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**Original Research Article**

# Transoral endoscopic thyroidectomy vestibular approach: early experience in a single centre

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## ABSTRACT

**Background:** Conventional open thyroidectomy is associated with a visible scar in the neck which may cause significant psychological distress to some patients, especially young women. Transoral endoscopic thyroidectomy vestibular approach (TOETVA) is an adaptation of the natural orifice transluminal endoscopic surgery (NOTES) technique to thyroid surgery and allows for a scarless surgery with minimal dissection.
**Methods:** This study retrospectively reviewed all TOETVA surgeries performed at the department of endocrine surgery between August 2016 and July 2018. Protocol for selecting patients for this novel approach included patients with clinically benign thyroid nodules less than 6cm in diameter, with a strong preference for scarless surgery. The surgery was performed endoscopically through the inferior oral vestibule using conventional laparoscopic instruments.
**Results:** A total of 11 patients were included. The mean size of the thyroid nodules was 3.72 cm. Hemithyroidectomy was performed in 7 patients and total thyroidectomy in 4. The median operative time was 150 minutes for hemithyroidectomy and 225 minutes for total thyroidectomy. One patient required conversion to open thyroidectomy due to excessive bleeding. Adverse effects included transient mental nerve palsy in 2 patients, temporary RLN palsy in 1 patient and temporary hpoparathyroidism in 1 patient. All 10 patients who underwent successful TOETVA reported satisfaction with the cosmetic outcome.
**Conclusions:** TOETVA can be used to offer scar free thyroidectomy in appropriately selected patients. Attention to the anatomy of the mental nerve is essential to prevent nerve injury. Additionally the relatively longer operative time could lessen with increasing operator experience.

**Keywords:** Scarless thyroidectomy, transoral thyroidectomy, thyroidectomy, endoscopic thyroidectomy, minimally invasive thyroidectomy

## INTRODUCTION

Visible scarring in the neck is a concern for a number of patients requiring thyroidectomy, as conventional thyroidectomy requires a 6 to 8 centimetre incision in the lower neck. Various remote access and endoscopic techniques have been developed over the past two decades to address this concern.[1–3] These techniques can be classified into those that use a cervical approach, and those that use an extracervical approach.[4] The cervical approach involves endoscopic surgery via a smaller cervical incision. The extracervical approaches include axillary, anterior chest, combined axillary and breast, posterior auricular and transoral approaches.[1,5–9] However, some of these techniques such as the axillary or the combined axillary and breast involve larger areas of flap dissection due to a lack of natural anatomic planes, and may not be truly minimally invasive.[1,2]

Natural orifice transluminal endoscopic surgery (NOTES) techniques have been adapted to thyroid surgery over the past ten years.[10,11] A sublingual approach through the floor of the mouth was initially used, but was not widely adopted due to the extent of tissue damage and a higher rate of complications and conversion to open surgery.[12,13] The Transoral Endoscopic Thyroidectomy - Vestibular Approach (TOETVA) popularized by Anuwong et al, uses conventional laparoscopic instruments via the oral vestibule.[9] This technique has become increasingly accepted as it is associated with less tissue damage, is safer and shows excellent cosmetic results.[14,15]

In this study, we report our early experience with a small series of patients who underwent thyroidectomy using the TOETVA technique at our institution.

## METHODS

This is a retrospective study including all patients who underwent transoral endoscopic thyroidectomy vestibular approach (TOETVA) between August-2016 and July-2018 at the department of Endocrine Surgery. Data was collected from the prospectively recorded hospital information system after getting institutional review board (IRB) clearance with IRB:11324. This research work has been reported in line with the process criteria[16].Our protocol for selecting patients for TOETVA included patients with a strong preference for scarless surgery, patients with benign and indeterminate cytology, thyroid gland diameter less than 6cm/ nodule size less than 6 cm. Patients with a history of prior neck surgery or radiation, or an FNAC diagnosis of malignancy were excluded from the study. All patients underwent routine preoperative evaluation which included thyroid function tests, ultrasound examination and fine needle aspiration cytology (FNAC).

As the sample size is small basic mean, median and mode was calculated using Microsoft excel.

### *Anatomy of mental nerve*

One of the drawbacks of the approach is the potential injury to the mental nerve, which can be avoided by a thorough understanding of its course during port placement. Avoiding injury to the mental nerve is critical to prevent loss of sensation over the lower lip. We performed cadaveric dissection to understand the anatomy of oral vestibule and mental nerve.

The mental nerve is the terminal branch of the inferior alveolar nerve. It enters the face through the mental foramen, where it is directed backwards, and supplies the skin of the lower lip and labial gingiva. The mental foramen, which transmits the mental nerve and vessels, lies below the apices of the lower pre-molar teeth, about two fingers' breadth from the median plane and about one finger's breadth above the lower border of the mandible. The mental nerve divides into three branches, two of which pass upward and forward to form an incisor plexus labial to the teeth, supplying the gingiva (and probably the periosteum). The third branch of the mental nerve passes through the intermingled fibres of depressor angularis and platysma to supply the skin of the lower lip and chin.

### *Operative technique and postoperative management*

The patient was placed in a supine position with neck extended with cushion supported posteriorly. Nasotracheal intubation was performed and the nostril and eyes were sealed with sterile sealing drapes. Oral cavity was prepped with chlorhexidine (0.1%) aqueous solution.

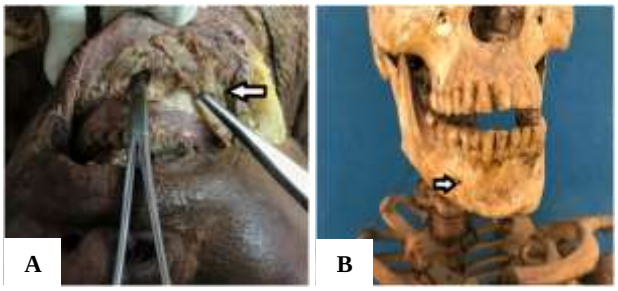


**Figure 1: (A) Mental nerve; (B) mental foramen.**

Three incisions were made in the inferior vestibule of the oral cavity – a 10 mm midline (camera) port, and two 5mm (working) ports laterally at the junction between the canine and first premolar teeth avoiding the mental nerve (Figure 1A and B). The midline access was tunneled through the lip and over the periosteum of the mentum to enter the subfascial plane in the midline right down to the sternal notch. The track was infiltrated with adrenaline saline solution and then dilated to place the three ports. The subfascial plane was further dissected to create a dome shaped working space over the full width of the strap muscles. Carbondioxide insufflation with a low pressure of 6 mm Hg was maintained to prevent subcutaneous emphysema and sufficient to keep the flap elevated. The midline was opened with hook cautery and the straps dissected carefully off the thyroid surface. A silk suture (2/0) was placed through the skin for lateral traction on the strap muscle.

The isthmus was mobilised and divided, entering the medial space, then the lobe was dissected from superior pole downwards posteriorly, visualising the superior parathyroid and the recurrent laryngeal nerve. The thyroid lobe was dissected out preserving the inferior parathyroid gland. The same was done for the opposite lobe and the specimen was extracted through the midline port.

The vestibular incision was closed using 4/0 polyglactin sutures. Drains were not used. A pressure dressing was applied over the neck and mandibular area for a period of

48 hours. Antibiotic prophylaxis included amoxcicillin + clavulanate at the time of induction and for 48hours after surgery. All patients were started on an oral diet on the second post-operative day.

***Outcomes***

All patients were reviewed on an OPD basis at 3months, 6months and 1 year after surgery. Patients with postoperative voice change were evaluated by laryngoscopy. A permanent RLN palsy was defined as one which did not recover in 6 months. Mental nerve injury was identified by paraesthesia over the lower lip following surgery. Hypoparathyroidism was defined as a serum parathyroid hormone <8 pg/ml, the day after surgery. Hypoparathyroidism persisting beyond 6 months was considered as permanent hypoparathyroidism.

## RESULTS

A total of 11 patients underwent TOETVA during the study period. All patients were female, with a mean age of 24 years (range 19 to 46). Seven (63%) patients were diagnosed with a solitary thyroid nodule, while four patients had a diagnosis of multinodular goiter. None of the patients had clinical or ultrasound features suggestive of locally invasive malignancy. Baseline characteristics are summarized in Table 1.

**Table 1: Baseline characteristics.**

| Characteristic (n=11) | | Value |
|---|---|---|
| **Mean age in years** | | 24 (21-46) |
| **Thyroid disease** | Solitary nodule | 7 (64%) |
| | Multinodular goiter | 4 |
| **FNAC** | Benign | 10 (91%) |
| | Atypia of undetermined significance | 1 |
| **Mean tumor size in centimetres** | | 3.72 (2-6) |
| **Ultrasound, thyroid imaging reporting and data system (TIRADS)** | TIRADS 2 | 1 |
| | TIRADS 3 | 9 (82%) |
| | TIRADS 4a | 1 |

**Table 2: Details of surgery.**

| | | N (%) |
|---|---|---|
| **Surgery** | Hemithyroidectomy | 7 (64) |
| | Total thyroidectomy | 4 |
| **Median operative time in minutes** | Hemithyroidectomy | 150 (150-180) |
| | Total thyroidectomy | 225 (165-360) |
| **Complications** | Temporary hypoparathyroidism | 1 (25) |
| | Transient mental nerve paresis | 2 (18) |
| | Temporary RLN palsy | 1 (9) |
| **Haemorrhage/infection** | Nil | |
| **Permanent hypoparathyroidism** | Nil | |
| **Permanent RLN palsy** | Nil | |


**Figure 2: (A) Pre-operative image; (B) post-operative day 7.**

The median operative time was 150 minutes (range 150 to 180 min) for hemithyroidectomy and 225 minutes (range, 165–360) for total thyroidectomy. Surgery was converted to open thyroidectomy in 1 patient due to excessive bleeding. Only one patient developed temporary hypoparathyroidism postoperatively. She was managed with oral calcium and calcitriol. Hypocalcemia resolved after 3 months. None had permanent hypoparathyroidism. One patient had minimal voice change after surgery, which recovered in 4 weeks. Her vocal cord assessment done 3 months after surgery showed mobile vocal cords. Transient mental nerve paresis was noted in 2 (18%) patients, which recovered fully in 4-8 weeks. None of the patients had mental nerve paresis or palsy at the 3 month follow-up. Other complications such as infection, hematoma or subcutaneous emphysema were not observed. All patients reported satisfaction with the cosmetic outcomes. Details of surgery and postoperative complications are summarized in Table 2.


**Figure 3: (A) Seventh post-operative day (mucosal stitches); (B) seventh post-operative day.**

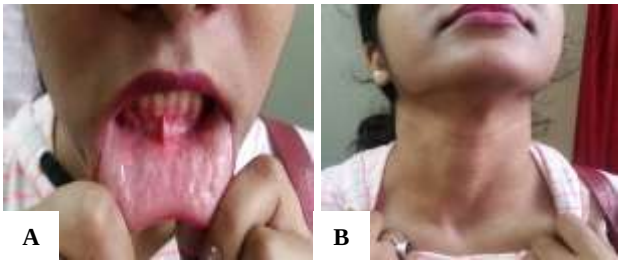


**Figure 4: (A) Seven months post-operative (no scar); (B) seven months post-operative.**

Histopathology revealed nodular hyperplasia in six patients, adenomatous hyperplasia in three and follicular variant of papillary thyroid carcinoma in two patients. Cosmetic outcomes are depicted in the above photographs (Figure 2 to 4).

## DISCUSSION

Various remote access techniques for thyroid surgery have been introduced over the past two decades with the aim of minimizing visible scarring in the neck. A cosmetically pleasing outcome is of significant importance to a number of patients, especially young women. In addition to cosmesis, an ideal remote access technique would also be associated with lesser tissue trauma, faster wound healing and a lower risk of complications. Some of these approaches such as the axillary, combined axilla and breast and retroauricular techniques cannot be considered as truly minimally invasive as they involve extensive flap dissection to reach the thyroid.[1,2,17] They are therefore associated with more pain with some patients experiencing prolonged paresthesias.[18] The transoral technique was developed to address a few of these concerns, as the incision would be at a short distance from the thyroid, and good cosmetic outcomes could be obtained with basic laparoscopic instruments.[19] Various approaches have been devised to apply natural orifice transluminal endoscopic surgery (NOTES) techniques to thyroidectomy. Transoral thyroidectomy through an incision in the sublingual area in cadaveric and porcine models was first performed by Witzel et al.[10] Combination approaches with ports both the floor of the mouth and oral vestibule were described by Benhidjeb et al – Totally transoral video assisted thyroidectomy (TOVAT) and Wilhelm et al - endoscopic minimally invasive thyroidectomy (eMIT).[11,12] In the series of 8 patients who underwent eMIT – 3(37.5%) needed conversion to open surgery, Mental nerve injury occurred in 6 (75%), RLN palsy was seen in 2 (25%) and stitch abscess was reported in 1 (12.5%) patient.[12] The Transoral video-assisted neck surgery procedure (TOVANS), devised by Nakajo et al utilised a single central 2.5 cm incision in the oral vestibule with Kirschner wires and a mechanical retracting system to lift up the skin.[20] Mental nerve injury persisting for more than 6 months was seen in all the patients in their series.[20]

Of the various remote access techniques TOETVA offers the shortest path to the thyroid gland. This factor helps decrease both the extent of dissection required and the operating time.[21] As TOETVA is through a median approach both hemi and total thyroidectomy can be performed through the same incision.[19] Additionally, TOETVA is a true scarless technique as the oral mucosa heals rapidly making the vestibular incisions invisible. This study describes 11 patients who underwent TOETVA at our institution. Operative procedures included hemithyroidectomy in 7 patients and total thyroidectomy in 4 patients. One patient required conversion to open thyroidectomy as the tumour proved to be vascular, leading to excessive bleeding. This study employed TOETVA in patients with benign thyroid nodules less than 6cm in diameter. The average tumour size was 3.85 cm. Large nodules may not be suitable for the TOETVA approach as dissection may become difficult due to the small working field. Large nodules also obscure the working space. However with increasing operator experience, TOETVA can be applied to larger nodules. A recent large TOETVA series by Anuwong et al included patients with a gland size $\leq$ 10 cm.[19] The mean nodule size in their study was 5.4 cm. Thyroidectomy and central compartment dissection using the TOETVA approach has been successfully performed in patients with papillary microcarcinoma.[15,22] TOETVA has also been safely used in patients with Graves disease.[23]

The median operative time in this series ranged from 150 minutes for hemithyroidectomies to 225 minutes for total thyroidectomy. Udelsman et al reported a similar mean operative time of 222 minutes for their series of 7 patients.[24] Anuwong et al, in their series reported operative times of 90 minutes for hemithyroidectomy and 135.5 minutes for total thyroidectomy.[9] Operative time may decrease with increasing experience with this procedure.[25] Complications observed in this study included temporary hypoparathyroidism in 1 (10%) patient and transient mental nerve paresis in 2 (18%) patients. All patients with paresthesia over the mental nerve distribution in the immediate post-operative period improved. Symptoms improved with time and paraesthesia or sensory deficit was not present in any patient at the 3 month follow-up. Other complications such as infection, subcutaneous or mediastinal emphysema, postoperative hematoma or seroma, and tracheal or esophageal injury were not observed. In a

large study comparing TOETVA with open thyroidectomy, complication rates were found to be similar between the two groups.[15] Their study reported transient RLN palsy in 4%, transient mental nerve injury in 1.4% and temporary hypoparathyroidism in 10.6% of patients undergoing TOETVA. A transoral incision may have a higher risk of infection as the oral cavity is not sterile. However, patients undergoing TOETVA are routinely given antibiotic prophylaxis and no serious infection has been reported.[15,20,24]

Yang et al compared endoscopic thyroidectomy via the oral vestibular approach with endoscopic thyroidectomy via the areola approach. There were no differences between the two groups in operation time or complication rate. However the transoral technique completely eliminated cutaneous scars and showed better cosmetic results.[26] Transoral thyroidectomy vestibular approach has also been performed using the robotic technique (TORTVA). A study comparing TORTVA with TOETVA found similar operative outcomes, however operative time was greater with TORTVA which could be partly explained by the learning curve.[27] Nevertheless TOETVA may be a more economical option as robotic surgery requires specialized equipment unlike TOETVA which can be performed with routine laparoscopic instruments.

The major limitation of this study is the small sample size. A direct comparison with open thyroidectomy in patients with a similar profile is also lacking.

In conclusion, this is a report of our initial experience with the TOETVA technique of scarless surgery. It is a safe and economically viable approach for management of benign thyroid disease in patients who are concerned about a postoperative cervical scar. The prolonged operative time observed in this study may decrease with increasing operator experience. TOETVA in patients with other indications such as differentiated thyroid cancer without local extension and Graves disease needs further study.

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