



Original Research

Patient Eligibility for Transoral Endoscopic Thyroidectomy Vestibular Approach in an Endemic Region

Ozgun Cevdet Kose, Yigit Turk, Murat Ozdemir, Ozer Makay, Gokhan Icoz

Department of General Surgery, Division of Endocrine Surgery, Ege University School of Medicine, Izmir, Turkey

Abstract

Objective: Transoral endoscopic thyroidectomy vestibular approach (TOETVA) is a scarless method that enables thyroidectomy using natural orifice of the body. The opinion which is even common among TOETVA performing surgeons is that this surgery involves a small percentage of thyroidectomy applied patients. In this study, based on the currently accepted exclusion criteria, we aimed to determine what percentage of patients, who underwent thyroidectomy in an endemic area are actually suitable for TOETVA.

Methods: Between January 2017 and December 2019, 1197 consecutive patients who underwent surgery for thyroid pathology in our clinic were analyzed retrospectively. Pre-operative evaluations were made according to the current exclusion criteria and as a result, patients with no previous neck surgery, no history of radiotherapy, no retrosternal thyroid extension, and none lymph node dissection operation been made and whose thyroid gland diameter is <10 cm and gland volume is not more than 45 ml, malignant nodule diameter is <2 cm, and benign nodule diameter is <4 cm are involved to this study by being considered appropriate for TOETVA procedure.

Results: According to the criteria, 513 patients (42.8%) were found suitable for TOETVA. A total of 421 (82%) of these patients were female and 92 (18%) were male. The mean age was 46.2 ± 13.2 . A total of 192 (37%) of these patients were operated due to the benign reasons, and 321 (63%) of these patients operated due to the malignancy or suspicion of malignancy. Average nodule size was 1.9 cm, and the average thyroid volume was 23.8 ml among benign patients. Whereas among malignant patients, the average nodule size was 1.7 cm and the average thyroid volume was 21.8 ml. A total of 462 (90.1%) of the patients were applied to the total thyroidectomy and 51 (9.9%) of the patients were applied to the hemithyroidectomy. In the same period, 29 patients operated through TOETVA and 4 patients operated through bilateral axillary breast approach thyroidectomy. When the final pathology, results of the patients were examined, papillary thyroid carcinoma was seen in 301 (58.7%) patients, benign pathologies were seen in 192 (37.4%) patients, and 20 (3.9%) patients were diagnosed with other pathologies (follicular thyroid carcinoma, poorly differentiated carcinoma and Hürthle cell neoplasia, etc.).

Conclusion: Although “patient willingness” factor could not be included in the study, TOETVA eligible patient repository is wider contrary to popular belief. In our humble opinion, TOETVA method is going to pursue its spread and become a part of the routine surgical training session due to its effectiveness in terms of credibility in today’s world where cosmetic concerns gradually gain prominence.

Keywords: Minimally invasive endoscopic thyroidectomy; Scarless thyroidectomy; Transoral endoscopic thyroidectomy vestibular approach.

Please cite this article as: Kose OC, Turk Y, Ozdemir M, Makay O, Icoz G. Patient Eligibility for Transoral Endoscopic Thyroidectomy Vestibular approach in an Endemic Region. Med Bull Sisli Etfal Hosp 2021;55(3):304–309.

Address for correspondence: Yigit Turk, MD. Ege University Hospital, Department of General Surgery Bornova–Izmir 35100 Turkey

Phone: +90 232 390 50 50 **E-mail:** yigiturk87@gmail.com

Submitted Date: June 03, 2021 **Accepted Date:** July 28, 2021 **Available Online Date:** September 24, 2021

©Copyright 2021 by The Medical Bulletin of Sisli Etfal Hospital - Available online at www.sislietfaltip.org

OPEN ACCESS This is an open access article under the CC BY-NC license (<http://creativecommons.org/licenses/by-nc/4.0/>).



Introduction

Thyroid gland disorders are more prevalent in women than men on both nationally and globally which affect about 3.5% of our population.^[1] For all of these disorders, surgical procedures are the therapeutic choice.

Conventional thyroidectomy, which is first identified by Theodor Kocher in the 19th century and conducted through a transcervical incision in front of the throat, is still the gold standard of thyroid surgery due to its high level of safety and efficacy.^[2,3] Unhealed scars after neck surgery are not desirable in today's culture, where esthetic considerations are paramount.^[4,5] Therefore, remote access has gained prominence during the last decade and has been implemented.^[6] So far, 20 distinct endoscopic thyroidectomy procedures with variants have been reported in this pursuit.^[7] Many of these approaches have lost popularity over-time due to the distance from the target organ, necessity of extensive dissection, and other complications.

Natural orifice transluminal endoscopic surgery (NOTES) method enables endoscopic surgery to be done without making a skin incision using the body's natural orifices. Although this method created excitement among thyroid surgeons, it was abandoned after the first sublingual and transtracheal operations because of the severe tissue damage, limited range of motion in the surgical area, high intraoperative complication, and high rates of conversion to conventional open surgery methods.^[8-10]

Among NOTES techniques, the transoral vestibular approach was first demonstrated on a cadaver in 2011 under the leadership of Richmon *et al.* In 2014, the transoral endoscopic thyroidectomy vestibular approach (TOETVA) method was applied in 60 volunteer patients by Anuwong, and technical standardization was achieved with the publication of the results in 2016. It attracted attention with better cosmetic results and minimal complication rates.^[11,12] Following the initial sequence, this method expanded to several nations and it was observed to be effective and reliable on 700 cases in only 3 years and then succeeding new cases' have been documented every year.^[13]

With the increasing experience of surgeons in TOETVA procedure, which is the most common NOTES technique for thyroidectomy today, it has been shown that neck dissections (e.g., lymph node dissections of central <level 6> and lateral <level 2,3,4> neck levels), which were previously thought to be ineligible, can be performed and this surgical method has shed light on the further development.^[14-16]

Thus far, the TOETVA has been shown to be safe and efficient, but it must be proven further through multicenter clinical trials. Besides, according to a common consensus

with physicians who conduct this treatment is that thyroidectomy is performed on a limited subset of patients.^[17,18] While controversy persists about its prevalence and applicability to the general population, there is little research on the topic.

This research aimed to ascertain the content and applicability of this treatment in the general patient community using generally recognized exclusion criteria; we also hoped to gain insight into his possible role in thyroidectomy operations and his eligibility for inclusion in the surgical assistant core training program.

Methods

Between January 2017 and December 2019, we retrospectively examined 1197 consecutive patients who underwent a surgery for thyroid pathology in our clinic. We analyzed the patients' demographic records, operative reports, pre-operative ultrasonographic characteristics (nodule size, gland volume, and nodule diameter), type of surgery, and histopathological characteristics. To ascertain the number of instances that qualify for TOETVA, standard exclusion requirements from the literature were used.^[19-21] Patients diagnosed with medullary cancer were excluded from the research because they could have an indication for prophylactic central neck dissection since all patients with nodule had routine calcitonin measurement in our clinic. These conditions are as follows: Prior neck surgery, the experience of neck radiotherapy, lymph node dissection, retrosternal expansion, thyroid gland diameter >10 cm, thyroid gland volume >45 ml, malignant nodule diameter larger than 2 cm, and benign nodule diameter larger than 4 cm (Table 1). The study was approved by the

Table 1. Inclusion and exclusion criteria for TOETVA

| Inclusion criteria | Exclusion criteria |
|---------------------------------------|--|
| Thyroid diameter ≤10 cm | Substernal goiter (Grade 2 and above) |
| Thyroid volume ≤45 mL | Radiation on the neck |
| Nodule size ≤2 cm if malign pathology | Previous neck surgery |
| Nodule size ≤4 cm if benign pathology | Lymph node or distant metastasis |
| Graves' disease | Extrathyroidal extension including tracheal or esophageal invasion |
| Substernal goiter (only Grade 1) | Under 18 years old |

TOETVA: Transoral endoscopic thyroidectomy; vestibular approach.

Local Ethics Committee on May 6, 2021, and this study was conducted in accordance with the Declaration of Helsinki (Approval Number: 21-5T/84).

Statistical Analysis

The study is a retrospective-descriptive research, and the data were analyzed using the statistical software program SPSS (Statistical Package for the Social Sciences– IBM® SPSS Statistics for Windows, Version 24.0. Armonk, NY: IBM Corp.). The Kolmogorov–Smirnov test was used to assess the compliance of continuous variables with the assumption of normal distribution. Descriptive statistics were provided in the form of categorical variables of numbers and percentages and numerical variables of mean and standard deviation.

Results

Five hundred and thirteen patients (42.8%) of 1197 patients met the inclusion criteria for the TOETVA. The average age was 46.2±13.2 years. A total of 421 (82.1%) of these patients were female while 92 (17.9%) were male. The mean nodule size was 1.9 cm in benign patients and the mean thyroid volume was 23.8 ml. The mean nodule size was 1.7 cm in malignant cases and the mean thyroid volume was 21.8 ml (Table 2).

Cytologically, 321 (36.3%) of 882 patients with malignant and/or malignancy suspicion and 192 (60.9%) of 315 patients with benign thyroid pathology were considered

to be TOETVA candidates (Table 3). A total of 192 of the patients were operated because of benign reasons; 67 of them (34.9%) were operated due to the Graves' disease and toxic nodular goiter and 125 of them (65.1%) were operated for multinodular goiter. Malignancy was seen in the definitive pathology results of 18 patients from this group. A total of 480 were operated with conventional thyroidectomy, 29 with TOETVA, and 4 with bilateral axillary breast approach thyroidectomy technique; 462 (90.1%) of these patients underwent total thyroidectomy and 51 (9.9%) hemithyroidectomy. When the definitive pathology results of the patients were examined, 301 (58.7%) patients had papillary thyroid carcinoma, 192 (37.4%) patients had benign pathologies, 8 (1.6%) patients had follicular carcinoma of the thyroid, 7 (1.4%) patients had non-invasive follicular thyroid neoplasm with papillary-like nuclear appearance (NIFT-P), 4 (0.7%) patients had Hürthle cell thyroid carcinoma, and 1 (0.2%) patient had poorly differentiated carcinoma. A total of 192 of the patients (37.4%) whose definitive pathology result was benign; follicular nodular disease in 117 of them (66.9%), Graves' disease in 66 (34.4%), follicular adenoma

Table 2. Patients' characteristics

| Characteristics | n (%) or mean (±SD) |
|---|---------------------|
| Gender | |
| Female | 421 (82.1%) |
| Male | 92 (17.9%) |
| Age (years) | 46.2 (±13.2) |
| Type of surgery | |
| Hemithyroidectomy | 51 (9.9%) |
| Total thyroidectomy | 462 (90.1%) |
| Benign thyroid disease | |
| Gland volume (mL) | 23.8 (±10.0) |
| Estimated thyroid diameter (cm) | 5.3 (±10.5) |
| Nodule size (cm) | 1.9 (±13.7) |
| Malignant disease or suspicious of malignancy | |
| Gland volume (mL) | 21.8 (±10.3) |
| Estimated thyroid diameter (cm) | 5.1 (±11.0) |
| Nodule size (cm) | 1.7 (±10.9) |

SD: Standard deviation.

Table 3. Percentage of patients eligible for TOETVA by indication

| | Eligible n (%) | Not eligible n (%) | Total n (%) |
|---------------------------------------|-------------------|-----------------------|----------------|
| Benign thyroid condition | 192 (37.4%) | 123 (18%) | 315 (26.3%) |
| Malignant or suspicious of malignancy | 321 (62.6%) | 561 (82%) | 882 (73.7%) |
| Total | 513 | 684 | 1197 |

TOETVA: Transoral endoscopic thyroidectomy; vestibular approach.

Table 4. Reasons not to be eligible for TOETVA

| | n (%) |
|--------------------------------------|-------------|
| Multiple contraindications | 147 (21.5%) |
| Reoperation | 145 (21.2%) |
| Neck dissection for cancer | 112 (16.4%) |
| Thyroid gland volume >45 mL | 94 (13.7%) |
| Malign thyroid nodule >2 cm | 82 (12%) |
| Benign thyroid nodule >4 cm | 56 (8.2%) |
| Substernal goiter (Grade 2 or above) | 42 (6.2%) |
| Estimated thyroid diameter >10 cm | 5 (0.7%) |
| Previous neck radiation | 1 (0.1%) |
| Total | 684 (100%) |

TOETVA: Transoral endoscopic thyroidectomy; vestibular approach.

in 5 (2.6%), and normal thyroid tissue in 4 (2.1%) were detected.

Among all 1197 patients examined, the most common reasons for not being a suitable candidate were patients' having multiple contraindications in 21.5%, need for reoperation in 21.2%, and neck dissection in 16.4% (Table 4).

Discussion

As an endocrine surgery clinic at a tertiary center, it is determined that 42.8% of patients qualified for thyroid surgery are candidates for TOETVA. Although there is inadequate data on the annual number of thyroidectomy operations conducted in this patient community in our country, there is no research evaluating the TOETVA method's eligibility.

According to the World Health Organization's thyroid cancer numbers declared in 2020, approximately 12,000 patients are diagnosed with thyroid cancer per year in our country.^[22] Considering that approximately 40,000 thyroidectomy operations are performed because of benign pathologies and cancer suspicion. Our data show that TOETVA can be applied to around 15,000–20,000 patients annually in our country. Quite the contrary to what is believed, TOETVA can be applied to a larger patient population rather than a small patient group.

In a similar study performed on 1000 patients in the United States (two general surgery department and one otolaryngology – head-and-neck endocrine surgery department), it was found that 55.8% of the patients who required an operation due to thyroid and parathyroid surgery were eligible for transoral endoscopic surgery. The reason that this research's results were greater than ours was assumed to be due to the fact that our country is situated in an endemic area and/or the United States is non-endemic and parathyroidectomy surgeries were not included in our research.^[23]

Acquiring manual dexterity in TOETVA training requires an individual training.^[24] In addition, the surgeon has to master the anatomy of the perioral, chin, and submental regions to minimize possible complications.^[25] Present TOETVA trainings in our country are carried out in local surgical centers and in certain periods to a limited number of participants. In our opinion, it is possible to reach this high patient potential by supporting TOETVA training, providing this training to a wider surgeon group, being included in the surgical assistant core program and increasing patient awareness. It should also be noted that the capability of surgeons with increasing experience to perform "central and/or lateral lymph node dissections" will expand the patient repository suitable for TOETVA.^[15,16]

To be accepted by everyone and to become more widespread, this technique ought continue to find answers for questions such as; "Is it as safe as open surgery at least?" and To what extent does having no anterior neck incision affect the patient's quality of life? Anuwong *et al.* reported that in a series of 425 patients, there was minor post-operative pain relative to traditional thyroidectomy, and the expected blood loss and complication rates were comparable.^[26] Prolonged operation time compared to conventional thyroidectomy may be a limitation that prevents TOETVA from becoming widespread. While the operation period was prolonged in the same report, it was shown in several studies that the operation time decreased with adequate preparation and practice due to the TOETVA's low learning curve.^[27,28] Numerous multicenter researches verifying the safety and effectiveness of TOETVA are continued to be conducted and larger-scale randomized controlled trials remain necessary due to the small number of case.^[29-31]

Thyroiditis was seen in 46 (8.9%) of the patients who were deemed appropriate for TOETVA. Although thyroiditis was first seen as an exclusion criterion in the learning process along of parenchymal fibrosis and dissection difficulties, TOETVA may now be implemented to current patients depending on the surgeon's choice as experience grows. Pre-operative thyroiditis was found in 3(10.3%) of the 29 patients who underwent TOETVA at our clinic. Furthermore, Dinc *et al.* found that TOETVA had comparable complication rates in thyroiditis patients when compared to traditional thyroidectomy.^[32]

While scarring is less significant in Turkish culture than in far eastern and western cultures, our society's consciousness grows as appearance becomes more critical in contemporary social life.^[4,33,34] Scars are critical in this regard especially in visible parts of the body in everyday life such as the frontal part of the neck.

In a study using the Dermatology Quality of Life Index to investigate the effect of thyroid scars on quality of life, the mean score was 9.02 similar to that of patients with chronic skin diseases such as psoriasis, vitiligo, and severe atopic dermatitis. In this aforementioned study, the quality of life was not related to the severity of the wound. It was determined that it is related to the presence of the wound and it was emphasized that smaller incisions should be preferred in addition.^[5]

In a questionnaire study conducted by Coorough *et al.*, the participants were asked questions with hypothetical scenarios and despite the four times higher risk of complications compared to conventional thyroidectomy, patients preferred endoscopic surgery.^[4] In the same study, it was stated that participants would agree to pay an additional

fee for the endoscopic approach versus conventional thyroidectomy. While in another question, it was noteworthy that 20% of the participants preferred the endoscopic method, even though they were said thyroid cancer treatment might not be possible. With these studies, it is seen that some patients or potential patients avoid cervical incision, take the additional surgical risk, and accept additional cost burden.

One of the limitations of our study is that our hospital is a tertiary health center serving more cancer cases than the general population. For this reason, patients who require neck dissections and more reoperations due to metastatic, locally advanced, and recurrent cases are operated. Therefore, the proportion of patients who can receive TOETVA may be higher in the general patient population. In addition, the suitability for the operation was evaluated by this study according to the indications for which only the thyroid tissue was evaluated. If conditions such as anatomical incompatibilities of the patients, body mass index, oral or dental infections, and severe thyroiditis were included, the percentage of patients eligible for TOETVA may decrease. The most crucial factor is that "Patient's willingness" was not included in the study. Since this study is a retrospective study, it is not known how many of the patients included in the study would accept the TOETVA procedure. Therefore, more prospective studies are needed.

In the past 20 years, endoscopic and robotic interventions have been increasing gradually as the rising generation surgeons prefer minimally invasive methods and they are more eager to the innovative approaches than the traditional approach.^[35,36] This situation will inevitably cause the widespread use of endoscopic thyroid surgery, according as in other surgical procedures.

Conclusion

Patients as well as surgeons are increasingly interested in the TOETVA procedure, which has proven its efficacy and safety, because thyroid cases are increasing day by day and therefore the cosmetic concerns of the society are increasing gradually. In line with our data, it has been seen that in nearly half of the patients applying for thyroid surgery, TOETVA can be applied and contrary to common belief the patient repository is much larger. As a result, any patient with an indication should be informed about the alternative TOETVA procedure and the option of scarless thyroidectomy should be offered. We foresee that TOETVA will become more widespread with adequate surgical training and informing patients about the procedure, and we think that it will take its place in routine surgical assistant training in the coming years.

Disclosures

Ethics Committee Approval: This study was approved by the Ege University Medical Research Ethics Committee (Approval Number: 21-5T / 84) on May 6, 2021 and was conducted in accordance with the Declaration of Helsinki.

Peer-review: Externally peer-reviewed.

Conflict of Interest: None declared.

Authorship Contributions: Concept – O.C.K., M.O., G.I.; Design – O.C.K., Y.T., M.O., G.I.; Supervision – M.O., O.M., G.I.; Materials – O.C.K., Y.T.; Data collection &/ or processing – O.C.K., Y.T.; Analysis and/or interpretation – All authors; Literature search – O.C.K., Y.T., M.O.; Writing – All authors; Critical review – M.O., O.M., G.I.

References

- Özdemir M, Makay Ö, Lee KE, Kim HY, Robotik tiroidektomi. In: Altıntoprak F, editor. Robotik Cerrahi: Teknik, Ulusal Deneyimler ve Güncel Literatür Sonuçları. 1st ed. Ankara: Türkiye Klinikleri; 2009. p. 7–14.
- Halsted WS. IV. (I) The excision of both lobes of the thyroid gland for the cure of Graves's disease. (II) The preliminary ligation of the thyroid arteries and of the inferior in preference to the superior artery. *Ann Surg* 1913;58:178–82. [\[CrossRef\]](#)
- Scerrino G, Inviati A, Di Giovanni S, Paladino NC, Di Paola V, Lo Re G, et al. Esophageal motility changes after thyroidectomy; possible associations with postoperative voice and swallowing disorders: preliminary results. *Otolaryngol Head Neck Surg* 2013;148:926–32. [\[CrossRef\]](#)
- Coorough NE, Schneider DF, Rosen MW, Sippel RS, Chen H, Schwarze ML, et al. A survey of preferences regarding surgical approach to thyroid surgery. *World J Surg* 2014;38:696–703. [\[CrossRef\]](#)
- Choi Y, Lee JH, Kim YH, Lee YS, Chang HS, Park CS, et al. Impact of postthyroidectomy scar on the quality of life of thyroid cancer patients. *Ann Dermatol* 2014;26:693–9. [\[CrossRef\]](#)
- Berber E, Bernet V, Fahey TJ 3rd, Kebebew E, Shaha A, Stack BC Jr, et al; American Thyroid Association Surgical Affairs Committee. American Thyroid Association statement on remote-access thyroid surgery. *Thyroid* 2016;26:331–7. [\[CrossRef\]](#)
- Dionigi G, Tufano RP, Russell J, Kim HY, Piantanida E, Anuwong A. Transoral thyroidectomy: advantages and limitations. *J Endocrinol Invest* 2017;40:1259–63. [\[CrossRef\]](#)
- Liu E, Qadir Khan A, Niu J, Xu Z, Peng C. Natural orifice total trans-tracheal endoscopic thyroidectomy surgery: first reported experiment. *J Laparoendosc Adv Surg Tech A* 2015;25:586–91. [\[CrossRef\]](#)
- Karakas E, Steinfeldt T, Gockel A, Westermann R, Kiefer A, Bartsch DK. Transoral thyroid and parathyroid surgery. *Surg Endosc* 2010;24:1261–7. [\[CrossRef\]](#)
- Karakas E, Steinfeldt T, Gockel A, Mangalo A, Sesterhenn A, Bartsch DK. Transoral parathyroid surgery—a new alternative or nonsense? *Langenbecks Arch Surg* 2014;399:741–5. [\[CrossRef\]](#)

11. Richmon JD, Pattani KM, Benhidjeb T, Tufano RP. Transoral robotic-assisted thyroidectomy: a preclinical feasibility study in 2 cadavers. *Head Neck* 2011;33:330–3. [CrossRef]
12. Anuwong A. Transoral endoscopic thyroidectomy vestibular approach: a series of the first 60 human cases. *World J Surg* 2016;40:491–7. [CrossRef]
13. Russell JO, Razavi CR, Shaeer M, Chen LW, Lee AH, Ranganath R, et al. Transoral vestibular thyroidectomy: current state of affairs and considerations for the future. *J Clin Endocrinol Metab* 2019;104:3779–84. [CrossRef]
14. Tan Y, Guo B, Deng X, Ding Z, Wu B, Niu Y, et al. Transoral endoscopic selective lateral neck dissection for papillary thyroid carcinoma: a pilot study. *Surg Endosc* 2020;34:5274–82. [CrossRef]
15. Wang T, Wu Y, Xie Q, Yan H, Zhou X, Yu X, et al. Safety of central compartment neck dissection for transoral endoscopic thyroid surgery in papillary thyroid carcinoma. *Jpn J Clin Oncol* 2020;50:387–91. [CrossRef]
16. Ngo DQ, Tran TD, Le DT, Ngo QX, Van Le Q. Transoral endoscopic modified radical neck dissection for papillary thyroid carcinoma. *Ann Surg Oncol* 2021;28:2766. [CrossRef]
17. Yeh MW. Thyroid surgery through the mouth might not be as crazy as it sounds. *JAMA Surg* 2018;153:28. [CrossRef]
18. Hodin RA. Comment on Udelsman et al. *Ann Surg* 2016;264:e17. [CrossRef]
19. Dionigi G, Chai YJ, Tufano RP, Anuwong A, Kim HY. Transoral endoscopic thyroidectomy via a vestibular approach: why and how? *Endocrine* 2018;59:275–9. [CrossRef]
20. Razavi CR, Russell JO. Indications and contraindications to transoral thyroidectomy. *Ann Thyroid* 2017;2:12. [CrossRef]
21. Anuwong A, Sasanakietkul T, Jitpratoom P, Ketwong K, Kim HY, Dionigi G, et al. Transoral endoscopic thyroidectomy vestibular approach (TOETVA): indications, techniques and results. *Surg Endosc* 2018;32:456–65. [CrossRef]
22. IARC, Globocan 2020. Available at: <https://gco.iarc.fr/>. Accessed May 1, 2021.
23. Grogan RH, Suh I, Chomsky-Higgins K, Alsafran S, Vasiliou E, Razavi CR, et al. Patient eligibility for transoral endocrine surgery procedures in the United States. *JAMA Netw Open* 2019;2:e194829. [CrossRef]
24. Fama F, Zhang D, Pontin A, Makay Ö, Tufano RP, Kim HY, et al. Patient and surgeon candidacy for transoral endoscopic thyroid surgery. *Turk Arch Otorhinolaryngol* 2019;57:105–8. [CrossRef]
25. Celik S, Makay O, Yoruk MD, Bayzit Kocer I, Ozdemir M, Kilic KD, et al. A surgical and anatomo-histological study on Transoral Endoscopic Thyroidectomy Vestibular Approach (TOETVA). *Surg Endosc* 2020;34:1088–102. [CrossRef]
26. Anuwong A, Ketwong K, Jitpratoom P, Sasanakietkul T, Duh QY. Safety and outcomes of the transoral endoscopic thyroidectomy vestibular approach. *JAMA Surg* 2018;153:21–7. [CrossRef]
27. Lira RB, Ramos AT, Nogueira RMR, de Carvalho GB, Russell JO, Tufano RP, et al. Transoral thyroidectomy (TOETVA): Complications, surgical time and learning curve. *Oral Oncol* 2020;110:104871. [CrossRef]
28. Chai YJ, Chae S, Oh MY, Kwon H, Park WS. Transoral endoscopic thyroidectomy vestibular approach (TOETVA): surgical outcomes and learning curve. *J Clin Med* 2021;10:863. [CrossRef]
29. Fernandez Ranvier G, Meknat A, Guevara DE, Llorente PM, Vidal Fortuny J, Sneider M, et al. International multi-institutional experience with the transoral endoscopic thyroidectomy vestibular approach. *J Laparoendosc Adv Surg Tech A* 2020;30:278–83. [CrossRef]
30. Shan L, Liu J. A systemic review of transoral thyroidectomy. *Surg Laparosc Endosc Percutan Tech* 2018;28:135–8. [CrossRef]
31. Chen S, Zhao M, Qiu J. Transoral vestibule approach for thyroid disease: a systematic review. *Eur Arch Otorhinolaryngol* 2019;276:297–304. [CrossRef]
32. Dinc B, Gunduz UR, Belen NH. Transoral endoscopic thyroidectomy vestibular approach (TOETVA) in thyroiditis. *Surg Laparosc Endosc Percutan Tech* 2020;31:188–92. [CrossRef]
33. Lee S, Kim HY, Lee CR, Park S, Son H, Kang SW, et al. A prospective comparison of patient body image after robotic thyroidectomy and conventional open thyroidectomy in patients with papillary thyroid carcinoma. *Surgery* 2014;156:117–25. [CrossRef]
34. Linos D, Economopoulos KP, Kiriakopoulos A, Linos E, Petralias A. Scar perceptions after thyroid and parathyroid surgery: comparison of minimal and conventional approaches. *Surgery* 2013;153:400–7. [CrossRef]
35. Patel K. Robotics the future of surgery. *Int J Surg* 2008;6:441–2. [CrossRef]
36. Geng XP. How to balance the development of new surgical techniques and protection of patients' health interests. *Hepatobiliary Surg Nutr* 2020;9:333–5. [CrossRef]