



Recovery of Neuromuscular Function Following Early Type I Thyroplasty

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ABSTRACT

While Type I thyroplasty remains the gold standard treatment for unilateral vocal cord paralysis (UVCP), it has been suggested that thyroplasty be reserved for cases that fail to spontaneously recover neuromuscular function within 6-12 months. This arbitrary delay is based on the assumption that thyroplasty may permanently alter the vocal mechanism or impair neuromuscular recovery.

Our aim is to present 3 patients for whom preoperative and postoperative longitudinal data are available following spontaneous recovery after thyroplasty performed within one month of UVCP. Subjects underwent acoustic analysis before and after thyroplasty until full kinematic recovery. All patients demonstrated complete recovery of vocal cord motion without the necessity to remove the implant and with evidence of continuing acoustic improvement over time.

These observations appear to dispel prevailing concerns and could move us towards a greater use of type I thyroplasty as a first line treatment option for UVCP in selected patients.

REFERENCES

1. Isshiki N et al. Thyroplasty as a new phonosurgical technique. *Acta Otolaryngol.* 1974; 78:451-7
2. Arviso LC et al. Long-term outcomes of injection laryngoplasty in patients with potentially recoverable vocal fold paralysis. *Laryngoscope* 2010; 120:2237-40
3. Joo D et al. Recovery of Vocal Fold Paralysis After Cardiovascular Surgery. *Laryngoscope* 2009; 119:1435-8
4. Hirano M. Electromyography for laryngeal paralysis In: *Neurology: Recent Advances*; Hirano M, Kirchner JA, Bless DM eds. San Diego, CA Singular Publishing; 1991; 232-48
5. Van Riper, C. Speech Correction: Principles and Methods (4th ed.) Englewood Cliffs, N.J.: Prentice Hall, 1963
6. Uloza V et al. Multidimensional assessment of functional outcomes of medialization thyroplasty. *Eur. Arch. Otorhinolaryngol.* 2005; 262:616-21
7. Billante CR et al. Voice gains following thyroplasty may improve over time. *Clin. Otolaryngol. Allied Sci.* 2002; 27:89-94
8. Young WN et al. Analysis of laryngeal framework surgery: 10-year follow-up to a National survey. *Laryngoscope* 2010; 120:1602-8
9. Friedman AD et al. Early versus late injection medialization for unilateral vocal cord paralysis. *Laryngoscope* 2010; 120:2042-6
10. Sulica L. The natural history of idiopathic vocal cord paralysis: Evidence and Problems. *Laryngoscope* 2008; 118:1303-07

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INTRODUCTION

Unilateral vocal cord paralysis (UVCP) is commonly treated by either medialization thyroplasty (MT) or vocal cord injection (VCI). Type I Isshiki thyroplasty¹ involves surgical insertion of an implant within a window created in the thyroid cartilage, external to the inner perichondrium and therefore remote from the neuromuscular unit of the vocal mechanism. This results in medial displacement, by lateral compression, of the paralyzed vocal cord. VCI, attempts to provide a similar, though temporary, result through direct injection of filler materials into the lateral aspect of the vocal cord medial to the inner perichondrium of the thyroid cartilage.

There is debate in the literature as to the optimal timing of either intervention. Some advocate VCI as a first intervention in acute UVCP while awaiting spontaneous recovery.^{2,3} It has been suggested that MT should be reserved for permanent UVCP, only in cases that do not recover within a 6³ to 12² month follow-up period. This recommendation is based largely on observational studies⁴ with no data in the literature to support this arbitrary time frame to delay thyroplasty.

Here we describe three patients for whom complete longitudinal acoustic measures were available pre and post type I Isshiki thyroplasty within one month of presentation.

METHODS AND MATERIALS

Subjects: 3 adult males, ranging 52 to 77 years of age, with UVCP due to a variety of etiologies (**Table 1**) were evaluated before and after type I thyroplasty until full vocal cord kinematic recovery, defined as recovery of vocal cord motion by flexible fiberoptic laryngoscopy, was seen.

Data collection: Acoustic measures of fundamental frequency (Fo), maximum phonation time (MPT), voice jitter and shimmer were obtained between 3 to 6 days preoperative, 15 to 67 days postoperative and regularly at 2 to 6 month intervals until full recovery was observed.

F₀: from reading first paragraph of "My Grandfather Passage".⁵

MPT: patient asked to sustain vowel /a/ as long as possible on a single breath.

Jitter/Shimmer: measured as RAP (relative average perturbation) and SdB (shimmer in decibels) obtained from middle 2s of vowel /a/ prolongation.

Voice analysis software: KayPentax, Lincoln Park, NJ, VisiPitch IV, model 3950.

DISCUSSION

Medialization thyroplasty has demonstrated high rates of success in re-establishing voice quality. Clinical experience over many years has confirmed that these gains in voice quality are immediate and long lasting.^{6,7} A 10 year national survey of 23,682 thyroplasty procedures revealed high efficacy and safety of this procedure.

Studies do not demonstrate significant differences in voice outcome between MT and VCI in the short term at 1 month, 3 months and 6 months postoperative. However, thyroplasty remains superior in the long term. Patients treated with VCI often do not maintain initial gains and are often subjected to repeat injections in the long term. The percentage of patients receiving VCI who elect to thyroplasty has been reported between 28-43%.⁹

In addition, MT does not interfere with the mucosal wave as the implant is positioned lateral to the inner perichondrium of the thyroid cartilage and remote from the body and cover of the vocal mechanism.

The rate of spontaneous recovery in untreated UVCP is reported at only 36%.¹⁰ This, in addition to our inability to accurately identify temporary cases, brings into question the suggested arbitrary 6-12 month delay in thyroplasty. Our data of complete recovery of vocal cord motion following early Type I thyroplasty without the necessity to remove the implant, and with evidence of continuing acoustic improvement over time, appear to dispel prevailing concerns that thyroplasty may permanently alter the vocal mechanism or impair neuromuscular recovery.

These data, combined with the proven safety and better long term acoustic outcomes of thyroplasty, suggest MT can be justifiably recommended as a first line treatment option for UVCP in the appropriate patient population.

Limitations: Small patient series have inherent limitations of comparison and conclusions. There is a lack of information in the literature regarding extent of kinematic and acoustic recovery in subpopulations of both completely untreated or VCI cohorts that experience spontaneous neuromuscular recovery. It is therefore not entirely possible to assert whether long term acoustic recovery is better or worse following MT compared to untreated or VCI patients who spontaneously recover kinematic function.

CONCLUSIONS

Our data :

1) Provide evidence supporting the use of type I thyroplasty as a first-line option for UVCP in select patients.

2) Call into question the obligatory 6 month to one year waiting period before applying type I thyroplasty.

RESULTS

Table 1. Subject Characteristics

Patient	Age/sex	Etiology	Time from paralysis to thyroplasty (D)	Time from thyroplasty to recovery (D)	Time from paralysis to recovery (D)
1	77/M	Idiopathic; right vocal fold paralysis	20	183	203
2	71/M	Mediastinoscopy for lymph node dissection/lung adenocarcinoma; left vocal fold paralysis	14	432	446
3	52/M	Intubation for 2 weeks following aspiration; right vocal fold paralysis	20	414	434

Table 2. Pre-operative, post-operative and at-recovery acoustic parameters

Patient		Fo	MPT	RAP	SdB
1	Pre-thyroplasty	197.66	7.49	1.78	0.96
	Post-thyroplasty (POD 29)	171.04	9.58	3.79	0.76
	Recovery	177.08	12.79	2.41	0.41
2	Pre-thyroplasty	133.95	11.86	2.20	0.73
	Post-thyroplasty (POD 67)	110.10	13.65	1.53	1.44
	Recovery	97.63	27.79	0.22	0.28
3	Pre-thyroplasty	121.65	1.69	1.77	0.88
	Post-thyroplasty (POD 15)	143.56	9.03	1.35	0.38
	Recovery	149.59	8.08	1.08	0.17

Normal Range: Fo = 100-150 Hz, MPT = 11-41s, RAP = < 0.38 (jitter), SdB = < 0.18 (shimmer)