In recent years, the use of novel endoscopic approaches in the treatment of refractory intractable diseases has evolved substantially. Originally, the role of endoscopy was to diagnose gastrointestinal disease and treat the confirmed disease including cancer. However, recent advancements trends in endoscopic treatment allow for the diagnosis of unsolved gastrointestinal diseases, as well as conditions associated with metabolic syndrome, including obesity and hyperlipidemia. Currently, the majority of endoscopy-related devices for metabolic obesity disease are developed in Western countries, where the prevalence and interest of metabolic obesity disease is high. However, in Asia, there has been a rapid increase in the prevalence of obesity, cardiovascular disease, and gastrointestinal disease (including colon cancer and gastroesophageal reflux disease) in recent years. Therefore, the development of novel endoscopic technology has received increased attention in Asia. This report discusses the novel endoluminal and transgastric technologies currently available in Asia and the future of these devices.

Obesity and its associated conditions including cardiovascular disease and type 2 diabetes mellitus are severe medical problems that are increasing in prevalence worldwide, and they result in significant expenses to healthcare systems. The prevalence of obesity in Asian countries has increased substantially over the last decade.1 While behavioral and pharmacological treatment approaches are partly effective in the short-term, their effects are not long-lasting. Although previous studies have described bariatric surgery as the most effective treatment for metabolic obesity disease, it has been found to be associated with morbidity, mortality, and economic burden.2,3 Endoluminal interventions performed entirely by using gastrointestinal flexible endoscopy offer an alternative approach to the treatment of obesity that is safer and more cost-effective than current surgical approaches.4 The use of endoluminal techniques in the field of metabolic obesity disease has several promising applications, such as endoscopic gastroplasty, intragastric balloon, endoluminal malabsorptive bariatric procedures, and gastric electrical stimulation for modulation of gastric emptying.

Endoluminal gastroplasty involves a reduction of gastric volume through the creation of a mucosa-to-mucosa tissue apposition or making a sleeve gastro mucosa-to-mucosa apposition or making a stomach sleeve similar to surgical sleeve gastrectomy. Endoscopic gastroplasty uses natural orifice transluminal endoscopic surgery (NOTES) to reduce or eliminate the trauma of access incisions. The crucial device used during NOTES (including endoluminal gastroplasty) is the endoscopic suture device. The currently available endoscopic suturing devices for human and animal studies are as following: EndoCinch™ (C.R. Bard Inc., Murray Hill, NJ,
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USA), TOGA system (Satiety Inc., Palo Alto, CA, USA), Esophyx (Boston Scientific Corp., Natick, MA, USA), KUMC Successive Suturing Device (Korea University, Chun HJ, Seoul, Korea), overstitch endoscopic suturing system (Apollo Endosurgery, Austin, TX, USA), G Prox (USGI Medical, San Clemente, CA, USA), NDO plicator (NDO Surgical, Mansfield, MA, USA), T-anchors (Ethicon Endo Surgery, Cinncinati, OH, USA), Loop T-anchors (Cook Endoscopy, USA), OTSCs (Aponos, Kingston, NH, USA), Double-arm-bar suturing system (Hirohito Mori, Zeon Medical Co., Tokyo, Japan).5-8 However, each of these devices has several weaknesses including safety, interrupted suture, complicated installation, time consuming, and difficulty of endoscopic approach to upper gastric lesion. BaroSense (Redwood City, CA, USA) has developed the Trans-oral Endoscopic Restrictive Implant System™ (TERIS), but there is limited data on use in humans and long term efficacy.4

Intragastric balloons were developed to treat obesity by filling the stomach to induce early satiety. This technique was introduced 30 years ago, but had to be abandoned owing to adverse events and balloon deflation. However, several intragastric balloons were commercialized after several upgraded products were developed. The balloon of BioEnterics (Inamed Corporation, Arklow, Country Wicklow, Ireland and Bioenterics Corporation, Carpentry, Allergan Inc., Irvine, CA, USA) has been used for long time for weight loss and is still used today.9 It consists of a silicone balloon resistant to gastric acid and a radiopaque self-sealing valve, and it is filled with isotonic saline and methylene blue. In recent years, several other balloon devices for weight loss have been developed such as the Bioenterics Consecutive Balloon (Bioenterics Corporation, Carpentry, Allergan Inc., Irvine, CA, USA), the Ullorex oral Intragastric Balloon (Obalon Therapeutics, Inc., San Diego, CA, USA/ Phagia Technologies, Inc., USA),11 the BaroNova polymer pill (BaroNova Therapeutics Inc., Foster City, CA, USA), the Spatz Adjustable Intragastric Balloon (SpatzGFAR, Inc., NY, USA),12 the Heliosphere Bag (Helioscopie Medical Implants, Vienna, France),13 the pear-shaped Semistationary Antral Balloon (JP Industria Farmacéutica S.A., Brazil), the Silimed Gastric Balloon (Slimed Brazil), and the Endogast-ATIIP (Adjustable Totally Implantable Intragastric Prosthesis, Districlass Medical S.A., France).2,14 However, these balloon devices also have several limitations including migration, balloon rupture, gastric erosion, ulcers, perforation, technical problems, and clinical intolerance.

Another endoscopic procedure for the treatment of metabolic obesity disease involves malabsorption techniques. The endoluminal malabsorptive device was designed to make an endoscopic duodenal-jejunal bypass, allowing for weight loss and control over diabetes mellitus.15,16 The first endoscopic malabsorptive product was the Endobarrier (GI Dynamics, Inc., Watertown, MA, USA), which is an intraluminal tube-shaped liner, anchored in the bulb as a self-expanding metallic stent and located inside the duodenum to proximal jejunum (60 cm). The ValenTx device (ValenTx Inc., Carpinteria, CA, USA) is a 120-cm long endoscopic gastro-duodenal-jejunal sleeve that combines both gastric restriction and malabsorption techniques. The other endoluminal mechanical device—the SatiSphere (Endosphere Inc., Columbus, OH, USA)—is also implanted into the stomach and duodenum, and it has shown short-term effectiveness in the treatment of metabolic obesity disease.17

The implantable gastric electrical stimulation devices generate electrical pulses via bipolar leads in the muscular layer of the gastric wall. The generator is positioned subcutaneously along the abdominal wall. This gastric electrical stimulation was mainly used as a treatment for gastroparesis unresponsive to medical treatment, under the approval of the Food and Drug Administration. Various devices have been developed and studied for not only several gastrointestinal disease but also for metabolic obesity disease, such as the Enterra/Transcend Implantable Gastric Stimulator (Transneuronix Inc. and Enterra Therapy system, Medtronic, Minneapolis,
MN, USA), the Endostim (EndoStim BV, The Hague, Netherlands), the Intrapace Abiliti Gastric Stimulator (Menlo Park, CA, USA), and the Diamond/Tantalus II system (Metacure, Kfar-Saba, Israel). However, the limitations of these devices include lead dislodgement, a lack of long-term effect, and surgical risk. The placement of a permanent gastric electrical stimulation device currently requires surgery and considerable cost. More importantly, this method of therapy may not be effective for all patients. Recent endoscopic installation trials of gastric electrical stimulation devices have shown minimal effectiveness.

The recent advancement in endoluminal technology for the treatment of obesity and refractory gastrointestinal diseases is promising. The development of new endoscopic techniques and improvement of existing designs, allow the endoscopist to play an increasingly important role in the treatment of obesity. There will be particular interest in reversible approaches that do not commit the patient to permanent surgical modification of the gastrointestinal tract. In addition, there is hope that continued technological advancement would lead to an effective, easily deployed therapy to help the millions of people worldwide who suffer from refractory gastrointestinal disease and severe metabolic obesity disease. Each device will need to be carefully assessed through clinical trials to determine their safety, efficacy, and durability. Future research will allow for widespread clinical use of these devices.

References


