Health Evidence Review Commission (HERC)

Coverage Guidance: Newer Interventional Procedures for GERD

Approved 1/17/2019

HERC Coverage Guidance

Transoral incisionless fundoplication (TIF) is recommended for coverage of GERD treatment only when the following criteria are met *(weak recommendation)*:

- 18 years of age or older
- Confirmed diagnosis of esophageal reflux by endoscopy, ambulatory pH, or barium swallow testing
- History of GERD symptoms for one year, occurring at least two to three times per week in the past month
- History of daily proton pump inhibitor therapy for the most recent six months
- Body mass index (BMI) ≤ 35
- Absence of all of the following conditions
    - Hiatal hernia larger than 2 cm
    - Esophagitis with LA grade of C or D
    - Barrett's esophagus greater than 2 cm
    - Achalasia
    - Esophageal ulcer
    - Esophageal motility disorder
    - Altered esophageal anatomy preventing insertion of the device
    - Previous failed anti-reflux surgery or procedure

EsophyX® was the only device identified in the evidence reviewed for this coverage guidance. Other transoral fundoplication devices or systems are not recommended for coverage.

For patients who have recurrent symptoms or fail the initial TIF procedure, repeat TIF is not recommended for coverage *(strong recommendation)*.

Magnetic sphincter augmentation for treatment of GERD is not recommended for coverage *(weak recommendation)*.

Note: Definitions for strength of recommendation are in Appendix A: *GRADE Table Element Descriptions*.

Rationales for each recommendation appear below in the GRADE table.

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Rationale for development of coverage guidances and multisector intervention reports

Coverage guidances are developed to inform coverage recommendations for public and private health plans in Oregon as plan administrators seek to improve patients' experience of care, population health, and the cost-effectiveness of health care. In the era of public and private sector health system transformation, reaching these goals requires a focus on maximizing the benefits and minimizing the harms and costs of health interventions.

HERC uses the following principles in selecting topics for its reports to guide public and private payers:

- Represents a significant burden of disease or health problem
- Represents important uncertainty with regard to effectiveness or harms
- Represents important variation or controversy in implementation or practice
- Represents high costs or significant economic impact
- Topic is of high public interest

HERC bases its reports on a review of the best available research applicable to the intervention(s) in question. For coverage guidances, which focus on diagnostic and clinical interventions, evidence is evaluated using an adaptation of the Grading of Recommendations, Assessment, Development, and Evaluation (GRADE) methodology. For more information on coverage guidance methodology, see Appendix A.

Multisector interventions can be effective ways to prevent, treat, or manage disease at a population level. In some cases, HERC has reviewed evidence and identified effective interventions, but has not made formal coverage recommendations when these policies are implemented in settings other than traditional health care delivery systems because effectiveness could depend on the environment in which the intervention is implemented.

GRADE Table

HERC develops recommendations by using the concepts of the GRADE system. GRADE is a transparent and structured process for developing and presenting evidence and for performing the steps involved in developing recommendations. The table below lists the elements that determine the strength of a recommendation. HERC reviews the evidence and assesses each element, which in turn is used to develop the recommendations presented in the coverage guidance box. Estimates of effect are derived from the evidence presented in this document. Assessments of confidence are from the published systematic reviews and meta-analyses, where available and judged to be reliable.

In some cases, no systematic reviews or meta-analyses encompass the most current literature. In those cases, HERC may describe the additional evidence or alter the assessments of confidence in light of all available information. Such assessments are informed by clinical epidemiologists from the Center for Evidence-based Policy. Unless otherwise noted, statements regarding resource allocation, values and preferences, and other considerations are the assessments of HERC, as informed by the evidence reviewed, public testimony, and subcommittee discussion.

Recommendations for coverage are based on the balance of benefit and harms, resource allocation, values and preferences, and other considerations. See Appendix A for more details about the factors that constitute the GRADE table.

GRADE Table

Should transoral incisionless fundoplication (TIF) be recommended for coverage for GERD?

Outcomes	Estimate of Effect for Outcome/ *Confidence in Estimate*	Resource Allocation	Values and Preferences	Other Considerations
Incident Barrett's esophagus *(Critical outcome)*	No data	Professional fees for the TIF procedure are generally lower than the fees for laparoscopic surgical procedures, but when facility and ancillary costs are taken into account, the difference in total procedure costs may not be significant. If lesser degrees of GERD severity are treated with TIF rather than chronic medical therapy, surgical treatment costs for the covered population will	For patients with chronic GERD symptomatology, we would expect values and preferences to be highly variable between medical and surgical treatment options, depending on the severity of symptoms and disease complications. Most patients with symptomatic control on chronic	
Complications of GERD (e.g., stricture) *(Critical outcome)*	No data			
GERD symptom scores *(Important outcome)*	Treatment response at 6 months 124/188 (66%) for intervention vs. 32/105 (30%) for control/sham ARD = 36% NNT = 2-3 RR 2.44 (95% CI 1.44 to 1.79, p = 0.02) ●●○○ *(Low confidence, based on 4 RCTs, n = 293)*			
Change in PPI therapy *(Important outcome)*	At 6 months, approximately 70% of patients reported PPI cessation ●●○○ *(Low confidence, based on 9 observational studies, n = 439)*			

Should transoral incisionless fundoplication (TIF) be recommended for coverage for GERD?

Outcomes	Estimate of Effect for Outcome/ *Confidence in Estimate*	Resource Allocation	Values and Preferences	Other Considerations
Harms *(Important outcome)*	Overall rate of serious adverse events was 2.4% ●●○○ *(Low confidence, based on 12 observational studies and 4 RCTs, n = 781)*	rise as TIF utilization increases. The magnitude of offsetting savings in PPI or other medical therapy will vary, depending on the pricing of generic and brand name drugs.	PPI therapy would prefer to continue medical management, although some would choose surgery to avoid possible long-term harm associated with PPIs. GERD patients for whom PPI therapy isn't working or is needed twice daily would value surgical intervention if safe and effective. Many would prefer TIF as a less invasive procedure, but others would prefer the laparoscopic Nissen or Toupe procedures as better established.	

Should transoral incisionless fundoplication (TIF) be recommended for coverage for GERD?

Outcomes	Estimate of Effect for Outcome/ *Confidence in Estimate*	Resource Allocation	Values and Preferences	Other Considerations
Balance of benefits and harms: Based on low-certainty evidence, the TIF procedure using the EsophyX® device appears to be effective in improving GERD-related quality of life and reducing or eliminating the need for chronic PPI therapy. There is no evidence that TIF reduces the rate of incident Barrett's esophagus or complications of GERD (e.g., stricture). Serious adverse effects (including perforation, bleeding, and pneumothorax) do occur with TIF, but the overall 2.4% rate of these events suggests that, on balance, the benefits of TIF outweigh the harms.				
Rationale: Although there is no evidence directly comparing TIF with laparoscopic fundoplication procedures, overall the two surgical approaches appear to have similar effectiveness. Coverage of the TIF procedure will not significantly change resource allocation for GERD management, and values and preferences would favor inclusion of TIF coverage, especially as an option for GERD patients whose symptoms are not controlled on chronic medical therapy. Current published evidence supports the safety and efficacy of the EsophyX® device used in this procedure. EsophyX® was the only device included in the systematic reviews and randomized trials that were identified for this coverage guidance. Other TIF devices and systems are not recommended for coverage because there are no comparative data. Our recommendation to cover the TIF procedure is weak because of our low level of confidence in the evidence.				
Recommendation: Transoral incisionless fundoplication (TIF) is recommended for coverage for GERD treatment only when the following criteria are met *(weak recommendation)*: • 18 years of age or older • Confirmed diagnosis of esophageal reflux by endoscopy, ambulatory pH, or barium swallow testing • History of GERD symptoms for one year, occurring at least two to three times per week in the past month • History of daily proton pump inhibitor therapy for the most recent six months • Body mass index (BMI) ≤ 35 • Absence of all of the following conditions o Hiatal hernia larger than 2 cm o Esophagitis with LA grade of C or D o Barrett's esophagus greater than 2 cm o Achalasia o Esophageal ulcer o Esophageal motility disorder				

Should transoral incisionless fundoplication (TIF) be recommended for coverage for GERD?

Outcomes	Estimate of Effect for Outcome/ *Confidence in Estimate*	Resource Allocation	Values and Preferences	Other Considerations
o Altered esophageal anatomy preventing insertion of the device o Previous failed anti-reflux surgery or procedure EsophyX® was the only device identified in the evidence reviewed for this coverage guidance. Other transoral fundoplication devices or systems are not recommended for coverage. For patients who have recurrent symptoms or fail the initial TIF procedure, repeat TIF is not recommended for coverage *(strong recommendation)*.				

Should magnetic sphincter augmentation (MSA) be recommended for coverage for GERD?

Outcomes	Estimate of Effect for Outcome/ *Confidence in Estimate*	Resource Allocation	Values and Preferences	Other Considerations
Incident Barrett's esophagus *(Critical outcome)*	No data	Similar to the considerations for TIF, if lesser degrees of GERD severity are treated with MSA rather than chronic medical therapy, surgical treatment costs for the covered population will rise as utilization increases. The magnitude of	Most GERD patients with symptomatic control on chronic PPI therapy would prefer to continue medical management, although some would choose surgery to avoid possible long-term	
Complications of GERD (e.g., stricture) *(Critical outcome)*	No data			
GERD symptom scores *(Important outcome)*	No statistically significant difference in GERD health-related quality of life scores with MSA compared to fundoplication at 6 to 12 months Mean difference -0.48 (95% CI -1.05 to 0.09, p = 0.10)			

Should magnetic sphincter augmentation (MSA) be recommended for coverage for GERD?

Outcomes	Estimate of Effect for Outcome/ *Confidence in Estimate*	Resource Allocation	Values and Preferences	Other Considerations
	●○○○ *(Very low confidence, based on 6 observational studies, n = 1,083)* Significantly more patients reported > 50% improvement in GERD health-related quality of life score with MSA (84%) than PPI (10%) at 6 months (p < 0.001) ●○○○ *(Very low confidence, based on 1 RCT, n = 152)*	offsetting savings in PPI or other medical therapy will be variable. Overall, there would most likely be some increase in resource allocation for GERD management with the addition of MSA coverage.	harm associated with PPIs. GERD patients for whom PPI therapy isn't working or is needed twice daily would value surgical intervention if safe and effective. The level of laparoscopic intervention would appear to be similar for MSA and Nissen procedures; therefore, many GERD patients might prefer the laparoscopic Nissen or Toupe procedures as better established.	
Change in PPI therapy *(Important outcome)*	No statistically significant difference in PPI cessation with MSA compared to fundoplication at 6 to 12 months OR 0.81 (95% CI 0.42 to 1.58, p = 0.55) ●○○○ *(Very low confidence, based on 6 observational studies, n = 1,098)* 91% of patients undergoing MSA reported PPI cessation at 6 months ●○○○ *(Very low confidence, based on 1 RCT, n = 50)*			
Harms *(Important outcome)*	No statistically significant difference in need for endoscopic dilation with MSA compared to fundoplication at 6 to 12 months OR 1.56 (95% CI 0.61 to 3.95, p = 0.12) ●○○○ *(Very low confidence, based on 5 observational studies, n = 535)* No statistically significant difference in need for reoperation with MSA compared to fundoplication at 6 to 12 months			

Should magnetic sphincter augmentation (MSA) be recommended for coverage for GERD?

Outcomes	Estimate of Effect for Outcome/ *Confidence in Estimate*	Resource Allocation	Values and Preferences	Other Considerations
	0.54 (95% CI 0.22 to 1.34, p = 0.18) ●○○○ *(Very low confidence, based on 3 observational studies, n = 1,187)* 32% of patients experienced dysphagia; 5% experienced persistent moderate or severe dysphagia at 6 months ●○○○ *(Very low confidence, based on 1 RCT, n = 50)*			

Balance of benefits and harms: Although MSA appears to have similar effectiveness and similar adverse events and complications compared to laparoscopic fundoplication, we have very low confidence in the evidence.
Rationale: Based on observational studies and one poor-quality RCT, the level of evidence is insufficient at present to establish the comparative effectiveness of MSA. Some additional costs would be likely with the addition of MSA coverage, and there are no strong values or preferences that would favor MSA over other available GERD treatment options. Our recommendation for non-coverage is weak because future studies may better establish the benefits of the MSA procedure.
Recommendation: Magnetic sphincter augmentation for treatment of GERD is not recommended for coverage *(weak recommendation)*.

Note: GRADE table elements are described in Appendix A. A GRADE Evidence Profile is in Appendix B.

Background

Gastroesophageal reflux disease (GERD) is a long-lasting and more serious form of gastroesophageal reflux (or acid reflux). The lower esophageal sphincter becomes weak or relaxes, allowing stomach contents to rise up into the esophagus. Common symptoms of GERD include heartburn, bad breath, nausea, pain in the chest or upper part of the abdomen, painful swallowing, and vomiting. Patients with GERD can sometimes breathe stomach acid into the lungs, provoking asthma, laryngitis, or pneumonia. GERD can also cause Barrett's esophagus, a precursor of esophageal adenocarcinoma (National Institute of Diabetes and Digestive and Kidney Diseases [NIDDKD], 2018).

An estimated 20% of the U.S. population has GERD. Populations at higher risk for GERD include people who are overweight, pregnant women, people who smoke or are exposed to secondhand smoke, and people taking certain medicines (e.g., calcium channel blockers, antihistamines, sedatives, antidepressants, asthma medications, pain medications). GERD is often classified by the frequency and severity of symptoms. Procedures to test for GERD include upper gastrointestinal endoscopy and biopsy, x-rays of the upper gastrointestinal area, and esophageal pH and impedance monitoring (NIDDKD, 2018).

Lifestyle changes may improve or eliminate GERD, such as not overeating, not eating two to three hours before sleeping, quitting smoking and avoiding secondhand smoke, wearing loose-fitting clothing around the abdomen, and sleeping on a bed that is on a slight angle. Medicines (both prescription and nonprescription) to treat GERD include antacids, histamine 2 receptor antagonists, proton pump inhibitors (PPI), and prokinetic agents (NIDDKD, 2018).

The most common surgery for GERD is laparoscopic fundoplication, in which the top of the stomach is sewed around the esophagus to add pressure to the lower end of the esophagus and reduce reflux. Laparoscopic fundoplication is performed under general anesthesia, and most patients return to usual activities in two to three weeks (NIDDKD, 2018).

The focus of this coverage guidance is two additional treatments for GERD: transoral incisionless fundoplication (TIF) and magnetic sphincter augmentation (MSA).

Indications

Indications for TIF include intractable GERD symptoms, no or mild esophagitis with hiatal hernia < 2 cm, and abnormal acid reflux (Richter et al., 2018).

MSA is performed using the LINX Reflux Management System. This device was approved by the U.S. Food and Drug Administration (FDA) in 2012 and is indicated for patients diagnosed with GERD as defined by abnormal pH testing, and who continue to have chronic GERD symptoms despite maximum therapy for the treatment of reflux (FDA, 2012).

Technology Description

TIF is a minimally invasive, endoscopic technique that restores the valve at the gastroesophageal junction via endoluminal fundoplication using EsophyX (Huang et al., 2017). The EsophyX device is a fastener delivery system designed to reconstruct the gastroesophageal valve and help restore its function as a reflux barrier. Approximately 20 fasteners are implanted during the procedure to create

fusion of the esophageal and fundus tissues and form the valve (EndoGastric Solutions, 2016). The first iteration of TIF (sometimes called TIF 1.0) creates the fundoplication wrap around the gastroesophageal junction; the later version of the procedure (TIF 2.0) creates the wrap around the intraabdominal portion of the esophagus.

The LINX Reflux Management System is a small, flexible ring of interlinked titanium beads with magnetic cores that is placed around the esophagus just above the stomach during a laparoscopic procedure. A sizing tool is used to determine the appropriate size LINX System, and the device is positioned using sutures. The magnetic attraction between the beads helps the lower esophageal sphincter resist opening because of gastric pressures. Swallowing temporarily breaks the magnetic bonds, allowing food and liquid to pass normally into the stomach (Torax Medical, 2018).

Evidence Review

Huang et al., 2017

This is a good-quality systematic review and meta-analysis of prospective studies of TIF. The primary outcome measure for the meta-analysis was treatment response at six months defined as improvement of at least 50% in the GERD health-related quality of life score, or remission of heartburn and regurgitation, or complete cessation of PPI therapy; these outcomes were considered hierarchically in the order described (i.e., cessation of PPI therapy only contributed to the outcome if the other two outcomes were not reported). The authors identified five randomized controlled trials (total n = 343) published in 2014 and 2015, all of which used the TIF 2.0 procedure. Two of the RCTs compared TIF to a sham procedure, and three trials compared TIF to PPI therapy. The included trials were mainly low to moderate risk of bias, although one trial was deemed to be at high risk of bias due to concerns with blinding and attrition. Three of the five studies were sponsored by the manufacturer of the EsophyX TIF system. The authors also identified 13 prospective observational studies, but these were not included in the primary meta-analyses. In general, studies excluded patients with large hiatal hernias or BMI greater than 30 or 35 kg/m^2.

For the primary outcome of treatment response at six months, four studies with 293 patients contributed to the meta-analysis. Overall, in the intention-to-treat analysis, treatment response occurred in 124 of the 188 patients randomized to TIF (66%) compared to 32 of 105 patients randomized to the control group (30%) (RR 2.44, 95% CI 1.44 to 4.79, p = 0.02, I^2 = 70%). Data from the prospective observational studies were not meta-analyzed, but did allow for an assessment of the durability of treatment effects beyond six months. Based on these studies, the treatment response to TIF appears to be sustained through 36 months but then begins to decline, although estimates beyond 36 months are based on very small numbers of patients. Similarly, the analysis of PPI use in prospective observational studies shows a sustained effect for PPI cessation between 12 and 36 months of follow-up (rate of approximately 60%), but the rate of PPI cessation beyond 36 months falls to 30-50% (again based on a very small number of observations).

Five-year follow-up from one of the included RCTs was separately reported (Trad et al., 2018). In this study, all control group patients crossed over to TIF after six months (total n = 63, of whom 44 had available data for follow-up at five years). At five years, there was sustained improvement in GERD health-related quality of life score compared to baseline (22.2 at baseline to 6.8 at five years, p < 0.01), although the rate of PPI use steadily increased from 17% at one year to 34% at five years.

In a total of 16 studies (four RCTs and 12 observational studies), there were 19 serious adverse events among 781 patients who received the TIF procedure (2.4%). These events included seven perforations, five episodes of bleeding, four pneumothoraces, and one death (reported 20 months after the TIF procedure). In the five-year follow-up reported by Trad et al. (2018), there were no serious adverse events, but three patients (5%) did require reoperation.

Richter et al., 2018

Because there are no RCTs directly comparing TIF with laparoscopic Nissen fundoplication (LNF), Richter et al. undertook a network meta-analysis (NMA), which allows for indirect comparisons. The PPI node allowed for an indirect comparison of TIF and LNF (120 patients were included in the TIF vs. PPI trials, and 835 patients were included in the LNF vs. PPI trials). For the NMA outcome of improved GERD health-related quality of life, TIF was found to have the greatest probability of being the best treatment (surface under the cumulative ranking curve of 0.92) followed by LNF (surface under the cumulative ranking curve of 0.66), although in the pairwise comparison the difference between the two procedures was not statistically significant (OR 2.08, 95% CI 0.71 to 6.09) and the quality of evidence was judged to be very low. The authors of this study also queried the MAUDE database for reports on the TIF procedure and found 50 cases of device malfunction and 75 cases of injury including 36 perforations, 10 gastrointestinal bleeds, 8 esophageal lacerations, 8 pleural effusions, and 6 mediastinal abscesses (out of an unknown denominator of total TIF procedures).

Aiolfi et al., 2018

This is a fair-quality systematic review and meta-analysis of seven observational studies comparing MSA with laparoscopic fundoplication (Nissen or Toupe techniques). The review is mainly limited by incomplete reporting of the quality ratings of the included studies. One study was a prospective cohort and the remaining six studies were retrospective cohorts. The included studies were published between 2014 and 2017 and involved 1,211 patients in total; 686 patients (56%) were treated with MSA and 524 (44%) underwent laparoscopic fundoplication. The mean age of patients ranged from approximately 40 to 55 years old, the mean BMI ranged from 24 to 30 kg/m^2, and the mean hiatal hernia size ranged from 1 to 2 cm. Six studies with 1,083 patients contributed to the random effects meta-analysis of the pooled mean difference in GERD health-related quality of life score at six to 12 months, which found a non-statistically significant difference of -0.48 (95% CI -1.05 to 0.09, $p = 0.10$, $I^2 = 0\%$). Six studies with 1,098 patients contributed to the random effects meta-analysis of the pooled odds ratio of PPI cessation at six to 12 months, which found a non-statistically significant difference of 0.81 (95% CI 0.42 to 1.58, $p = 0.55$, $I^2 = 64\%$). Five studies with 535 patients contributed to the random effects meta-analysis of the pooled odds ratio of endoscopic dilation at six to 12 months, which found a non-statistically significant difference of 1.56 (95% CI 0.61 to 3.95, $p = 0.12$, $I^2 = 35\%$). Three studies with 1,187 patients contributed to the random effects meta-analysis of the pooled odds ratio of reoperation at six to 12 months, which found a non-statistically significant difference of 0.54 (95% CI 0.22 to 1.34, $p = 0.18$, $I^2 = 0\%$). In terms of harms, the authors observed that overall postoperative morbidity ranged from 0% to 3% in the MSA groups and 0% to 7% in the fundoplication groups. The ability to vomit or belch was better preserved in the MSA groups compared to the fundoplication groups.

Bell et al., 2019

This is a poor-quality randomized controlled trial of MSA compared to twice-daily PPI therapy for patients with persistent GERD despite once-daily PPI. Eligible patients were over age 21 and had moderate-to-severe regurgitation symptoms while taking once-daily PPI therapy for at least eight weeks. Patients who were already on twice-daily PPI, had hiatal hernias larger than 3 cm, BMI > 35 kg/m^2, or who had grade C or D esophagitis or Barrett's esophagus or esophageal strictures were excluded. Patients were mainly recruited from surgical clinics. Overall, 152 patients were enrolled and randomized in 2:1 fashion to twice-daily PPI or MSA after a one week washout period off their once-daily PPI treatment. In the intention-to-treat analysis, the primary endpoint of resolution of moderate-to-severe regurgitation at six months was achieved in 84% of the MSA group and 10% of the PPI group ($p < 0.001$). Similarly, the percentage of patients achieving > 50% improvement in the GERD health-related quality of life score was 81% in the MSA group and 8% in the PPI group ($p < 0.001$). In the MSA group, 91% of patients had stopped using PPI at six months. The main adverse effect of MSA was dysphagia, which occurred in 15 patients (32%). This dysphagia was reported as minimal or resolved for 13 patients by six months, but was persistent and moderate or severe in two patients at six months.

There were several methodological limitations to this trial. The manuscript does not describe methods for random sequence generation or allocation concealment. Study participants were not blinded to treatment group, which increases the risk of performance bias for subjectively reported outcomes. This concern about a placebo effect is heightened by the recruitment of participants from surgical clinics. Although the overall rate of attrition at six months was modest, it was different in the MSA group (0%) and the PPI group (14%). There was no statement in the manuscript regarding trial funding, sponsorship, or conflicts of interest.

Evidence Summary

There is no evidence that either TIF or MSA reduce the rate of incident Barrett's esophagus or complications of GERD (e.g., stricture). There is low-certainty evidence that TIF improved treatment response compared with sham procedures and/or PPI, although the durability of that improvement beyond 36 months is less certain. Many patients who underwent TIF were able to stop PPI treatment. The overall rate of adverse effects with TIF is approximately 2.5% in the studies. There are no direct randomized comparisons of TIF and laparoscopic fundoplication procedures, but a network meta-analysis suggested that there was no statistically significant difference between the two procedures in the odds of improving GERD health-related quality of life.

There is very low-certainty evidence that MSA is not statistically significantly better than laparoscopic fundoplication for reducing GERD symptoms or stopping PPI therapy. There is very low-certainty evidence from one small RCT with a high risk of bias that MSA is superior to twice-daily PPI therapy for improving GERD symptoms. There is very low-certainty evidence that the need for endoscopic dilation or reoperation did not differ significantly between MSA and fundoplication; the rate of dysphagia in the MSA group of the sole randomized trial was 32%, although only 5% had persistent moderate-to-severe dysphagia at six months.

Policy Landscape

Payer Coverage Policies

Medicaid

No coverage policies were found for Washington Medicaid for either TIF or MSA.

Medicare

No Medicare National Coverage Determinations were found for TIF or MSA, and two Local Coverage Determinations (LCD) were found for these procedures. Two LCDs provide coverage for TIF. L34659 (revision effective 1/1/2018) provides coverage of TIF for treatment of patients in whom PPI therapy fails. The procedure must be done by a well-trained surgeon, and the patient must meet these conditions:

- Symptomatic chronic gastroesophageal reflux (defined as > 6 months of symptoms)
- Symptoms must not be completely responsive to PPI as judged by GERD HRQL scores of ≤ 12 while on PPI and ≥ 20 when off for 14 days (or difference ≥ 10 of the scores between off and on therapy)
- Hiatal hernia ≤ 2 cm, if present

Coverage is not extended for patients who have recurrent symptoms or fail this procedure, and repeat TIF is considered investigational. This LCD does not mention MSA.

The other LCD, L35080 (revision effective 12/1/2017), provides coverage for TIF, except for patients:

- Who have recurrent symptoms or other evidence of failure following a prior TIF
- In which a staged procedure is being done (i.e., laparoscopic esophageal or paraesophageal diaphragmatic hernia/opening closure followed by a TIF endoscopically)
- Who have a preoperative hiatal hernia > 2 cm
- With BMI > 35, esophagitis LA grade > B, Barrett's esophagus > 2 cm, and presence of achalasia or esophageal ulcer or has not been on an appropriate trial of PPI

This LCD states that LINX® Reflux Management System, a MSA device, is not considered reasonable and necessary for the treatment of GERD.

A third LCD, L33296 (revision effective 1/25/2018), states that transesophageal endoscopic procedures (e.g., TIF) for the treatment of GERD are not covered.

Private Payers

Coverage policies were searched for four private payers: Aetna, Cigna, Moda, and Regence. None of these private payers covered MSA, and only Moda covered TIF. The Moda policy on endoscopic procedures for GERD (effective 7/1/2018) provides coverage for TIF when all these conditions are met:

a. 18 years of age or older
b. Confirmed diagnosis of esophageal reflux by endoscopy, ambulatory pH, or barium swallow testing
c. History of GERD symptoms for one year occurring two to three times per week
d. GERD patients with body mass index (BMI) ≤ 35
e. History of daily PPI therapy for greater than six months

f. Absence of all of the following conditions:
    i. Absence of a hiatal hernia or one that is 2 cm or less
    ii. No esophagitis LA grade C or D
    iii. Barrett's esophagus, or if present it is 2 cm or less
    iv. Achalasia
    v. Esophageal ulcer
    vi. Esophageal motility disorder
    vii. Altered esophageal anatomy preventing insertion of the device
    viii. No [sic] previous failed anti-reflux surgery/procedure

This Moda policy considers MSA to be investigational.

The Aetna policy on GERD treatment devices (last review 5/24/18) does not cover StomaphyX or EsophyX (TIF devices) or LINX Reflux Management System (a sphincter augmentation device). The Cigna policy on endoscopic anti-reflux procedures (effective 3/15/18) does not provide coverage for TIF or injection/implantation of biocompatible material, such as the LINX Reflux Management System. The Regence policy on transesophageal endoscopic therapies for GERD (effective 3/1/2018) does not provide coverage for TIF, and the Regence policy on MSA (effective 3/1/2018) does not provide coverage for that procedure.

Recommendations from Others

The search for clinical practice guidelines found guidelines from three organizations: American College of Gastroenterology, National Institute for Health and Care Excellence (NICE), and European Association of Endoscopic Surgery. All of these guidelines generally recommended against the use of TIF or MSA.

The American College of Gastroenterology guidelines on diagnosis and management of GERD (Katz et al., 2013) states that TIF cannot be recommended as an alternative to medical or traditional surgical therapy. These guidelines discuss the LINX Reflux System and state that more data are needed before widespread usage of LINX can be recommended.

The NICE guidelines on GERD in adults do not mention TIF or MSA (NICE, 2014). A more recent interventional procedures guidance from NICE concludes:

> There are no major safety concerns about laparoscopic insertion of a magnetic titanium ring for [GERD]. There is limited evidence of short-term efficacy, but evidence of long-term efficacy is inadequate in quality and quantity. Therefore, this procedure should only be used with special arrangements for clinical governance, consent, and audit or research (NICE, 2017, p.2).

The European Association of Endoscopic Surgery guidelines on GERD (Fuchs et al., 2014) conclude that there is not enough evidence available to recommend an alternative option to laparoscopic fundoplication for severe GERD.

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Appendix A. GRADE Table Element Descriptions

Element	Description
Balance of benefits and harms	The larger the difference between the desirable and undesirable effects, the higher the likelihood that a strong recommendation is warranted. An estimate that is not statistically significant or has a confidence interval crossing a predetermined clinical decision threshold will be downgraded.
Quality of evidence	The higher the quality of evidence, the higher the likelihood that a strong recommendation is warranted
Resource allocation	The higher the costs of an intervention—that is, the greater the resources consumed in the absence of likely cost offsets—the lower the likelihood that a strong recommendation is warranted
Values and preferences	The more values and preferences vary, or the greater the uncertainty in values and preferences, the higher the likelihood that a weak recommendation is warranted
Other considerations	Other considerations include issues about the implementation and operationalization of the technology or intervention in health systems and practices within Oregon.

Strong recommendation

In Favor: The subcommittee concludes that the desirable effects of adherence to a recommendation outweigh the undesirable effects, considering the balance of benefits and harms, resource allocation, values and preferences and other factors.

Against: The subcommittee concludes that the undesirable effects of adherence to a recommendation outweigh the desirable effects, considering the balance of benefits and harms, resource allocation, values and preferences and other factors.

Weak recommendation

In Favor: The subcommittee concludes that the desirable effects of adherence to a recommendation probably outweigh the undesirable effects, considering the balance of benefits and harms, resource allocation, values and preferences and other factors., but further research or additional information could lead to a different conclusion.

Against: The subcommittee concludes that the undesirable effects of adherence to a recommendation probably outweigh the desirable effects, considering the balance of benefits and harms, cost and resource allocation, and values and preferences, but further research or additional information could lead to a different conclusion.

Confidence in estimate rating across studies for the intervention/outcome

Assessment of confidence in estimate includes factors such as risk of bias, precision, directness, consistency and publication bias.

High: The subcommittee is very confident that the true effect lies close to that of the estimate of the effect. Typical sets of studies are RCTs with few or no limitations and the estimate of effect is likely stable.

Moderate: The subcommittee is moderately confident in the estimate of effect: The true effect is likely to be close to the estimate of the effect, but there is a possibility that it is substantially different. Typical sets of studies are RCTs with some limitations or well-performed nonrandomized studies with additional strengths that guard against potential bias and have large estimates of effects.

Low: The subcommittee's confidence in the estimate of effect is limited: The true effect may be substantially different from the estimate of the effect. Typical sets of studies are RCTs with serious limitations or nonrandomized studies without special strengths.

Very low: The subcommittee has very little confidence in the estimate of effect: The true effect is likely to be substantially different from the estimate of effect. Typical sets of studies are nonrandomized studies with serious limitations or inconsistent results across studies.

Appendix B. GRADE Evidence Profile

Quality Assessment (Confidence in Estimate of Effect) Transoral Incisionless Fundoplication							
No. of Studies	**Study Design(s)**	**Risk of Bias**	**Inconsistency**	**Indirectness**	**Imprecision**	**Other Factors**	**Quality**
Incident Barrett's esophagus							
0							No data
Complications of GERD							
0							No data
GERD symptom scores (Treatment response)							
4	RCTs	Moderate	Serious	Not serious	Not serious		Low ●●○○
Change in PPI therapy							
9	Observational	Low	Not serious	Not serious	Not serious		Low ●●○○
Harms							
12	Mixed	Low	Not serious	Not serious	Not serious		Low ●●○○

Quality Assessment (Confidence in Estimate of Effect) Magnetic Sphincter Augmentation Compared to Fundoplication							
No. of Studies	**Study Design(s)**	**Risk of Bias**	**Inconsistency**	**Indirectness**	**Imprecision**	**Other Factors**	**Quality**
Incident Barrett's esophagus							
0							No data
Complications of GERD							
0							No data
GERD symptom scores							
6	Observational	Moderate	Not serious	Not serious	Serious		Very Low ●○○○
Change in PPI therapy							
6	Observational	Moderate	Not serious	Not serious	Serious		Very Low ●○○○
Harms							
Endoscopic dilation 5 Re-operation 3	Observational	Moderate	Not serious	Not serious	Serious		Very Low ●○○○

Quality Assessment (Confidence in Estimate of Effect) Magnetic Sphincter Augmentation Compared to PPI							
No. of Studies	**Study Design(s)**	**Risk of Bias**	**Inconsistency**	**Indirectness**	**Imprecision**	**Other Factors**	**Quality**
Incident Barrett's esophagus							
0							No data
Complications of GERD							
0							No data
GERD symptom scores							
1	RCT	High	N/A	Not serious	Not reported	Sparse data	Very Low ●○○○
Change in PPI therapy							
1	RCT	High	N/A	Not serious	Not reported	Sparse data	Very Low ●○○○
Harms							
1	RCT	High	N/A	Not serious	Not reported	Sparse data	Very Low ●○○○

Appendix C. Methods

Scope Statement

Populations

Adults with gastroesophageal reflux disease (GERD)

Population scoping notes: None

Interventions

Laparoscopic magnetic ring procedure for augmentation of the lower esophageal sphincter; transoral incisionless fundoplication

Intervention exclusions: None

Comparators

Medical management, Nissen fundoplication, interventions compared to each other, sham interventions

Outcomes

Critical: Incident Barrett's esophagus, complications of GERD (e.g., stricture)

Important: GERD symptom scores, change in proton pump inhibitor (PPI) therapy, harms (e.g., repeat interventions)

Considered but not selected for the GRADE table: None

Key Questions

KQ1: What is the comparative effectiveness of magnetic sphincter augmentation of the lower esophageal sphincter and transoral incisionless fundoplication in the treatment of GERD?

KQ2: How does the effectiveness of magnetic sphincter augmentation of the lower esophageal sphincter and transoral incisionless fundoplication in the treatment vary by:

a. Patient characteristics (e.g., age, gender, weight, tobacco use)
b. Comorbid conditions
c. Duration of symptoms
d. Response to prior treatments
e. Procedural technique

KQ3: What are the harms of magnetic sphincter augmentation of the lower esophageal sphincter and transoral incisionless fundoplication in the treatment of GERD?

Search Strategy

A full search of the core sources was conducted to identify systematic reviews, meta-analyses, and technology assessments that meet the criteria for the scope described above. Searches of core sources were limited to citations published after 2013.

The following core sources were searched:

- Agency for Healthcare Research and Quality (AHRQ)
- Canadian Agency for Drugs and Technologies in Health (CADTH)
- Cochrane Library (Wiley Online Library)
- Institute for Clinical and Economic Review (ICER)
- Medicaid Evidence-based Decisions Project (MED)
- National Institute for Health and Care Excellence (NICE)
- Tufts Cost-effectiveness Analysis Registry
- Veterans Administration Evidence-based Synthesis Program (ESP)
- Washington State Health Technology Assessment Program

A MEDLINE® search was also conducted to identify systematic reviews, meta-analyses, and technology assessments, using the search terms gastroesophageal reflux disease (GERD) and magnetic or transoral fundoplication. The search was limited to publications in English published since 2012. In addition, a MEDLINE® search was conducted for randomized controlled trials published after the search dates of the most recent systematic review selected for each indication.

Searches for clinical practice guidelines were limited to those published since 2013. A search for relevant clinical practice guidelines was also conducted using MEDLINE® and the following sources:

- Australian Government National Health and Medical Research Council (NHMRC)
- Canadian Agency for Drugs and Technologies in Health (CADTH)
- Centers for Disease Control and Prevention (CDC), Community Preventive Services
- National Guidelines Clearinghouse
- National Institute for Health and Care Excellence (NICE)
- Scottish Intercollegiate Guidelines Network (SIGN)
- United States Preventive Services Task Force (USPSTF)
- Veterans Administration/Department of Defense (VA/DoD) Clinical Practice Guidelines

Inclusion/Exclusion Criteria

Studies were excluded if they were not published in English, did not address the scope statement, or were study designs other than systematic reviews, meta-analyses, technology assessments, randomized controlled trials, or clinical practice guidelines.

Appendix D. Applicable Codes

CODES	DESCRIPTION
CPT Codes	
43210	Esophagogastroduodenoscopy, flexible, transoral; with esophagogastric fundoplasty, partial or complete, includes duodenoscopy when performed
43284	Laparoscopy, surgical, esophageal sphincter augmentation procedure, placement of sphincter augmentation device (ie, magnetic band), including cruroplasty when performed
43285	Removal of esophageal sphincter augmentation device

Note: Inclusion on this list does not guarantee coverage.