# Gastrointestinal electrical stimulation for obesity

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Policy contains: Enterra, gastrointestinal electrical stimulation, obesity

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## Coverage policy

Gastrointestinal electrical stimulation, also known as gastric pacemaker, for obesity, is investigational/not clinically proven and, therefore, not medically necessary.

Limitations

No limitations were identified during the writing of this policy.

Alternative covered services

- Bariatric surgery.
- Medications for appetite control.

## Background

Obesity in the United States has increased rapidly in the past several decades. The prevalence from 2017 to 2020 was 19.7% for children ages 2 to 19 (Centers for Disease Control and Prevention, 2022a), and 41.9% among adults — up from 30.5% from 1999 to 2000 (Centers for Disease Control and Prevention, 2022b). Obesity is associated with common causes of preventable deaths, including heart disease, stroke, Type 2 diabetes, and certain cancers.

Obesity is commonly treated with conservative measures such as dietary changes and exercise. Other treatments include medications and bariatric surgery (National Institute of Diabetes and Digestive and Kidney Diseases, 2018). Another alternative to treating obesity is gastrointestinal electrical stimulation, also known as gastric pacemaker, which has been successful in treatment of gastroparesis. The treatment is used to reduce appetite through the use of implanted devices believed to modulate neurohormones and/or stimulate stomach muscles.

Gastrointestinal electrical stimulation is a less invasive procedure than bariatric surgery. It consists of a small electrical generator surgically implanted under the skin of the abdomen, and two electrodes surgically placed into the superficial tissue of the distal stomach (Ross, 2014). The device delivers two short pulses at intervals. Stimulation can be low-frequency/high-energy with long pulse stimulation, or high-frequency/low-energy with short pulse stimulation. The latter, known as the Enterra II gastric neurostimulator (Medtronic, Minneapolis, USA) is used on humans (Lal, 2015). Physicians can adjust voltage and rate settings of the device at any time according to patient symptoms.

In 2000, the U.S. Food and Drug Administration approved Enterra as a Humanitarian Device Exemption for treatment of chronic, drug-refractory nausea and vomiting secondary to gastroparesis — but not obesity — or idiopathic etiology for persons 18 to 70 years of age (U.S. Food and Drug Administration, 2015). To date, the Food and Drug Administration has not approved any gastrointestinal electrical stimulation product for obesity.

More recently, physicians have considered using gastrointestinal electrical stimulation for obesity, to decrease appetite and increase a feeling of satiety. Several methods have been used, including implantable gastric stimulation, the Tantalus system, and closed-loop gastric electrical stimulation (Maisiyiti, 2019). Vagal nerve stimulation, also referred to as the Maestro Rechargeable System (approved for obesity treatment by the Food and Drug Administration in 2020) is a related procedure, although not addressed in this policy.

## Findings

No guideline on obesity from professional medical associations, including the American Association of Clinical Endocrinologists, American College of Cardiology, American College of Endocrinology, American Heart Association, and National Institute for Health and Care Excellence address gastrointestinal electrical stimulation.

Several systematic reviews have been published:

- A systematic review examined 11 articles on gastrointestinal electrical stimulation for obesity. Authors conclude that the procedure has potential to treat obesity, but more research is needed through clinical trials to determine simulation parameters and treatment regimens (Maisiyiti, 2019).

- A systematic review of 30 studies (n = 1,367) of gastrointestinal electrical stimulation for obesity documented significant weight loss (22 studies) and appetite reduction (16) in the majority of studies. Almost all studies did not track patients for more than 12 months after the procedure (Cha, 2014).

Several randomized studies have been published:

- Ninety-seven obese participants in a prospective multicenter randomized study conducted in nine European centers received a laparoscopic implant of the Abiliti closed-loop gastrointestinal electrical system. Five clinical variables and three factor scores on a preoperative Three Factor Eating Questionnaire (F1 — cognitive-restraint; F2 — disinhibition; and F3 — hunger) were analyzed in order to determine predictors of weight loss success defined as excess weight loss > 30% and failure defined as excess weight loss < 20% at 12 months post-surgery (Del Agua, 2017).

- A double-blind, multicenter trial of 190 patients with Class 2 and 3 obesity undergoing implantation with a gastric stimulator were randomized to a study group (stimulator on) and a control group (stimulator off). All subjects consumed a diet with a 500 kilocalorie-per-day deficit and participated in monthly support group meetings. No difference in weight loss after 12 months was observed between the study group and control group (11.7% versus 11.8%), with no deaths and few complications in each group (Shikora, 2009).
- A study (n = 20) randomized morbidly obese patients undergoing gastric electrical stimulation using the Exilis system between those with the stimulator on or off. A significant reduction ($P < .01$) occurred after weeks 4, 13, and 26, but not at week 52. No significant differences after 12 months were observed between groups in terms of gastric emptying halftime, food intake, insulin levels, and glucose levels (Paulus, 2020).

Other, non-randomized studies include:

- A study (n = 47) of obese patients in four institutions followed subjects after implantation of a gastric electrical stimulator. Of 35 patients still enrolled after 24 months, mean percent total body weight loss changed only slightly, by 14.8% at month 12 and 13.3% at month 24 (Morales-Conde, 2018).
- A study (n = 34) tracked obese patients after gastrointestinal electrical stimulation. Excess weight loss, which was 28.7% after 12 months, was essentially the same after 27 months (27.5%). Improvements in body mass index, disinhibition and hunger factors, weekly physical activity, and quality of life were also observed at 12 months (Horbach, 2015).
- A study (n = 45) of obese patients documented that 12 months after gastrointestinal electrical stimulation, weight loss averaged 15.7% of baseline body weight. Significant improvements were observed in number of disallowed meals and between-meal snacks ($P < .05$), levels of physical activity ($P < .001$), and activity-based energy/calorie expenditure ($P < .001$) (Busetto, 2017).

In 2024, we found a literature review that examined advancements and developments in neurostimulation of the gastrointestinal tract, with particular emphasis on both temporary and permanent stimulation methods (Abell, 2015). It discussed several key studies: an open-label trial of temporary endoscopic gastric electrical stimulation (n=491) showed symptom improvement over one week; a study on pediatric gastroparesis patients (n=43) with a 63% response rate; and the double-masked, randomized, placebo-controlled WAVESS study (n=58) supported the efficacy of gastric electrical stimulation, which subsequently led to FDA approval as a humanitarian device(Abell, 2015). The review also addressed the

Enterra clinical trial of permanent stimulation, noting that despite missing its primary endpoint due to a flawed design, it showed promising long-term outcomes (Abell, 2015).

## References

On May 12, 2024, we searched PubMed and the databases of the Cochrane Library, the U.K. National Health Services Centre for Reviews and Dissemination, the Agency for Healthcare Research and Quality, and the Centers for Medicare & Medicaid Services. Search terms were Enterra; gastrointestinal electrical stimulation; and obesity We included the best available evidence according to established evidence hierarchies (typically systematic reviews, meta-analyses, and full economic analyses, where available) and professional guidelines based on such evidence and clinical expertise.


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## Policy updates

6/2023: initial review date and clinical policy effective date: 7/2023

6/2024: Policy references updated.