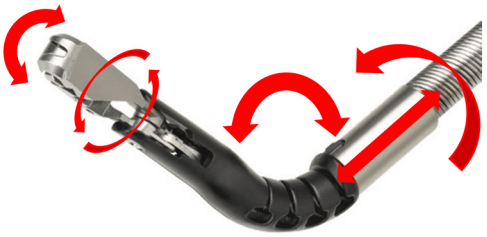

Figure 2. Movements of the articulating arm and rotatable grasper: gripping and rotation of the grasper, flexion, rotation, and advancement of the articulating arm.

Germany), a 2-mm injectable needle-knife (ORISE ProKnife; Boston Scientific, Marlborough, Mass, USA), and a 3.5-mm scissor-knife (Clutch Cutter, Fujifilm) were used for the procedure. First, the borders of the lesion were demarcated with the closed needle-knife under the soft coagulation mode. Then, a submucosal injection was performed with a 6% hetastarch, indigo carmine, and diluted epinephrine solution. This was followed by a circumferential mucosal incision around the lesion with the needle-knife. Then, the endoscope was withdrawn, and a double-channel endoscope with the traction device was introduced. The proximal edge of the mucosal flap was grasped by the rotatable grasper, and the articulating arm was lifted upward and rotated clockwise to apply the traction to the dissection plane. The dissection was performed from proximal to distal fashion using a scissors-type ESD knife. While the dissection plane was being extended, traction force was adjusted to better expose the submucosal tissue by reorienting the articulating arm. The complete en bloc resection was achieved in 13 minutes. An average time for removing similar lesions in our center with traditional ESD is approximately 30 minutes, similar to what is reported in the existing literature.[5] The traction device was also used to retrieve the specimen without requiring an additional tool. The specimen measured approximately 2 × 2 cm. The patient was discharged on the same day, and no antibiotics were given. Histologic examination of the samples revealed low-grade dysplasia with foci of high-grade dysplasia. The patient did well with no adverse events and was discharged on the same day.

The second case is a 57-year-old man who was found to have a large lesion in the rectosigmoid colon during his first screening colonoscopy. The colonoscopy at our center revealed a 5-cm laterally spreading tumor granular-type lesion with a type 2A pattern per the narrow-band imaging classification.[6] Therefore, the decision was made to proceed with ESD (Fig. 4). The procedure was performed with the patient under general anesthesia without antibiotic prophylaxis. First, a circumferential mucosal incision was completed using a 1.5-mm needle-knife (ORISE ProKnife,

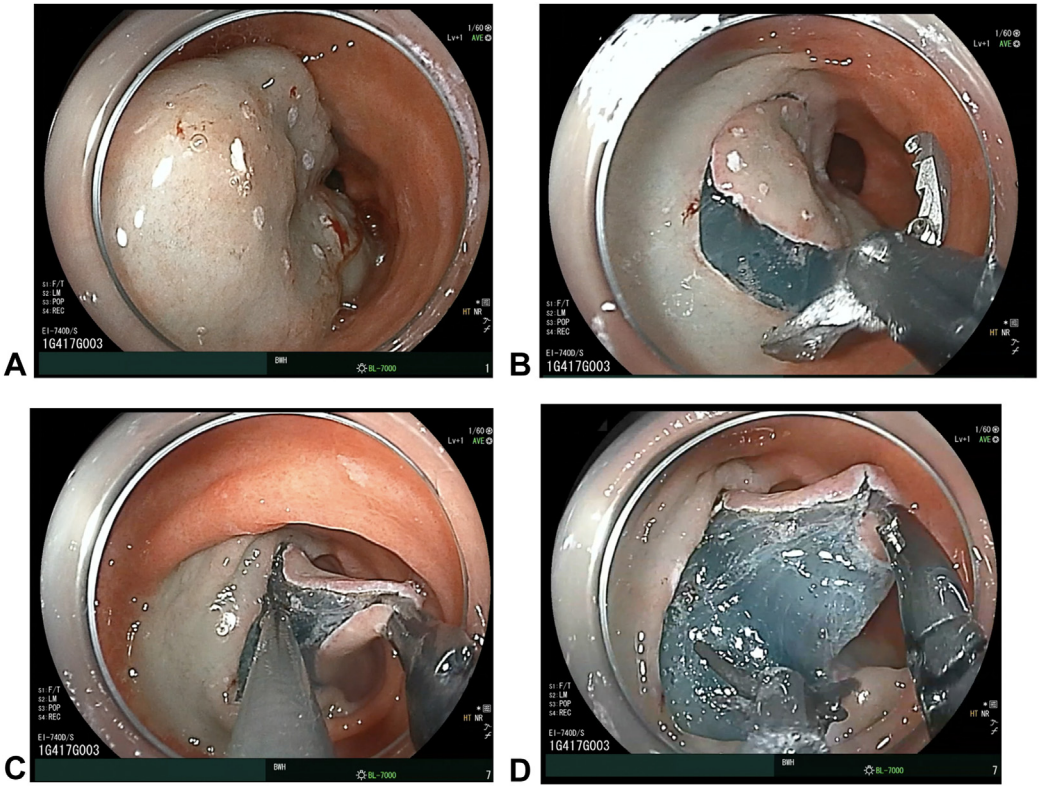

Figure 3. Summary of the first case. **A,** A 10-mm Paris IIa lesion in the antrum. **B,** A traction device was introduced after marking, submucosal injection, and mucosal incision steps. **C,** The mucosal flap was grasped by the jaws, and dissection was started with a scissor knife. **D** and **E,** Excellent exposure was obtained with dynamic modification of traction with flexion-extension and rotation movements. **F,** Final defect after completion of dissection.

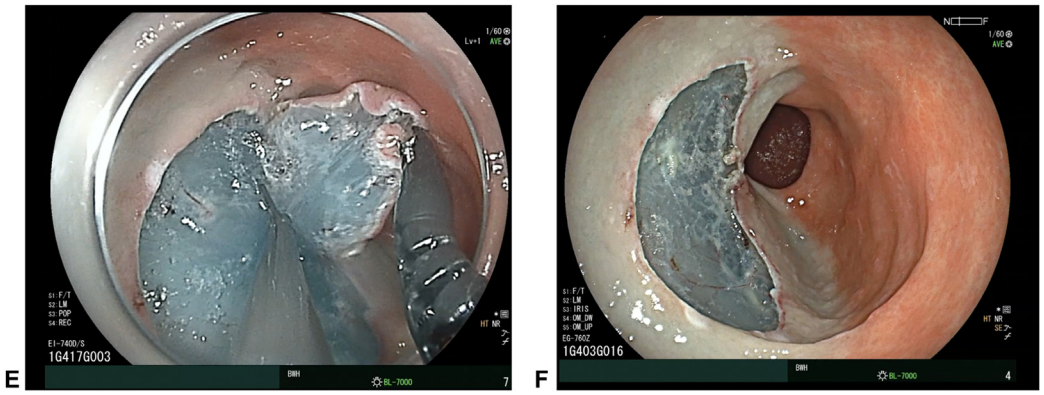

Figure 3. (Continued).

Boston Scientific). A scissors-type knife was used to perform submucosal dissection. During the dissection, repeated repositioning of the traction point was performed by releasing the mucosal flap from the initial traction point and regrasping another site of the lesion because of the lesion size. The regrasping maneuvers allowed a direct view of the submucosal dissection plane, and complete en bloc resection was achieved in 15 minutes. A small superficial thermal muscle injury was encountered without requiring a closure. An estimated procedure time for the removal of similar lesions with the traditional ESD technique is approximately 60 minutes in our center, comparable to the previously reported procedure times.[7] The patient was discharged on the same day with no adverse events. The final specimen measured approximately 5 × 4 cm, and histologic examination revealed tubulovillous adenoma with foci of high-grade dysplasia.

DISCUSSION

As demonstrated in these cases, the major advantage of the device is its maneuverability enabling the application of the traction force from diverse angles. In addition, with the instant grasping and regrasping ability, the traction can be easily applied at the different sites of the lesion throughout the procedure. The intuitive control of the handle makes the device user-friendly. The single-operator capability also allows an independent, precise, dynamic, and rapid control of the device by the endoscopist. As the device can be introduced through the scope's working channel without requiring an additional sheath or a cable, it preserves the maneuverability of the endoscope. However, several drawbacks of the device should also be noted. The device can only be used through the larger channel of double-channel endoscopes; therefore, it can only be introduced at the 5 o'clock position on the screen, which might limit the direction of the traction force. The device can be used in a retroflex position; however, because of the upward and left-to-right direction of traction with this device, the scope needs to be rotated to reposition the lesions at the 6 o'clock position for any lesions located at 12 to 3 o'clock on the screen. The device cannot be used in the proximal colon because of the inability to reach the area, and a separate high-definition endoscope is required to perform a pre-ESD evaluation with image-enhanced endoscopy. As the device is compatible with only a double-channel endoscope with a limited length and requires a separate working channel, further iterations might be required to allow its use with single-channel endoscopes and colonoscopes.

After grasping the tissue, the dissection is performed in a fixed position under a distance view with small maneuvers of the scope. When the dissection plane is beyond the reach of this fixed position, the scope or the device needs to be repositioned. The procedures need to be performed under a distant view because of the large working space needed for the traction device. Also, at that distance, small movements of the scope translate into bigger movements on the lesion. This might lead to unrefined movements during the early learning curve. Moreover, for lesions with fibrosis or at difficult locations, incomplete visualization of the vessels and muscle layer might increase the risk of bleeding, muscle injury, or perforation. The device can be used with different types of knives. We prefer a scissor knife as it allows a safer dissection from a distance and prophylactic precoagulation. Another potential drawback of the device is the difficulty of dynamically maneuvering the distal arm in the narrow lumen, such as the esophagus or the duodenum.

CONCLUSION

Refinement of the ESD technique with the use of endoscopic tools is a feasible strategy to increase its utilization. This novel traction device can potentially improve

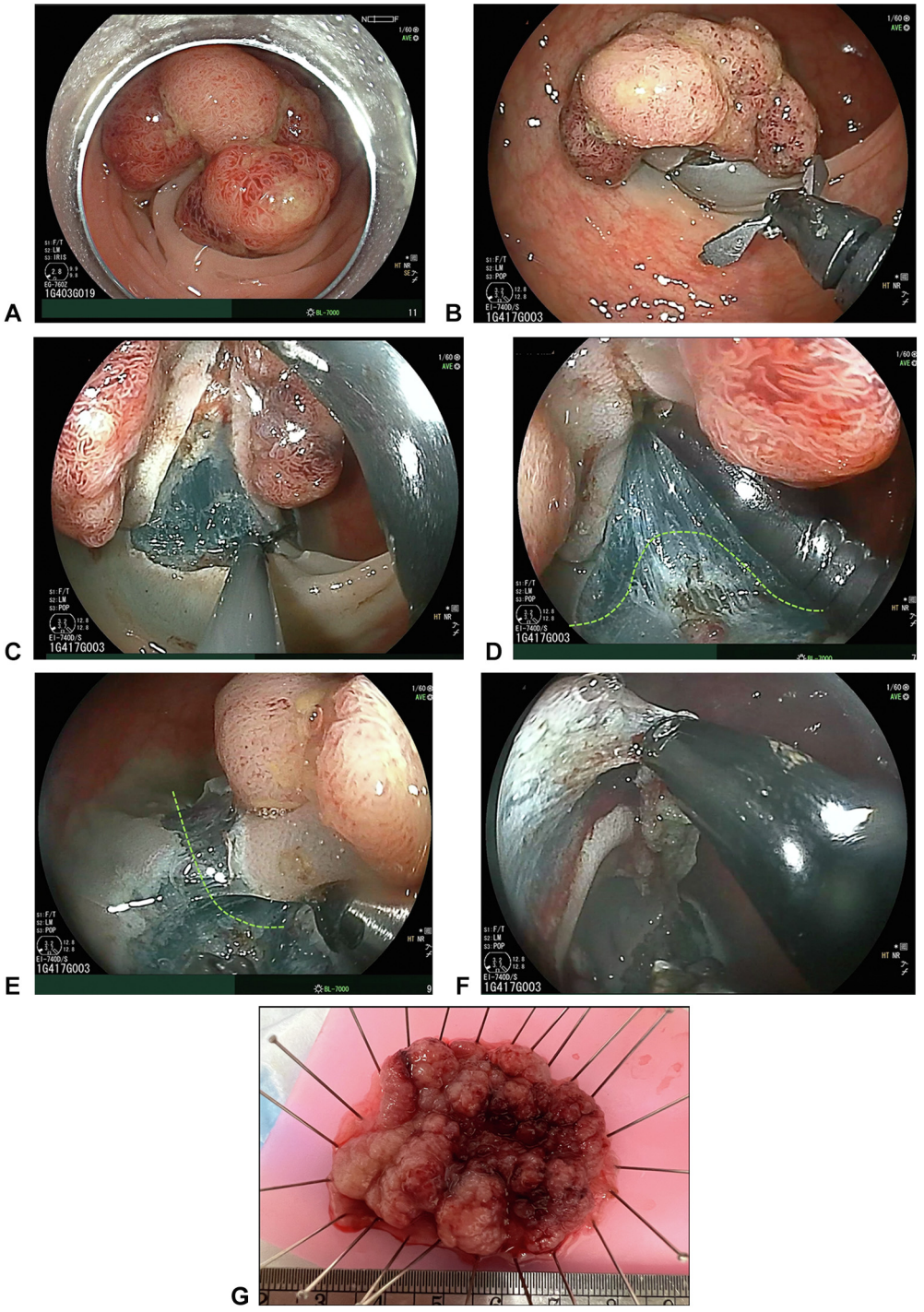

Figure 4. Summary of the second case. **A,** A 5-cm, laterally spreading granular tumor lesion in the rectosigmoid colon. **B,** The traction device was introduced after completion of the mucosal incision. **C,** Dissection was started from the distal end using a scissor knife. **D,** The lesion was regrasped at a different area of the mucosal flap to obtain better exposure. With increased traction force, tenting of the muscle deserves attention to prevent injury. **E,** Dynamic modification of traction with flexion-extension and rotation movements. **F,** A second regrasping maneuver from the proximal side. **G,** Specimen measuring 5 × 4 cm.

complete and negative margin resection rates and prevent complications. Despite the success in these cases, studies with endoscopists with different experience levels in ESD and comparisons to other traction devices and techniques should be performed (Video 1, available online at www.giejournal.org).

DISCLOSURES

Dr Thompson is a consultant for and receives research support from Apollo Endosurgery, GI Dynamics, Olympus America, and USGI Medical; is consultant for Boston Scientific, Medtronic, and Fractyl; and receives research support from Aspire Bariatric. Dr Aihara is a consultant for Olympus America, Fujifilm Medical Systems, Boston Scientific, ConMed, Medtronic, and 3D-Matrix. All other authors disclosed no financial relationships.

Abbreviation: ESD, endoscopic submucosal dissection.

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