

# Medialization Thyroplasty Using Silastic Implant

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## Abstract

Thyroplasty type-I has become treatment of choice in un-recovering unilateral vocal fold palsy, which the authors performed in 15 patients. Vocal fold palsy showed propensity for males (60%) and for left side in 67% cases. It was idiopathic in 67% of cases. Hand carved silastic implant was used and all the patients had statistically significant ( $p < 0.001$ ) improvement in voice immediately and after three month of surgery. There was no extrusion of implant and none required revision.

## INTRODUCTION

The human larynx plays a pivotal role in airway protection and phonation<sup>1</sup>. Paralytic unilateral vocal fold immobility is the most common neurogenic disorder affecting the larynx<sup>2</sup>. Unilateral laryngeal paralysis is symptomatic when it results in the failure of the mobile vocal fold to approximate with the paralyzed fold during adduction. The disability ranges from imperceptible to profound. Classically inability to project the voice, decreased exercise tolerance and aspiration of saliva and ingested materials form the clinical triad. The severity of symptoms is attributed to the position of the paralyzed vocal fold. When it is located in the midline, compensatory activity of the normal side of the larynx can often close the glottis during phonation. A lateralized position of the paralyzed vocal fold precludes adequate contact and results in a rough and breathy voice with impaired swallowing and a weak cough<sup>3</sup>.

Treatment for unilateral vocal fold paralysis is designed to position static paralyzed vocal fold in a median position. Thyroplasty type-I and arytenoid adduction have provided significant improvement<sup>4</sup>. Thyroplasty type-I has become the procedure of choice. This laryngeal surgery results in medial displacement of the immobile vocal fold by placing an implant between the thyroid cartilage and the inner perichondrium, through a window created in the thyroid cartilage<sup>3,4</sup>. Implants made of different materials have been used<sup>5</sup>. Authors report their experience on thyroplasty type-I using hand carved silastic implant.

## MATERIAL AND METHODS

This prospective study was carried out on 15 patients in the

age group of 20-60 years, having unilateral adductor vocal cord palsy not improving for at least 2 months. Patients with history of prior laryngeal surgery or radiotherapy were excluded from the study.

A detailed history, general physical and oto-laryngological examination was carried out. Patient's voice self-gradation in the visual analog scale of 1-100 was recorded<sup>6</sup>. After routine investigations and pre-anesthetic check-up patient was taken up for thyroplasty type-I.

The implant was hand carved of a silastic block. There are two parts of the prosthesis. Outer portion serves to lock the prosthesis to the window made in the thyroid lamina. The medial portion is triangular in shape. The hypotenuse of this triangle is designed to correspond to the long axis of the vocal cord. The base of the triangle is adherent to the inner plate of the portion of the prosthesis. The third side projects posteriorly in order to be in contact with the base of the vocal process of the arytenoids to help closure of the posterior commissure. (Fig-1) Implants of various sizes ranging from 3-6 mm in width, 3-4 mm in height and 7-12mm in length were prepared and sterilized. Broader part of the wedge was placed posteriorly and thinner part anteriorly, thus displacing the inner perichondrium of the thyroid cartilage and the vocal fold medially.

**Figure 1**

Figure 1: Hand carved silastic implant.



A flexible trans-nasal laryngeal examination was done, followed by a direct- laryngoscopic examination and the findings were recorded. The laryngoplasty was performed under sedation and local anesthesia with 2% xylocaine with 1:100000-aderaniline infiltrations. A horizontal incision was outlined with ink over the middle of the thyroid lamina. Local anesthesia was injected sub-cutaneously in four quadrants over the lamina. A horizontal 5-6 cm incision beginning on the contra-lateral side of the neck, midway between the thyroid notch and the inferior margin of the thyroid cartilage. It extends to the ipsilateral side of the neck, just beyond the anterior border of the sternocleidomastoid muscle. Incision was made through the skin and platysma. Superior and inferior flaps were elevated in the sub-platysmal plane. The sterno-hyoid muscles were separated in the midline so as to identify the thyroid notch, the thyroid lamina and the cricothyroid membrane. The strap muscles were undermined and retracted laterally. The thyro-hyoid muscle was elevated so as to expose the thyroid lamina. The inferior thyroid tubercle palpated about midway along the inferior border of the thyroid lamina and was exposed along with thyroid lamina anterior and posterior to this structure.

To provide effective medialization of the true vocal cord, the window was positioned on the thyroid cartilage at the level of the true vocal cord. The lower boundary of the window was 5mm from and parallel to the inferior border of thyroid cartilage. The window begins about 7mm posterior to the midline in females and 9mm posterior in male patients. This is to compensate the obtuse larynx of females. The size of the thyroplasty window varied between 10-12 mm in length and 3-4 mm in height. A plastic ruler and a pair of calipers determined the depth of the window and helped in selection of the implant.

The window was designed accordingly and the piece of cartilage thus dissected from the inner perichondrium taking utmost care to keep the inner perichondrium intact, which was circumferentially elevated from the inner surface of the thyroid cartilage. Different sizes of the implant were tried and the size best suitable as evidenced by the improvement of the voice was used.

The wound was then irrigated with povidine-iodine solution and the perichondrium was sutured. The strap muscles and the platysma were approximated with chromic catgut sutures. The skin wound closed with silk sutures with a corrugated drain, which was removed after 24 hours. Compression bandage was applied over the wound and the patient was observed for 24 hours for any respiratory distress.

Patient was followed up at one week when the sutures were removed and laryngeal examination and voice assessment was done. Final assessment was made at three months.

## OBSERVATION

Mean age of the patients was 43.2 years (range 20-60). There were ten males and five females, with a ratio of 3:2. Five of the patients had an identifiable cause while the rest of the ten cases were idiopathic in origin. Vocal fold palsy showed a left sided propensity in 67% patients. (Table-I).

**Figure 2**

Table 1: Etiology, duration and side of vocal fold palsy

SN.	Causes	No of Patients	Duration	Side effected
1.	Idiopathic	10	> 6 months	Left-8 Right-2
2.	Iatrogenic Thyroid Surgery	2	2 months	Right -1 Left-1
	Para-pharyngeal mass excision	1	2 months	Right-1
3.	Road side accident	1	3 months	Right-1
4.	Cut- throat injury	1	2 months	Left-1

Breathy dysphonia and aspiration of fluids were presenting symptoms in all patients. Five patients had symptoms for 2-3 months and rest was having symptoms with no improvement for more than 6 months. Vocal cord was found in para-median position in all cases.

The pre-operative voice grading values on visual analog scale were compared with values at first post-operative week and after three months of surgery. The mean pre-operative

value was  $14.0 \pm 4.59$ ; the mean post-operative value at first week was  $69 \pm 22.33$ , which decreased to a mean value of  $64 \pm 17.22$  at three months.

At one week and three months after surgery the voice grading was compared with pre-operative grade. There was a statically significant improvement in voice ( $p < 0.001$ ). However the voice grading at one week and three months after surgery did not show any significant difference ( $p > 0.05$ ). It implies that there was a significant improvement in voice after thyroplasty type-I and it remained stable at three months after surgery.

Complication was noted in one diabetic patient who developed cellulites of neck, which resolved on broad-spectrum antibiotics and insulin. None of patients developed respiratory distress.

### DISCUSSION

Patients with an isolated unilateral vocal fold paralysis suffer from voice loss with aspiration or swallowing difficulties<sub>3</sub>. All patients in our study also had symptoms of breathy dysphonia and episodes of aspiration.

A male predominance, similar to ratio of 3:2 in our series is reported in literature<sub>7,8</sub>. In our study 67% cases were idiopathic in origin, 20% were iatrogenic and 13% were due to neck trauma whereas Lundy et al had 40% cases as idiopathic<sub>8</sub>. Sixty seven percent cases had a left vocal cord paralysis which is similar to Omori et al<sub>9</sub>, however Lu et al found left vocal cord palsy in 73% of cases<sub>7</sub>. Larger number of left vocal cord palsy is accounted for long intra-thoracic course of left recurrent laryngeal nerve.

In the present series 67% patients had history of more than 6 months, but the rest of the cases were operated early with a history ranging from 2-3 months. Early surgical intervention is indicated in cases with severe aspiration. In proximal injuries to the vagus such that occurring after skull base surgery, aspiration is often present and can be life threatening and an early surgical medialization can be considered to tracheostomy<sub>5</sub>. Similarly patients undergoing intra-thoracic operative procedures for malignancy may require sacrifice of the recurrent laryngeal nerve. Post-operative vocal fold paralysis may lead to diminished cough with secretion retention, aspiration and life- endangering pneumonia. Type-I thyroplasty for vocal fold paralysis is well tolerated and is associated with improved patient outcome with no post-operative death in high-risk population<sub>10</sub>.

The cause of aspiration in patients with vocal fold paralysis includes pre-mature spillage of liquid from the mouth due to abnormal co-ordination of oro-pharyngeal motility, an abnormal glottal closure mechanism and ineffective bolus transport. Flint has described a mechanism by which a medialization laryngoplasty results in improvement in dysphagia and aspiration control. Pharyngeal pressure gradients are generated within the pharynx during the pharyngeal phase of swallowing. Patients who can attain glottic closure and glottic competence generate a negative sump pressure of the cervical esophagus. Incomplete glottic closure hinders this negative sump-effect impairing swallowing and allowing aspiration. Glottic closure procedures restore of the negative sump pressure, thus improving the dysphagia<sub>11,12</sub>.

Patients with a low potential of recovery of vocal fold movements who have difficulties with aspiration can be considered for immediate medialization. Patients without aspiration can be kept under observation. In these patients electromyography (EMG) is effective for evaluating the neural changes of vocal fold paralysis from 6 weeks to 3 months of onset. If no aspiration is present and polyphasic re-innervation potentials or nascent units are demonstrated at 6-12 weeks a temporary injection augmentation of the vocal folds versus observation should be considered. If no innervation potentials are demonstrated on laryngeal EMG by 3 months an early surgical medialization should be considered even without aspiration<sub>5</sub>.

A rigid direct laryngoscopy helps to identify the vocal fold lesions but limits the range of voicing tasks. A transnasal laryngoscopic examination is helpful in visualizing vocal fold movements both pre-operatively and intra-operatively when the implant is placed<sub>3,4,8</sub>.

With the implant in place on the paretic side the contra-lateral hyper-function resolves completely. This allows for a better assessment for minor degree of vocal fold bowing. Persistence of contra-lateral vocal fold bowing after ipsilateral medialization laryngoplasty, is an indication for simultaneous contra lateral implant. Bilateral implants are useful for patients more than 60 years of age to address the age- related changes of vocal folds that compound the glottic insufficiency<sub>5</sub>.

Intra-operative steroids were used to decrease the peri and post-operative. A slight amount of over- correction was still done in all cases to take care of this edema as also reported in literature<sub>13,14</sub>. Over-medialization, which can occur if

window is placed too close to anterior commissure or when a too large implant is placed will result in a strained voice even if the posterior commissure is wide open<sub>4</sub>.

All the cases had uneventful recovery except one diabetic patient who developed cellulites of the neck. None of our patients developed a respiratory distress. Weinman and Maragos in a retrospective study of 630 cases reported that no patient developed significant airway compromise while 3.5% of cases that underwent arytenoids adduction required tracheostomy<sub>15</sub>.

The medialized cartilage is absorbed overtime which results in degeneration of voice and in progressive aspiration<sub>13</sub>. We removed the cartilage instead of medializing it, with preservation of the inner thyroid perichondrium. Implant migration with endo-laryngeal extrusion of a gore-tex implant is reported in type-I thyroplasty where the inner thyroid perichondrium was not preserved<sub>16</sub>. There was no case of implant extrusion in the present series. The revision rates of the surgeons vary. Anderson et al<sub>17</sub> reported a revision rate of 24% while Rosen<sub>18</sub> in a national survey reported a revision rate of 5.5%. A CT or MRI is useful to identify the position of the window and the implant. The revision rate is coming down with experience, as no revision was required in present study.

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