


# Effect of Vocal Fold Medialization on Dysphagia in Patients with Unilateral Vocal Fold Immobility

Daniel J. Cates, MD<sup>1</sup>, Naren N. Venkatesan, MD<sup>1</sup>, Brandon Strong<sup>1</sup>, Maggie A. Kuhn, MD<sup>1</sup>, and Peter C. Belafsky, MPH, PhD, MD<sup>1</sup>

Otolaryngology—  
 Head and Neck Surgery  
 1–4  
 © American Academy of  
 Otolaryngology—Head and Neck  
 Surgery Foundation 2016  
 Reprints and permission:  
[sagepub.com/journalsPermissions.nav](http://sagepub.com/journalsPermissions.nav)  
 DOI: 10.1177/0194599816645765  
<http://otojournal.org>  


Sponsorships or competing interests that may be relevant to content are disclosed at the end of this article.

Received November 11, 2015; revised March 8, 2016; accepted April 1, 2016.

## Abstract

**Objective.** The effect of vocal fold medialization (VFM) on vocal improvement in persons with unilateral vocal fold immobility (UVFI) is well established. The effect of VFM on the symptom of dysphagia is uncertain. The purpose of this study is to evaluate dysphagia symptoms in patients with UVFI pre- and post-VFM.

**Study Design.** Case series with chart review.

**Setting.** Academic tertiary care medical center.

**Subjects and Methods.** The charts of 44 persons with UVFI who underwent VFM between June 1, 2013, and December 31, 2014, were abstracted from a prospectively maintained database at the University of California, Davis, Voice and Swallowing Center. Patient demographics, indications, and type of surgical procedure were recorded. Self-reported swallowing impairment was assessed with the validated 10-item Eating Assessment Tool (EAT-10) before and after surgery. A paired samples *t* test was used to compare pre- and postmedialization EAT-10 scores.

**Results.** Forty-four patients met criteria and underwent either vocal fold injection (73%) or thyroplasty (27%). Etiologies of vocal fold paralysis were iatrogenic (55%), idiopathic (29%), benign or malignant neoplastic (9%), traumatic (5%), or related to the late effects of radiation (2%). EAT-10 (mean ± SD) scores improved from 12.2 ± 11.1 to 7.7 ± 7.2 after medialization (*P* < .01) with a follow-up of 119 ± 65 days.

**Conclusion.** Patients with UVFI suffer from dysphagia and report significant improvement in swallowing symptoms following VFM. The symptomatic improvement appears to be durable over time.

## Keywords

dysphagia, unilateral vocal fold paralysis, injection laryngoplasty, medialization thyroplasty, EAT-10, Eating Assessment Tool, VHI, Voice Handicap Index

Glottal closure is a critical component of normal phonation and deglutition. Unilateral vocal fold immobility (UVFI) is a common cause of incomplete glottal closure and may occur as a consequence of iatrogenic vagal or recurrent nerve injury, cervical trauma, neoplasms, inflammatory processes, radiation therapy, or idiopathic causes. The resultant glottal insufficiency may lead to symptoms of dysphonia, aphonia, dyspnea, decreased cough strength, and dysphagia. The detriment of UVFI on voice,<sup>1</sup> breathing,<sup>2</sup> and voice-related quality of life<sup>3</sup> has been thoroughly studied. However, the prevalence of dysphagia symptoms and the pathophysiology of any underlying swallowing impairment in those with UVFI are less well defined.

UVFI has been linked with increased rates of aspiration before, during, and after the pharyngeal swallow.<sup>4</sup> Multiple series suggest that up to half of those patients with UVFI will demonstrate penetration or aspiration on videofluoroscopy studies or fiberoptic endoscopic evaluation of swallowing.<sup>5,6</sup> In addition to frank glottal incompetence, a growing body of evidence suggests that other factors, such as pharyngeal weakness<sup>7</sup> and decreased sensation,<sup>8</sup> may contribute to swallowing dysfunction in UVFI.

The benefits of vocal fold medialization (VFM) on voice quality and acoustic parameters have been thoroughly investigated. Vocal fold injection augmentation, whether performed under general anesthesia or in office, has a reported technical success rate of at least 97% across a number of injectable materials.<sup>9</sup> There does not appear to be a significant difference between injection augmentation and medialization

<sup>1</sup>Department of Otolaryngology Head and Neck Surgery, University of California, Davis, Sacramento, California, USA

This article was presented at the 2015 AAO-HNSF Annual Meeting & OTO EXPO; September 27-30, 2015; Dallas, Texas.

## Corresponding Author:

Daniel J. Cates, MD, Department of Otolaryngology Head and Neck Surgery, University of California, Davis, School of Medicine, 2521 Stockton Blvd, Suite 7200, Sacramento, CA 95817, USA.  
 Email: [djcates@ucdavis.edu](mailto:djcates@ucdavis.edu)

thyroplasty,<sup>10</sup> and both techniques demonstrate significant improvements in perceptual, acoustic, and aerodynamic measures of voice.<sup>11</sup> The effect of VFM on dysphagia in those with UVFI is less clear. Both injection medialization and type I thyroplasty have been found to improve rates of penetration and aspiration on fluoroscopy.<sup>5,12,13</sup> The impact of VFM on patient-reported dysphagia has yet to be studied. The purpose of this investigation was to evaluate the effect of VFM on self-reported symptoms of dysphagia.

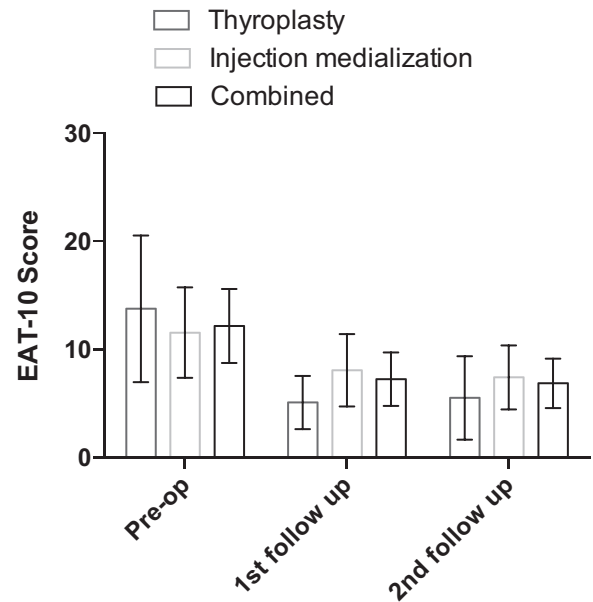
## Methods

The charts of persons with UVFI who underwent VFM between June 1, 2013, and December 31, 2014, were abstracted from a prospectively maintained database at the University of California, Davis, Voice and Swallowing Center. Use of this database for clinical research was approved by the Institutional Review Board of the University of California, Davis. All patients with UVFI were confirmed by videolaryngoscopy and/or stroboscopy. Individuals were excluded if they were <18 years of age; had incomplete symptom surveys, concomitant vocal fold lesions, or other head and neck surgeries during the study period; or received supplemental enteral nutrition. Descriptive data were recorded, including patient demographics, etiology of UVFI, duration of UVFI, and type of surgical procedure. All patients underwent either vocal fold injection medialization with calcium hydroxylapatite or type I Gore-Tex thyroplasty. The time between VFM and clinic follow-up was documented.

The primary outcome measure was self-reported swallowing disability. This was assessed with the validated 10-item Eating Assessment Tool (EAT-10) before and after surgery, with scores  $\geq 3$  considered abnormal, as suggested by normative data.<sup>14</sup> Scores on the 10-item Voice Handicap Index (VHI-10) described by Rosen et al served as the secondary outcome measure of self-reported voice impairment.<sup>15</sup> A paired samples *t* test was used to compare pre-VFM EAT-10 and VHI-10 scores with post-VFM scores at the first and second follow-up visits. Comparisons between the thyroplasty and injection medialization groups as well as between the idiopathic and iatrogenic groups were made with the independent samples *t* test. Statistical significance was based on a type I error <5%.

## Results

Forty-four patients met inclusion criteria. The etiology of UVFI was iatrogenic (55%), idiopathic (29%), benign or malignant neoplastic (9%), traumatic (5%), or related to the late effects of radiation (2%). The median duration of UVFI from symptom onset to date of surgery was 36 months, with the shortest duration recorded as 7 months. At the preoperative visit, 30 patients (68%) submitted abnormal EAT-10 scores ( $>2$ ). A total of 12 patients (27%) underwent type I thyroplasty, while the remaining 32 patients (73%) received injection medialization. Two patients participated in a swallow therapy session prior to surgery. The mean  $\pm$  SD time to first follow-up visit was  $28 \pm 14$  days. A total of 27

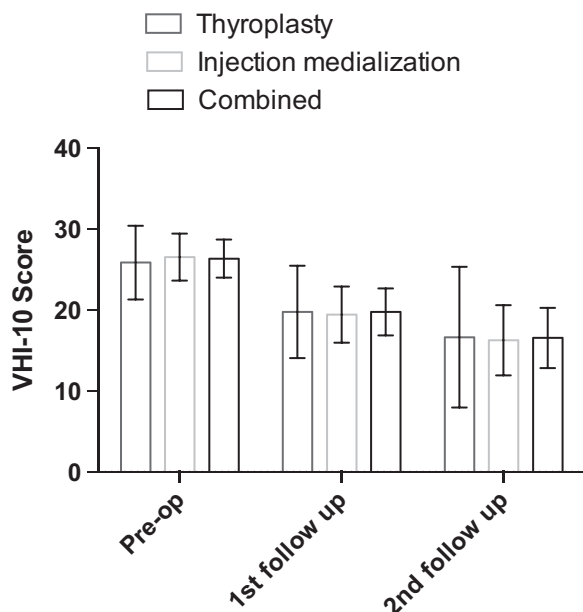


**Figure 1.** Mean 10-item Eating Assessment Tool (EAT-10) scores of the thyroplasty, injection medialization, and combined groups at the preoperative, first postoperative, and second postoperative visits. Error bars represent 95% confidence interval.

(61%) patients had a second follow-up visit, with a mean time to second follow-up of  $119 \pm 65$  days.

The mean  $\pm$  SD preoperative EAT-10 scores for the thyroplasty, injection medialization, and combined groups were  $13.8 \pm 10.7$ ,  $11.6 \pm 11.5$ , and  $12.2 \pm 11.1$ , respectively. There were statistically significant improvements in mean EAT-10 score at the first postoperative visit in the thyroplasty ( $5.1 \pm 3.9$ ,  $P = .0127$ ), injection medialization ( $8.1 \pm 9.1$ ,  $P = .0079$ ), and combined ( $7.7 \pm 8.1$ ,  $P = .0001$ ) groups. The mean EAT-10 score remained significantly improved at the second postoperative visit in the injection medialization ( $7.4 \pm 6.3$ ,  $P = .0097$ ) and combined ( $7.7 \pm 7.2$ ,  $P = .015$ ) groups. The improvement in mean EAT-10 score did not remain statistically significant among those treated with thyroplasty ( $5.5 \pm 4.6$ ,  $P = .1563$ ) at the second postoperative visit (**Figure 1**). There was no significant difference, however, between thyroplasty and injection medialization groups at the first or second follow-up visits ( $P = .1569$  and  $P = .9301$ , respectively). Of the 30 patients with abnormal preoperative EAT-10 scores, 6 reported scores within the normal range ( $<3$ ) at the second postoperative visit.

The mean preoperative VHI-10 scores for the thyroplasty, injection medialization, and combined groups were  $25.8 \pm 7.2$ ,  $26.5 \pm 7.9$ , and  $26.3 \pm 7.6$ , respectively. There were statistically significant improvements in mean VHI-10 score at the first postoperative visit in the thyroplasty ( $19.8 \pm 9.0$ ,  $P = .0352$ ), injection medialization ( $19.4 \pm 9.4$ ,  $P = .0007$ ), and combined ( $19.7 \pm 9.4$ ,  $P = .0002$ ) groups. The mean VHI-10 score remained significantly improved at the second postoperative visit in the thyroplasty ( $16.6 \pm 10.4$ ,  $P = .0469$ ), injection medialization ( $16.3 \pm 9.3$ ,  $P = .0002$ ), and



**Figure 2.** Mean 10-item Voice Handicap Index (VHI-10) scores of the thyroplasty, injection medialization, and combined groups at the preoperative, first postoperative, and second postoperative visits. Error bars represent 95% confidence interval.

combined ( $16.5 \pm 19.6$ ,  $P = .0001$ ; **Figure 2**) groups. There was no significant difference between thyroplasty and injection medialization groups at the first or second follow-up visits ( $P = .7029$  and  $P = .5064$ , respectively).

While the idiopathic group had a higher mean preoperative EAT-10 score than the iatrogenic group ( $14.5 \pm 12.4$  vs  $9.25 \pm 12.4$ , respectively), there was no significant difference in response to treatment ( $P = .1772$ ). Similarly, the idiopathic and iatrogenic groups showed no significant difference in VHI-10 scores following medialization ( $18.3 \pm 9.8$  vs  $19.6 \pm 8.4$ ,  $P = .74$ ).

## Discussion

Glottal competence plays a critical role in safe swallowing. Both injection medialization and medialization thyroplasty have been shown to decrease Penetration-Aspiration Scale scores on videofluoroscopy.<sup>5</sup> However, the effect of VFM on patient-described swallowing impairment has not been previously reported. In this investigation, greater than two-thirds of patients with UVFI reported dysphagia symptoms. This is comparable to previous studies, which suggest between 50% and 61% of those with UVFI may present with some degree of swallowing dysfunction.<sup>12,13,16</sup> Data from this investigation suggest that dysphagia is common in persons with UVFI and that VFM improves, but does not completely eliminate, dysphagia symptoms. Twenty percent of the patients with abnormal preoperative EAT-10 achieved a score within the normal range postoperatively. The mean EAT-10 score improved nearly 5 points, although the majority of patients with abnormal baseline scores continued to report symptoms postoperatively. Previous work from our center suggests that patients with UVFI also have comorbid

pharyngeal weakness.<sup>7</sup> The reduction but not elimination of dysphagia reported in this investigation supports this finding and suggests that glottal competence is not the sole etiology of dysphagia in patients with UVFI.

The findings of this study also suggest that the impact of VFM on dysphagia is durable across multiple follow-up visits, with a mean follow-up of approximately 4 months. Given the observed improvement in self-reported dysphagia symptoms following VFM, medialization may be considered a reasonable initial therapeutic option in patients with UVFI before further interventions for dysphagia are pursued. Investigation with longer follow-up is necessary to confirm prolonged durability of symptomatic improvement.

The limitations in this investigation include those intrinsic to a retrospective review. The patient population consists of only those patients with UVFI who have elected to undergo surgery, potentially selecting for higher preoperative scores on patient-reported symptom indices. In this study, a preponderance of patients opted to undergo injection medialization. The postoperative edema and potential for temporary worsening of swallowing dysfunction following open thyroplasty in short-term follow-up may account for the lack of statistical improvement in this group at the second follow-up visit. The relatively small numbers of patients in the thyroplasty group at the second follow-up may also have weakened the statistical analysis at the subgroup level. Loss to follow-up after the first postoperative visit occurred in approximately one-third of patients in this study, which could limit conclusions regarding durability of treatment effect. A prospective investigation with a larger sample size is indicated to confirm these results.

## Conclusion

Patients with UVFI commonly suffer from dysphagia and report significant improvement in swallowing symptoms following VFM. These outcomes are accompanied by improvement in self-reported voice quality and appear to be durable over time.

## Author Contributions

**Daniel J. Cates**, study conception and design, data acquisition and analysis, drafting, final approval of the version to be published, accountability for all aspects of the work; **Naren N. Venkatesan**, study conception and design, data analysis, drafting, final approval of the version to be published, accountability for all aspects of the work; **Brandon Strong**, study design, data acquisition and analysis, drafting, final approval of the version to be published, accountability for all aspects of the work; **Maggie A. Kuhn**, study design, data analysis, drafting, final approval of the version to be published, accountability for all aspects of the work; **Peter C. Belafsky**, study design, data analysis, drafting, final approval of the version to be published, accountability for all aspects of the work.

## Disclosures

**Competing interests:** Peter C. Belafsky, Cook, Merz—consultant.

**Sponsorships:** None.

**Funding source:** None.

## References

1. Behrman A. Evidence-based treatment of paralytic dysphonia: making sense of outcomes and efficacy data. *Otolaryngol Clin North Am.* 2004;37:75-104.
2. Asik MB, Karasimav O, Birkent H, Merati AL, Gerek M, Yildiz Y. Airway and respiration parameters improve following vocal fold medialization: a prospective study. *Ann Otol Rhinol Laryngol.* 2015;124:972-977.
3. Spector BC, Netterville JL, Billante C, Clary J, Reinisch L, Smith TL. Quality-of-life assessment in patients with unilateral vocal cord paralysis. *Otolaryngol Head Neck Surg.* 2001;125:176-182.
4. Nayak VK, Bhattacharyya N, Kotz T, Shapiro J. Patterns of swallowing failure following medialization in unilateral vocal fold immobility. *Laryngoscope.* 2002;112:1840-1844.
5. Bhattacharyya N, Kotz T, Shapiro J. Dysphagia and aspiration with unilateral vocal cord immobility: incidence, characterization, and response to surgical treatment. *Ann Otol Rhinol Laryngol.* 2002;111:672-679.
6. Leder SB, Ross DA. Incidence of vocal fold immobility in patients with dysphagia. *Dysphagia.* 2005;20:163-167.
7. Domer AS, Leonard R, Belafsky PC. Pharyngeal weakness and upper esophageal sphincter opening in patients with unilateral vocal fold immobility. *Laryngoscope.* 2014;124:2371-2374.
8. Tabae A, Murry T, Zschommler A, Desloge RB. Flexible endoscopic evaluation of swallowing with sensory testing in patients with unilateral vocal fold immobility: incidence and pathophysiology of aspiration. *Laryngoscope.* 2005;115:565-569.
9. Misono S, Merati AL. Evidence-based practice: evaluation and management of unilateral vocal fold paralysis. *Otolaryngol Clin North Am.* 2012;45:1083-1108.
10. Morgan JE, Zraick RI, Griffin AW, Bowen TL, Johnson FL. Injection versus medialization laryngoplasty for the treatment of unilateral vocal fold paralysis. *Laryngoscope.* 2007;117:2068-2074.
11. Billante CR, Clary J, Childs P, Netterville JL. Voice gains following thyroplasty may improve over time. *Clin Otolaryngol Allied Sci.* 2002;27:89-94.
12. Flint PW, Purcell LL, Cummings CW. Pathophysiology and indications for medialization thyroplasty in patients with dysphagia and aspiration. *Otolaryngol Head Neck Surg.* 1997;116:349-354.
13. Hendricker RM, deSilva BW, Forrest LA. Gore-Tex medialization laryngoplasty for treatment of dysphagia. *Otolaryngol Head Neck Surg.* 2010;142:536-539.
14. Belafsky PC, Mouadeb DA, Rees CJ, et al. Validity and reliability of the Eating Assessment Tool (EAT-10). *Ann Otol Rhinol Laryngol.* 2008;117:919-924.
15. Rosen CA, Lee AS, Osborne J, Zullo T, Murry T. Development and validation of the Voice Handicap Index-10. *Laryngoscope.* 2004;114:1549-1556.
16. Brunner E, Friedrich G, Kiesler K, Chibidziura-Priesching J, Gugatschka M. Subjective breathing impairment in unilateral vocal fold paralysis. *Folia Phoniatr Logop.* 2011;63:142-146.