



# Individual patient and population-level eligibility for transoral endocrine surgery

Raymon H. Grogan

Section of Endocrine Surgery, Department of Surgery, Baylor St. Luke's Medical Center, Houston, TX, USA

*Correspondence to:* Raymon H. Grogan, MD, MS, FACS. Associate Professor, Chief of Endocrine Surgery, Baylor St. Luke's Medical Center, 7200 Cambridge Street, Houston, TX 77030, USA. Email: rgrogan@bcm.edu.

**Abstract:** Transoral endocrine surgery offers thyroid and parathyroid patients the option of surgery without any visible scar on the front of the neck. Aside from curiosity and excitement the operation has also generated several questions. One of the most commonly asked questions is in regard to eligibility for the procedure. In this context there are two types of eligibility, one that applies to individual patients and one that applies to the broader population. Patient-centered eligibility refers to those factors that make any particular individual patient eligible or ineligible for the operation. This information is important to allow surgeons and patients to make informed decisions when choosing between the traditional and transoral approach. Population-centered eligibility refers to the percentage of all thyroid and parathyroid patients that would be eligible for the procedure. This information is crucial for the larger philosophical question of whether the operation has intrinsic value, and whether or not the operation has enough merit to continue to pursue it as a new means of performing thyroid and parathyroid surgery. This article reviews both the patient and population-level eligibility to give a better understanding of not only which patients are eligible, but also what value this operation may have in the broader context of thyroid and parathyroid surgery.

**Keywords:** Transoral thyroidectomy; transoral endocrine surgery; candidacy; applicability

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## Introduction

Transoral endocrine surgery is an alternative approach to traditional endocrine surgery procedures that allows thyroid and parathyroid surgery to be done without leaving any visible scar on the front of the neck. The term transoral endocrine surgery encompasses a group of operations that currently use the oral vestibular approach to access the central neck. The technical term for a thyroidectomy via the vestibular approach is transoral endoscopic thyroidectomy vestibular approach (TOETVA). In this approach three small incisions are made on the inside of the oral vestibule to allow laparoscopic instruments to be passed between the skin and mandible in order to access the central neck. This allows all the incisions for the operation to be completely hidden on the inside of the lower lip allowing for an essentially completely scarless thyroid or parathyroid

operation. The ability to completely eliminate the transcervical or Kocher incision for thyroid and parathyroid surgery continues to create excitement and interest from both patients and physicians worldwide.

Aside from curiosity and excitement the operation has also generated several questions. One of the most commonly asked questions is in regard to eligibility for the procedure. The question of eligibility has two components, the first is from the perspective of the individual patient as in what are the specific inclusion and exclusion criteria that any particular individual patient must meet in order to be a candidate for the operation. The second component is from the population level as in how many patients in a given population would be eligible for the operation based on the accepted inclusion and exclusion criteria. Both components are important questions. For the individual patient this is a clinical question that helps patients and physicians decide

**Table 1** Exclusion and inclusion criteria for TOETVA

Exclusion	Relative exclusions	Inclusion
Poorly differentiated thyroid cancer	Significant thyroiditis	Symptomatic goiter
Significant substernal extension	Minor substernal extension	Benign non-toxic nodule
Benign nodule size >6 cm	Posterior cancer near insertion of RLN	Benign toxic nodule
Malignant nodule size >2 cm	Positive central neck lymph nodes	Indeterminate thyroid nodule
Total thyroid length >10 cm	Severe gingivitis	Graves' disease
Total thyroid volume >45 mL	Presence of chin implant	Well-differentiated cancer
Reidel's thyroiditis		
Positive lateral neck lymph nodes		
Ongoing oral infection		
Significant medical comorbidity		

TOETVA, transoral endoscopic thyroidectomy vestibular approach; RLN, recurrent laryngeal nerve.

**Table 2** Exclusion and inclusion criteria for TOEPVA

Exclusion	Relative exclusions	Inclusion
Secondary hyperparathyroidism	Non-localized primary hyperparathyroidism	Primary hyperparathyroidism
Tertiary hyperparathyroidism	Ectopic parathyroid	

TOETVA, transoral endoscopic thyroidectomy vestibular approach.

if the operation is a good choice for an individual. The population level answer is also important to understand as it helps guide a broader discussion on whether the operation is applicable to a large percentage of the population and by extension how valuable might this procedure really be. This review article is written to provide the most up to date answer to both of these questions given the literature that is currently available.

### Individual patient eligibility

Currently, there is not complete consensus on the inclusion and exclusion criteria for TOETVA (1). This is mainly because the operation is still evolving and as of now there has not been a formal expert panel created to establish well-defined criteria. Until formal recommendations are established there will continue to be some controversy over the exact inclusion and exclusion criteria. This means that over time the inclusion criteria will likely continue to expand. A review of the known published small case series and opinion articles in which authors have described their own personal inclusion and exclusion criteria does show

some consensus. The majority of authors base their own inclusion and exclusion criteria on the original 60 case series published by Angkoon Anuwong (2). Based on this literature review the inclusion and exclusion criteria can be broadly grouped into three categories, namely patient motivation, medical and surgical history, and the organ system and its underlying pathology. With these broad groups in mind we first explore the individual patient level indications for this operation. After that we will explore the population level eligibility. The full list of inclusion and exclusion criteria can be found in *Table 1* for thyroidectomy and *Table 2* for parathyroidectomy.

### Inclusion criteria

Patient motivation is typically included as one of the main inclusion criteria for undergoing TOETVA. Because the operation is relatively new, it is currently not the gold standard operation for thyroid or parathyroid surgery. The traditional trans-cervical incision approach remains the gold standard operation at this time. With this in mind a patient must be made aware of this, which means the patient must

be self-motivated on some level to avoid a visible scar across the front of their neck in order to meet inclusion criteria. The motivation behind why a patient may want to avoid the traditional incision is beyond the scope of this article, and is not necessarily a part of the inclusion criteria, as each patient has their own intrinsic value system that surgeons may not completely understand or even agree with. However, it has been well documented that there are many valid reasons why a patient may be motivated to avoid a visible scar on the front of the neck (3-5). Within the idea of patient motivation, a history of hypertrophic scar or keloid is one of the more obvious indications for the procedure, and is one of the inclusion criteria that could be described as “medically necessary”.

The second inclusion criterion is the organ being operated upon and its underlying pathology. The initial decision to operate is dictated by the disease process, not by the type of operation. Thus it should first be determined if a patient needs either a thyroid or parathyroid operation based on standard clinical reasoning and guidelines, and only after that determination has been made should the operative approach be considered, at which point the inclusion and exclusion criteria for TOETVA should be applied. The TOETVA procedure allows access to the central neck, thus any central neck pathology could conceivably be operated upon with the TOETVA. At this time the majority of international experience is mostly limited to the thyroid and parathyroid, thus the main organ-based inclusion criteria are operations for the thyroid and parathyroid. However, this is only a relative inclusion criteria as there have been reports of Sistrunk procedures, thyroid cartilage shaving, and central neck lymph node dissections also being done via the vestibular approach. As the operation matures the inclusion criteria will likely continue to expand. For thyroid pathology it is currently considered acceptable to operate on symptomatic goiters, benign non-toxic nodules, toxic nodules, indeterminate thyroid nodules, Graves’ disease and well-differentiated thyroid cancer. For parathyroid pathology primary hyperparathyroidism is the main indication at this time.

### *Exclusion criteria*

Once it is determined that a patient needs either thyroid or parathyroid surgery, and they are highly motivated to avoid a visible scar across the front of their neck, exclusion criteria should be used to determine if the patient’s disease characteristics and anatomy are amenable to the vestibular

approach. Size is used as the first main exclusion criteria for TOETVA. There are several reasons why size may limit the ability to perform TOETVA. First, because the operation is endoscopic the working space is limited by the confines of the flap created. This means there may not be enough space to physically manipulate very large glands or very large individual nodules within the confines of the flap making visualization and exposure difficult. The second limitation based on size is the ability to remove the specimen through the midline vestibular incision. This limitation occurs based on both the size of the midline incision that can be made as well as the angle and protuberance of the chin. The final consideration based on size is whether the pathology is benign or malignant. In order to extract large nodules, while not typical, it may sometimes be necessary to remove them in pieces, thus malignant tumors are more limited in size. There are alternative methods of extraction of large specimens via either an axillary incision or a small submental incision, however this is a modification of the standard TOETVA approach.

Benign pathology size limitations depend on three factors, the length of the thyroid, the diameter of the individual benign nodule, and the volume of the thyroid. There is some variation in individual author recommendations for all of these limitations. However based on what is currently technically feasible and has been shown to be possible the maximum length of a thyroid that can be safely removed with TOETVA is 10 cm. Anything larger than this is difficult to maneuver within the subplatysmal flap space. The maximum diameter of a benign nodule is 6 cm. Again, anything larger than this takes up so much space that manipulation of larger nodules makes visualization and exposure difficult. The final criterion is volume of the thyroid lobe. In essence this is a combination of the first two criteria, both length as well as nodule size, and likely is ultimately the best criteria to use when trying to determine size limitations. However, because thyroid volume is not a routinely used indicator of size in thyroid surgery this measurement may be more difficult for the surgeon to conceptualize, and has been less well-defined in the literature. Some have suggested that a thyroid volume >45 mL should be excluded.

Exclusion criteria for malignant pathology are more strict than for benign disease. Oncologic outcomes are of utmost importance and weigh more heavily in the decision-making process, thus it stands to reason that a stricter cutoff criterion for malignant pathology is warranted. Most of the concern regarding malignant nodules is due to concern

for breaking the nodule's capsule during the operation or while trying to extract the specimen. Capsule disruption could theoretically cause tumor spread, and it can also make a complete diagnosis difficult. There are no definitive data to describe exactly what the cutoff size should be for malignant tumors, thus currently accepted limitations are based on arbitrary cutoffs. To make sure that a tumor can be easily removed through the midline without concern for disruption most authors have recommend limiting malignant pathology to nodules no greater than 2 cm in size. This is an arbitrary cutoff as larger nodules can most certainly be removed safely without disruption. But without long-term data on oncologic outcomes caution is warranted. At this time the more restrictive 2 cm cutoff remains the general consensus. There is also a general consensus that these operations should be limited to well-differentiated papillary and follicular thyroid cancer. There is no role for a relatively new operation being applied to aggressive cancers such as poorly differentiated or anaplastic thyroid cancer. Currently there is very limited experience with resection of medullary thyroid cancer using the vestibular approach thus it remains a relative contraindication.

Substernal extension is another relative contraindication listed by most authors. It is a relative contraindication partly because there is limited experience with resection of substernal goiters. There are known cases of removal of thyroids with significant substernal extension, however the limits of what is possible with substernal extension have yet to be well-defined. One of the concerns with operating on substernal goiters via the vestibular approach is the ability to clearly avoid the intrathoracic vasculature and more importantly the ability to control bleeding from these vessels should it be necessary. Currently due to the limited experience with TOETVA substernal extension remains a relative contraindication.

After patient motivation and organ system considerations the patient's personal medical and surgical history are also factors. A history of having previous thyroid surgery with a trans-cervical incision is a relative contraindication. It is known that reoperative thyroid surgery is feasible with TOETVA, thus it is not the reoperation that is the contraindication in this circumstance (6). Rather if an incision is already on the front of the neck there is no reason to approach the thyroid in the reoperative setting via TOETVA. However, there is an exception to this contraindication. There are circumstances in which a reoperation for thyroid surgery would require a second counter incision on the front of the neck. An example of

this would be a patient who had a thyroid lobectomy for a symptomatic goiter who presents many years later with a contralateral symptomatic goiter whose initial incision is now so low on the neck/upper chest that it cannot be used for the reoperation, which would necessitate a second neck incision. In this circumstance TOETVA would be an alternative approach that would prevent this patient from having two scars on the neck.

An active oral infection is another contraindication to TOETVA. As with any other elective or semi-elective procedure, an active infection at the site of planned surgical incision is a contraindication to proceeding. Any active oral infection should be treated prior to TOETVA. Other intraoral contraindications that have been discussed include dental braces and significant dental plaque that may necessitate professional dental cleaning. Some authors have suggested these are also exclusion criteria, however this is a minority of authors and the general consensus is that braces and extensive dental plaques are not contraindications to TOETVA. Dental wax should be applied to braces to avoid the sutures from being caught in the braces postoperatively and to avoid irritation of the fresh incisions.

A history of previous surgery on the chin and mandible must also be taken into consideration and can be considered a relative exclusion criterion. For example the presence of a chin implant is a relative exclusion. In this case a modified version of TOETVA must be used in which the central port is placed in a small submental incision below the implant (7). The lateral ports can still be placed in the oral vestibule as long as they do not interfere with the implant. Previous chin filler injections are also relative contraindications as these fillers can make creation of the central port tract difficult and can also make extraction of the specimen difficult. Mandibular advancement surgery and previous mandibular osteotomies are relative contraindications as this may have changed the anatomy of the mental nerve foramen and care must be taken in evaluating these patients. These are all considered relative exclusion criteria rather than strict exclusion criteria because the majority of these situations can be circumvented, however this requires extensive experience on the part of the surgeon. All of these situations have been encountered by surgeons currently performing TOETVA and there are known cases in which TOETVA has been performed successfully in all of the above situations, however the experience remains limited.

There is significantly less experience with parathyroid surgery via the vestibular approach worldwide. This is mainly due to the fact that parathyroid surgery is much less

common in the countries where transoral endocrine surgery originally evolved, thus by default there have been fewer patients available to have the operation in the initial phases of the procedure. However, as the transoral endocrine surgery has expanded into the United States, the early adopters there have begun to accumulate experience with parathyroid surgery via the vestibular approach. Because expansion in the United States is still limited relative to the Asian countries, the experience with parathyroidectomy remains limited. However, based on the current experience, mostly from US based surgeons, some consensus regarding parathyroid surgery has emerged. The exclusion criteria for parathyroid surgery using the vestibular approach include secondary and tertiary hyperparathyroidism. While technically feasible these operations have been found to be extremely challenging even in expert hands, thus this remains a contraindication at this time. This is due to the difficult anatomy, inflammation of the parathyroid, increased vascularity of the parathyroid in these situations, and possible anatomic involvement of the recurrent laryngeal nerve in the inflamed parathyroid. Non-localized primary hyperparathyroidism remains a relative exclusion criterion at this time. A four-gland exploration is feasible via the vestibular approach and some surgeons have argued that anecdotally there is actually better visualization of small glands in traditionally difficult to access locations such as under the recurrent laryngeal nerve on the right side. However, the general consensus at this time is that parathyroid surgery via the vestibular approach is still relatively new and with limited experience a four-gland exploration remains a relative contraindication. If a surgeon has to convert from a focused single parathyroid resection to a four-gland exploration in the course of a planned focused parathyroidectomy, it is reasonable to first explore the remaining parathyroids via the vestibular approach, however a surgeon should have a low threshold for conversion to open in this situation if the remaining glands are not easily identified. Finally, ectopic parathyroids are a relative contraindication to the vestibular approach, however this has to be taken into consideration case by case and depends on whether the location is a favorable to be accessed via the vestibular approach.

### Population-level eligibility

The question of how many people in the population would be eligible for transoral endocrine surgery is important. This is partly due to the fact that the traditional standard

approach to thyroidectomy and parathyroidectomy is already a very good operation. Thus in order for any new operation to compete with what is already a good gold-standard, the new procedure must prove to be impactful in some way. Judging the impact of a new operation on future generations is not an easy task, and is typically one of the factors that greatly limits many new procedures in their early phases. An impact of a new procedure can be judged by the impact of each individual operation on a single patient as well as the impact in aggregate across a population. For example, a new operation that has no alternative, is completely novel, and cures a life-threatening disorder would have a big impact at the individual level, thus this would be considered an important advancement, even if it had a very limited applicability to the general population. On the other extreme a new procedure that provides a very small benefit to any particular single individual, but was applicable to a large number of people in the population could likewise be considered to be impactful. This also means that a procedure with a small individual benefit that only benefits a few people would not be considered very important or impactful. In the beginning phases of TOETVA many skeptics of the procedure claimed the procedure belonged in this latter category, a procedure with a small individual benefit and limited population level applicability. Many felt it was a procedure that may provide some small benefit to an individual patient, but because of the exclusion criteria discussed above, it would have minimal impact because so few patients would be eligible for the operation. Indeed as we have seen in the earlier part of this chapter, there is what seems to be a long list of exclusion criteria, which calls into question whether or not the operation is valuable.

The first part of the value assumptions depends on how valuable the operation is to each individual patient. That issue is discussed in detail in a different chapter of this book. For our purposes we will assume that the operation has some value for the individual patient, whether it be large or small is not necessarily important as we will show. Given that it is not a novel life-saving procedure without any alternative, in order to be valuable the operation has to be able to positively impact a large number of people for who the operation is intended. This leads to the second part of these assumptions, i.e., how many people in the general population are eligible for TOETVA, and why this question of population level eligibility is so important. The larger this number is the more value TOETVA has as a new procedure.



**Table 3** Percentage of patients eligible for TES by diagnosis

Eligible for TES	No./total No. (%)				P value
	Institution #1 (n=334)	Institution #2 (n=333)	Institution #3 (n=333)	Total (n=1,000)	
Indeterminate thyroid nodule	58/72 (80.6)	43/71 (60.6)	64/74 (86.5)	165/217 (76.0)	0.08
Benign thyroid condition	36/55 (65.5)	34/59 (57.6)	96/126 (76.2)	166/240 (69.2)	<0.001
1° hyperparathyroidism	54/121 (44.6)	68/107 (63.6)	36/45 (80.0)	158/273 (57.9)	<0.001
Thyroid cancer	22/62 (35.5)	24/84 (28.6)	21/85 (24.7)	67/231 (29.0)	0.89
Other	1 (100.0)	0 (0)	0 (0)	1/2 (50.0)	0.37
Total	171/334 (51.2)	169/333 (50.8)	218/333 (65.5)	558/1,000 (55.8)	<0.001

Taken from “Patient Eligibility for Transoral Endocrine Surgery Procedures in the United States”, *JAMA Network Open*, May 31, 2019, Grogan *et al.* Open Access Article.

Currently there is only one paper in the literature that directly addresses this question. The paper by Grogan *et al.* is a retrospective review of 1,000 consecutive thyroid and parathyroid surgical cases that presented to three different high volume academic endocrine surgery units in the United States (8). Two of these endocrine surgery programs were general surgery and one was head and neck surgery. One program was on the East Coast, one in the Midwest, and one on the West Coast. The cases presented for surgery prior to the introduction of TOETVA in these institutions. Overall this represents a general picture of what types of cases present to an academic endocrine surgery practice in the United States. Once the cases were collected the list of inclusion and exclusion criteria for TOETVA as described previously in this chapter were applied to these cases to determine how many of these 1,000 cases would have been eligible for a transoral procedure. The authors found that 56% of all thyroid and parathyroid procedures that presented to these institutions were eligible for a transoral procedure (see *Table 3* for details). Using current estimates of the number of thyroid and parathyroid procedures done annually in the United States, this meant that approximately 140,000 patients per year in the United States could benefit from a scarless procedure. It is likely that these numbers are actually underestimates of eligibility for the general thyroid and parathyroid population. The reason being that in these academic institutions 10% of cases were reoperations, 5% presented with lateral neck lymph nodes, and 18% of parathyroids were not well-localized. Thus the referral patterns are biased toward more complex cases that are not completely representative of the average thyroid or parathyroid case. Regardless of the possibly underestimation, this finding was significant

as it showed that contrary to previous assumptions, a large number of thyroid and parathyroid patients are eligible for the transoral approach. Thus TOETVA is an operation that even if its impact on any one individual may be debatable, because of its broad applicability on a broader population level the significance and impact would be quite large if the procedure was widely available. With this in mind it is no longer debatable as to whether or not the operation has intrinsic merit. As long as the operation is as safe and as effective as the traditional approach, then the operation becomes a valuable operation with merit on a population level. However, this finding does uncover another challenge, which is how to safely teach the operation for wide-spread adoption of the technique. This finding is also regardless of how any one individual perceives the value of TOETVA. If a single individual places a large value on not having a scar, then this is also a reason why this is a valuable operation, and also why patient motivation is an important inclusion criterion. Given these findings it is more than reasonable to continue to develop and study the TOETVA operation to understand how safe and effective it truly is, and if proven it should be viewed as a viable and beneficial alternative to the traditional approach in the correctly selected patient.

## Conclusions

Transoral endocrine surgery is an operation that allows a way to cure thyroid and parathyroid disease without leaving any visible scar on the front of the neck. As it has evolved the earlier adopters of the operation have come to a general consensus on what is currently technically possible and not possible with the operation. From this we have been able to create a general list of inclusion and exclusion criteria for

the procedure. While at first glance this list may seem to preclude many people from benefitting from the operation, the reality is that a large number of surgical candidates World-Wide could benefit from the positive value of this operation.

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## References

1. Razavi CR, Russell JO. Indications and contraindications to transoral thyroidectomy. *Ann Thyroid* 2017;2:12.
2. Anuwong A. Transoral Endoscopic Thyroidectomy Vestibular Approach: A Series of the First 60 Human Cases. *World J Surg* 2016;40:491-7.
3. Coorough NE, Schneider DF, Rosen MW, et al. A survey of preferences regarding surgical approach to thyroid surgery. *World J Surg* 2014;38:696-703.
4. Grogan RH, Aschebrook-Kilfoy B, Angelos P. Interventions to improve thyroid cancer survivors' quality of life. *Future Oncol* 2016;12:1309-11.
5. Arora A, Swords C, Garas G, et al. The perception of scar cosmesis following thyroid and parathyroid surgery: A prospective cohort study. *Int J Surg* 2016;25:38-43.
6. Razavi CR, Tufano RP, Russell JO. Completion thyroidectomy via the transoral endoscopic vestibular approach. *Gland Surg* 2018;7:S77-S79.
7. Chen Y, Chomsky-Higgins K, Nwaogu I, et al. Hidden in Plain Sight: Transoral and Submental Thyroidectomy as a Compelling Alternative to "Scarless" Thyroidectomy. *J Laparoendosc Adv Surg Tech A*. 2018;28:1374-7.
8. Grogan RH, Suh I, Chomsky-Higgins K, et al. Patient Eligibility for Transoral Endocrine Surgery Procedures in the United States. *JAMA Netw Open* 2019;2:e194829.

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