Treatment Outcomes and Adverse Events Following In-Office Angiolytic Laser With or Without Concurrent Polypectomy for Vocal Fold Polyps

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IMPORTANCE In-office angiolytic laser procedures have been used successfully as an alternative treatment for vocal fold polyps; little is known in detail about the treatment outcomes and adverse events.

OBJECTIVE To examine the outcomes and incidence rates of adverse events associated with in-office angiolytic laser procedures with or without concurrent polypectomy as an alternative treatment for vocal fold polyps.

DESIGN, SETTING, AND PARTICIPANTS Retrospective cohort study at a tertiary medical center. We identified 114 consecutive patients with vocal polyps who underwent in-office angiolytic laser treatments between January 1, 2014, and August 31, 2016. After the exclusion of 17 with missing or incomplete data, 97 were enrolled.

INTERVENTIONS In-office 532-nm laser procedures with or without concurrent polypectomy.

MAIN OUTCOMES AND MEASURES Between 1 and 2 months after the surgical procedures, we collected the following outcome data: videolaryngostroboscopy, perceptual rating of voice quality, acoustic analysis, maximal phonation time, and subjective rating of voice quality using a visual analogue scale and 10-item voice handicap index.

RESULTS This study enrolled 97 patients (mean [SD] age, 45.6 [11.3] years; 48 [49%] male). The mean duration of symptoms was 10.1 months (range, 1-60 months). Twenty-nine patients (30%) had angiolytic laser procedures only, while 68 (70%) received laser with concurrent polypectomy. Both treatment modalities offered significant improvements. Only 1 patient (1%) receiving angiolytic laser with concurrent polypectomy underwent another treatment session, so this group had significantly less need for multiple treatments than those receiving laser treatment alone (6 [21%]; effect size, −1.57; 95% CI, −2.77 to −0.36). We identified 8 adverse events (8% of the cases): vocal fold edema (n = 5), vocal hematoma (n = 2), and vocal ulceration (n = 1). Patients treated with laser plus concurrent polypectomy had significantly fewer adverse events than those treated with angiolytic laser alone (2 [3%] vs 6 [21%]; effect size, 1.20; 95% CI, 0.26 to 2.13).

CONCLUSIONS AND RELEVANCE In-office angiolytic laser procedures can be an effective alternative treatment for vocal polyps, although with possible need for multiple treatment sessions and occasional occurrence of minor postoperative adverse events. Concurrent polypectomy following laser coagulation allows less laser energy delivery and reduces the risk of postoperative adverse events and the need for additional treatment sessions.
Vocal fold polyps are a common laryngeal disease usually presenting as an exophytic mass with polypoid/gelatinous content over the striking edge of the vocal folds. Previous studies have found common etiologies to be voice overuse, misuse, or abuse, cigarette smoking, and gastroesophageal reflux disease. Treatment usually begins with voice therapy and/or phonatory habit modification, with success rates ranging between 30% and 40%. When conservative management fails to restore satisfactory voice quality, microlaryngoscopic surgery is often used to remove the vocal polyps. However, microlaryngoscopic surgery may be inapplicable because of patients’ personal preferences, difficulties associated with suspension laryngoscope use (eg, trismus, retrognathia, prominent incisors), or underlying comorbidity that causes higher risk under general anesthesia. Thus, there is a need for a safe and effective surgical alternative treatment for this disease.

Recent advancements in endoscopic and laser technologies have led to new office-based laryngeal procedures, one being the angiolytic laser. Different from the carbon dioxide laser, which is characterized by its shallow penetration depth and water as the primary chromophore, the angiolytic laser (wavelength, 532–585 nm) make possible selective energy absorption by oxyhemoglobin deep within the targeted lesion through photoangiolysis or photocoagulation. Clinically, the angiolytic laser may be used to treat a myriad of laryngeal disorders, including recurrent respiratory papillomatosis, dysplasia, Reinke edema, vascular lesions, and vocal polyps. However, its use to treat vocal polyps in office settings might be limited by the surgeon’s experience and technique. In occasional circumstances, polyps might not involve completely following laser procedures, which necessitates additional treatment sessions. Concurrent polypectomy following angiolytic laser procedures may facilitate more rapid and discrete disease resolution than that offered by angiolytic laser alone. One subsequent study investigating 50 age-, sex-, and lesion size–matched patients with vocal polyps found no significant difference in outcomes between those receiving in-office angiolytic laser with concurrent polypectomy and those receiving microlaryngoscopic surgery.

Although there are cumulative reports of success at using in-office angiolytic laser procedures as an alternative treatment for vocal polyps, there is insufficient knowledge about voice outcomes, total laser energy delivered, and therapeutic end points (eg, coagulation vs ablation of lesions). Most importantly, there are only a few investigations of the adverse events associated with in-office angiolytic laser treatment. Therefore, we performed this comprehensive retrospective study investigating treatment outcomes and adverse events in patients with vocal polyps treated with in-office angiolytic laser procedures with or without concurrent polypectomy.

Methods

Study Population
We retrospectively reviewed 114 consecutive patients with vocal fold polyps for which they had received in-office angiolytic laser treatment at a tertiary medical center from January 2014 to August 2016. The diagnosis of vocal fold polyps was made by videolaryngostroboscopy (Model 9400, KayPentax). The size of vocal polyps was measured by the length of the vocal fold in full abduction position. Vocal polyps were further categorized by gross appearance into hemorrhagic and nonhemorrhagic types. Patients made their own decision after receiving an explanation of the pros and cons of office-based laser procedures and microlaryngoscopic surgery. Seventeen patients (11 men and 6 women; mean age, 45.9 years [range, 22–77 years], 9 hemorrhagic polyps and 8 nonhemorrhagic polyps) were excluded because of loss of follow-up (n = 12) or incomplete medical records (n = 5). The protocol for this study was approved by the Research Ethics Review Committee of Far Eastern Memorial Hospital. Informed consent was waived because of the retrospective study design.

In-Office Angiolytic Laser Procedures
All angiolytic laser procedures were performed under local anesthesia in office settings. The nasal cavities were anesthetized using cotton pledgets containing 1:10 000 epinephrine and 2% lidocaine hydrochloride. The larynx was anesthetized using a transnasal flexible laryngoscope (VNL-1590 STi, KayPentax) that dripped 2% lidocaine (5 mL) repeatedly as patients vocalized a sustained “ee” sound (ie, laryngeal gargle). Once adequate anesthesia had been achieved (absence of laryngeal reflex when endoscopic tip was pressed directly against the vocal folds), a 400-nm laser fiber was passed through the working channel of the flexible laryngoscope. A 532-nm surgical laser system (IDAS/S32 Surgical Laser System) was used with parameters set at power of 6 to 8 W, pulse width of 21 to 50 ms, and repetition rate of 2 Hz. Total energy delivered and tissue effects according to the proposed classification system of the potassium titanyl phosphate (KTP) laser were recorded at the end of each laser procedure.

Hemorrhagic polyps were mostly treated in a noncontact manner to coagulate or ablate the targeted lesion correspond-

Key Points

- **Questions**: What are the treatment outcomes and incidence rates of adverse events associated with in-office angiolytic laser treatment with or without concurrent polypectomy for vocal polyps?

- **Findings**: This cohort study found significant improvements in patient-reported, perceptual, and acoustic parameters in 97 patients treated with in-office 532-nm laser with or without concurrent polypectomy. Patients treated with laser and concurrent polypectomy received less laser energy, had fewer treatment-related adverse events, and less need for multiple treatment sessions than those treated with laser alone.

- **Meaning**: In-office angiolytic laser procedures might be used as an alternative treatment of vocal polyps; concurrent polypectomy allows less laser energy delivery, reduces the need for multiple treatment sessions, and avoids the development of minor postoperative adverse events.
ing to the treatment classification of KTP 1 or 2 effect. If present, surrounding varices were managed simultaneously (ie, KTP V effect). For nonhemorrhagic polyps with smooth and glazing surfaces, we preferred contact mode to facilitate laser energy absorption by the vocal polyps (ie, KTP 3 or 4 effects). Concurrent polypectomy was performed by using an endoscopic cup forceps (Pentax KW-1806) through the flexible working channel. After precise alignment of the forceps and the free edge of vocal fold, coagulated polyps were removed under direct visual guidance (Figure 1). The decision to perform concurrent polypectomy following laser procedures was based on the intraoperative situation, including (1) when a longer operative time was required to achieve complete vaporization of the vocal polyp, (2) when a vessel wall ruptured with extraluminal blood extravasation obscuring visualization and further laser delivery might cause unwanted collateral thermal injury, or (3) when pedunculated polyps with prominent stalks were found connected to the vocal folds. The total laser energy delivered (Joules) per procedure was recorded after the completion of treatment. Patients’ tolerance for the laser procedure was recorded on a 4-point Likert scale, in which 0 = no discomfort, 1 = minimal discomfort, 2 = much discomfort, and 3 = severe discomfort. All patients were instructed to rest their voices for 3 days postoperatively.

Outcome Assessment
Treatment outcomes were assessed between 1 and 2 months after the laser procedures. For patients receiving multiple treatment sessions, treatment outcomes were evaluated following the last procedure received. Outcome parameters included (1) videolaryngostroboscopy to evaluate lesion resolution, mucosal wave recovery, and occurrence of adverse events; (2) perceptual rating of voice quality using GRB (grade, roughness, breathiness) rated 0 = normal, 1 = mildly deviated, 2 = moderately deviated, or 3 = severely deviated, based on senior surgeon (C.-T. W.) and speech pathologist (F.-C. L.) consensus; (3) acoustic measurements (MDVP, Model 4500, Kay Elemetrics Corp); (4) maximal phonation time; and (5) subjective rating of voice quality as reported by the patient using a visual analogue scale ranging from 0 (worst) to 10 (best) and a 10-item voice handicap index (VHI-10). Adverse events associated with the particular procedures were all counted into analysis regardless of their occurrence following the first or subsequent laser treatments.

Statistical Analysis
Patients were characterized descriptively with results reported as mean and standard deviation. Categorical variables were reported as frequencies and percentages. The differences between

Figure 1. Clinical Photographs of Angiolytic Laser Coagulation With Concurrent Polypectomy

A, Hemorrhagic vocal polyp in a man in his 50s (arrowhead). B, Coagulation of vocal polyp using 532-nm laser in the office (arrowheads), with C, concurrent polypectomy. D, Follow-up endoscopic examination 2 months later.

A. Hemorrhagic vocal polyp
B. Coagulation of polyp with laser
C. Concurrent polypectomy
D. At 2-month follow-up
categorical variables were tested using Pearson χ² tests and those of continuous variables using the t test or the Mann-Whitney U test. Paired t tests or Wilcoxon signed rank tests were used to evaluate the interval changes between pretreatment and post-treatment measurements. Effect sizes and their corresponding 95% confidence intervals were provided to examine clinical significance. All statistical operations were performed using the SPSS, version 22 (SPSS Inc), and R, version 3.3.1, software (R Foundation).

## Results

### Demographic Features

Ninety-seven patients (48 men, 49 women; mean age, 45.6 years [range, 24-76 years]) received in-office 532-nm laser procedures for vocal polyps. The mean reported duration of symptoms was 10.1 months (range, 1-60 months). We found no significant differences in age, sex, polyp types (ie, hemorrhagic vs nonhemorrhagic polyp), and lesion size between patients receiving angiolytic laser alone and those who underwent concurrent polypectomy (Table 1). Further comparisons of demographic characteristics showed older age in patients with hemorrhagic polyps than those with nonhemorrhagic polyps (eTable 1 in the Supplement).

### Laser Parameters and Procedures

The mean operative time, laryngeal anesthesia included, was 12.3 minutes (range, 6-25 minutes). The mean laser energy delivery of the initial procedures was 47.9 J (range, 9.1-184.4 J). Patients receiving laser alone had significantly higher KTP laser effects (KTP3 and KTP4) than those receiving laser with concurrent polypectomy (19 of 29 [66%] vs 13 of 68 [19%]) (Table 1). Sixty-eight (70%) of the patients received concurrent polypectomies with the angiolytic laser procedures. Excluding the time for laryngeal anesthesia, the mean (SD) duration of laser use prior to polypectomy was 2.4 (1.0) minutes, significantly shorter than that for the non-polypectomy group (3.3 ± 1.9 minutes; effect size, 0.69; 95% CI, 0.24-1.13). Reasons for performing concurrent polypectomy were prolonged operative time (n = 26), vessel ruptured with blood extravasation (n = 17), and pedunculated polyps (n = 25). Comparing these 2 groups, we found that the performance of concurrent polypectomy did not lengthen the overall duration of treatment or increase intra-procedural discomfort. The mean (SD) laser energy delivered in the initial procedures was significantly lower in patients receiving concurrent polypectomy than in those receiving angiolytic laser procedures alone (Table 1).
ing laser alone (37.9 [18.8] J vs 69.4 [54.6] J; effect size, 0.94; 95% CI, 0.48-1.38) (Table 1). There was no statistically significant difference of laser parameters between hemorrhagic and nonhemorrhagic polyps (eTable 1 in the Supplement).

Voice Outcomes

Treatment outcomes were measured as a mean (SD) of 35.8 (18.7) and 34.7 (15.7) days after treatment for patients receiving laser alone and concurrent polypectomy, respectively (effect size, 0.07; 95% CI, −0.37 to 0.50). Videolaryngostroboscopy identified 12 patients with incomplete recovery (ie, residual polyp and/or abnormal mucosal wave), more commonly seen in those treated with laser procedures alone (8 of 29 [28%] vs 4 of 68 [6%]) (Table 1). Only 1 of the 68 patients (1%) who received laser with concurrent polypectomy required multiple treatment sessions, a rate significantly lower than that found in the laser treatment alone group, in which 6 of the 29 patients (21%) needed additional treatment (effect size, −1.57; 95% CI, −2.77 to −0.36) (Table 1). Laser parameters and voice outcomes of patients receiving multiple procedures are provided in eTable 2 in the Supplement.

There was no significant difference in presurgical voice assessments between those receiving angioytic laser alone and those receiving laser and concurrent polypectomy (Table 2). The 29 patients receiving angioytic laser alone were found to have significant mean (SD) improvements in visual analogue scale (from 2.96 [1.55] to 6.75 [2.38] points; effect size, −1.78; 95% CI, −2.57 to −0.98), VHI-10 (from 24.80 [9.45] to 11.30 [10.80] points; effect size, 1.34; 95% CI, 0.72 to 1.96), and perceptual voice quality (summation of GRB scores, from 4.31 [1.63] to 1.71 [1.83] points; effect size, 1.48; 95% CI, 0.95 to 2.01) (Table 2). Similarly, the 68 patients treated with angioytic laser and concurrent polypectomy were found to have significant improvements in patient reported perceptual, acoustic measurements, including visual analogue scale, VHI-10, maximal phonation time, GRB scale summation, and acoustic analysis including jitter, shimmer, and noise to harmonic ratio. Comparison of the postoperative measurements showed nonsignificant differences between the 2 treatment groups, except for longer mean (SD) postoperative maximal phonation time in patients receiving laser with polypectomy than in those receiving laser alone (13.8 [5.41] vs 11.1 [4.41] seconds; effect size, −0.53; 95% CI, −1.00 to −0.04).

Adverse Events

Adverse events were identified in 8 (8%) patients in this series (Table 3), and 7 events developed after the initial laser procedure. The only patient developing vocal fold edema after the second procedure received 26.8 J in the first session and 120.1 J in the second session (eTable 2 in the Supplement). Patients receiving concurrent polypectomy had significantly fewer adverse events postoperatively, compared with those receiving angioytic laser alone (2 [3%] vs 6 [21%]; effect size, 1.20; 95% CI, 0.26-2.13) (Table 1). Vocal fold edema was the most common adverse event (n = 5 [5%]). Four of these 5 patients had transient dysphonia and recovered their voices within 1 month; only 1 patient required additional medication to relieve symptoms (Table 3). We reviewed the intraoperative recording videos to identify the possible causes of these adverse events and found that the causes could be related to inadequate surgical technique (ie, misfiring of laser onto normal tissue or excessive laser energy delivery) in 3 patients, overtreatment.
of collateral varices in 1 patient, and continual smoking with inadequate control of laryngopharyngeal reflux in 1 patient (Table 3). In 2 cases (2%) with postoperative vocal fold submucosal hematoma (Figure 2A and B), they experienced prolonged recovery (1.0-1.5 months) of voice quality. Concurrent polypectomy was not performed in patient 7 because of higher discomfort level. Ulceration of the vocal fold was identified in 1 patient (1%) (Figure 2C and D), which might be a result of excessive laser energy delivery. There was no significant difference in risk for postoperative

<table>
<thead>
<tr>
<th>Patient No./Sex/Age, y</th>
<th>Type of Polyp</th>
<th>Adverse Events</th>
<th>Consequences</th>
<th>Treatment</th>
<th>Laser Effect</th>
<th>Laser Settings</th>
<th>Reason</th>
</tr>
</thead>
<tbody>
<tr>
<td>1/M/30s</td>
<td>Hemorrhagic</td>
<td>Edema*</td>
<td>Transient hoarseness for 0.5 mo</td>
<td>Laser only</td>
<td>KTP 2</td>
<td>7 W 21 ms 120.1 J*</td>
<td>Surgical technique</td>
</tr>
<tr>
<td>2/F/30s</td>
<td>Hemorrhagic</td>
<td>Edema</td>
<td>Dysphonia requiring additional medication</td>
<td>Laser + polypectomy</td>
<td>KTP 2</td>
<td>7 W 35 ms 49.7 J</td>
<td>Varices</td>
</tr>
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<td>Edema</td>
<td>Transient hoarseness for 1 mo</td>
<td>Laser only</td>
<td>KTP 3</td>
<td>8 W 50 ms 180.8 J</td>
<td>Surgical technique</td>
</tr>
<tr>
<td>4/F/60s</td>
<td>Hemorrhagic</td>
<td>Hematoma</td>
<td>Transient hoarseness for 1 mo</td>
<td>Laser + polypectomy</td>
<td>KTP 2</td>
<td>7 W 24 ms 29.7 J</td>
<td>Swallow motion</td>
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<td>5/F/30s</td>
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<td>Ulcer</td>
<td>Transient hoarseness for 1.5 mo</td>
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<td>Surgical technique</td>
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<tr>
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<td>No active discomfort</td>
<td>Laser only</td>
<td>KTP 4</td>
<td>7 W 35 ms 141.6 J</td>
<td>Smoking, LPR</td>
</tr>
<tr>
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<td>Hematoma</td>
<td>Vocal fatigue for 1.5 mo</td>
<td>Laser only</td>
<td>KTP 2</td>
<td>7 W 35 ms 31.1 J</td>
<td>Rupture of polyp</td>
</tr>
<tr>
<td>8/F/40s</td>
<td>Hemorrhagic</td>
<td>Edema</td>
<td>Lowered phonation pitch for 1 mo</td>
<td>Laser only</td>
<td>KTP 3</td>
<td>7 W 35 ms 116.6 J</td>
<td>Surgical technique</td>
</tr>
</tbody>
</table>

Abbreviations: KTP, potassium titanyl phosphate; LPR, laryngopharyngeal reflux.

*Adverse event was noted after the second procedure. Listed laser parameters are from the second procedure.
adverse events between patients with hemorrhagic and nonhemorrhagic polyps (eTable 1 in the Supplement).

Discussion
An increasing number of studies have investigated the clinical utility of angiolytic lasers in treating various laryngeal disease conditions. Hsiung et al26 first applied the KTP laser to treat microvascular lesions in the operating room using a continuous mode of energy delivery. Although Hirano et al27 subsequently showed promising results in treating vocal ectasia and vocal varices, the authors did not advocate using it for free-blood–enriched lesions such as hemorrhagic polyps out of concern over risk of thermal injury. By shifting the mode of the angiolytic laser from continuous to pulsed, subsequent investigations have demonstrated that polyps can also be treated successfully and safely in the office setting.20,24,28 Although standard microsurgery under general anesthesia might avoid discomfort associated with an in-office laser procedure, in-office laser treatment may alternatively reduce the risks and adverse effects associated with general anesthesia and suspension laryngoscopy. More importantly, in-office procedures significantly reduced lost work days and medical expenditures for that population.8 Sridharan et al15 found significant improvement in VHI-10 and acoustic parameters when using the KTP laser to treat 10 hemorrhagic and 21 nonhemorrhagic polyps. A more recent retrospective study by Del Signore et al17 reported that 90% of 116 vocal polyps were treated successfully using either KTP or pulsed-dye lasers. Also incorporating vocal habit modification and vocal hygiene education as part of a treatment program, Mizuta et al16 reported that the in-office KTP laser was as effective as direct microsurgical coagulation of vocal polyps. As we, too, had found previously,19,20

Although many investigations have found the in-office angiolytic laser to be a promising alternative treatment option for vocal polyps, controversies remained regarding optimal procedural end points (eg, coagulation vs vaporization of the polyp).14,19 In cases of lesion coagulation without complete vaporization, it may not be easy to ensure lesion regression weeks after surgery. As a result, patients occasionally encountered insufficient resolution of the remaining polyp or incomplete recovery of voice quality and required additional treatment sessions.15 One retrospective study by Mizuta et al16 reported that 15% (3 of 20 patients) of their study population underwent another in-office laser procedure to achieve complete involution of vocal polyps. Similarly, another study by Del Signore et al17 found that 11% of the 144 vocal varices or polyps ultimately required additional treatments.

Another limitation of in-office angiolytic laser procedures is the inherent limited working time after local anesthesia to the larynx. If the laryngeal lesions require longer operative time or if the patients are more susceptible to throat discomfort, surgeons may not have enough time to complete treatment. In a multicenter prospective study by Young et al,29 procedures requiring longer treatment duration were associated with significantly higher postoperative discomfort and lower success rates. Likewise, Mouadeb et al30 reported that 13 of 117 pulsed-dye laser procedures (11%) ultimately called for early termination, especially in patients with large polyps or increased patient-reported intraoperative discomfort.

To address these disadvantages of in-office angiolytic laser treatment, we proposed a refined technique incorporating concurrent polypectomy following 532-nm laser coagulation of vocal polyps.18 Pulsing the angiolytic laser made this possible by condensing the fibrinoid content within the polyp and creating a cleavage plane separating the targeted lesion from the underlying superficial lamina propria, which allows easy and immediate removal of the coagulated polyp (Figure 1).12,30 In the present series, we found that concurrent polypectomy offered 2 additional advantages. First, because concurrent polypectomy removes the polyp directly, the likelihood of retreatment of residual lesions is significantly reduced (1 of 68 [1%] vs 6 of 29 [21%] (Table 1). Second, laser energy and tissue effect in those receiving concurrent polypectomy was significantly decreased compared with those receiving angiolytic laser treatment alone (Table 1). The reduced energy delivery and tissue effects (coagulation without direct contact) could avoid overheating of the delicate microstructures surrounding the polyps and subsequent development of postoperative adverse events.

In this study, 8 patients had minor postoperative adverse events and all recovered by 0.5 to 1.5 months postoperatively (Table 3). Similar to Del Signore et al,17 we found posttreatment vocal edema to be the most common. Analyzing the contributing factors, we found half of adverse events (n = 4) to be related to inadequate surgical technique. All these patients received higher-than-average laser energy and laser effects ranging from KTP type 2 to KTP type 4 (Table 3). In addition, among the 7 patients requiring multiple treatments, adverse events tended to occur after exposure to excessive laser energy instead of repeated procedures (eTable 2 in the Supplement). The management of concomitant vocal varices remained controversial because varices were vulnerable to blood extravasation and susceptible to thermal injury (Table 3). A recent retrospective study by Tang et al31 investigating 513 professional vocalists found that the incidence of hemorrhage in the presence of varix was quite low (3.3 cases/1000 person-months). Accordingly, we proposed that excessive laser firing onto the surrounding normal tissues when the laryngeal target moved with each breath could be potentially dangerous. Surgeons should consider delivering the minimally required laser energy when performing in-office laser procedures. Meanwhile, adequate maintenance of vocal hygiene and control of laryngopharyngeal reflux postoperatively shall always be provided by the voice care team to achieve the best treatment outcomes.

Limitations
This study has some limitations. One limitation is the retrospective study design. Although we did not find demographic differences between the patients receiving concur-
rent polypectomy and those not receiving it, some minor difference might have been undiscovered because the treat-
ment modalities were not randomly allocated. Furthermore, posttreatment voice outcomes were measured between 1
and 2 months in this study. Wound remodeling processes
may persist in the second month postoperatively and affect
the assessment of treatment results. Another limitation was
that 17 patients (15%) were excluded from the study because
of incomplete follow-up or incomplete medical records.
Similar to other reports,11–19 the details of operation (eg,
fiber position and fiber-to-tissue distance) might differ
slightly depending on each clinical scenario and surgeon’s
preference. In addition, limited by the maximal power out-
put (8 W) of our laser module, we had to increase the pulse
width to achieve adequate tissue effect.14 Future study is
warranted to investigate how different laser settings (eg,
higher wattage or lower pulse width) will affect the treat-
ment outcomes of in-office laser procedures. Other factors,
including surgical experience and patient cooperation,
could also possibly confound the final interpretation of
treatment outcomes.

Conclusions
This study demonstrated significant improvements follow-
in-office angiolytic laser procedures for vocal polyps
with or without concurrent polypectomy. It was not uncom-
mon for patients to need multiple treatment sessions and
encounter minor postoperative adverse events. Conserva-
tive laser energy delivery might be the crux of in-office
laser procedures to avoid treatment-associated complications.
Compared with direct vaporization of the polyp, concurrent
polypectomy following laser coagulation allows less laser
energy delivery and reduces the risks of postoperative
adverse events. Immediate removal of the cauterized polyp
reduces the likelihood of residual lesion and therefore the
need for additional treatment sessions.

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ARTICLE INFORMATION

Accepted for Publication: November 5, 2017.
Published Online: January 18, 2018.

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Obtained funding: Wang.

Administrative, technical, or material support: Y.-H.

Study supervision: Wang, Cheng.

Conflict of Interest Disclosures: All authors have
completed and submitted the ICMJE Form for
Disclosure of Potential Conflicts of Interest and
none were reported.

Funding/Support: This study was supported by
grants from the Ministry of Science and Technology,
Taipei, Taiwan (MOST-105-2314-B-418-008 and
MOST 105-2410-H-468-015-MY3).

Role of the Funder/Sponsor: The funders had no
role in the design and conduct of the study;
collection, management, analysis, and
interpretation of the data; preparation, review, or
approval of the manuscript; and decision to submit
the manuscript for publication.

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