Although Reinke’s Edema (RE) is a benign disease, intervention is often indicated to improve voice quality and laryngeal function. Treatment begins with elimination of smoking, as well as addressing factors such as laryngopharyngeal reflux which may exacerbate the dysphonia. Short-term voice therapy is appropriate to introduce optimal vocal behavior and reduce vocal abuse. There is no universally accepted single surgical approach to the treatment of RE. Recently, studies have reported safe in-office treatment of RE with both the 585nm Pulse Dye (PDL) and the 532nm KTP in-office photothermolysis lasers, however, to date, a quantitative evaluation of the benefits has yet to be reported.

We present a case series of 7 patients with clinically diagnosed RE who were treated with a 532nm KTP laser. Their voice improvement was subjectively and objectively evaluated before and after treatment. Additionally, we compared the pathologic effect of laser treatment in two cases to the histologic findings in a patient who had not been treated with laser.

### METHODS AND MATERIALS

**Patients.** In the study period between 2008 and 2009, 7 patients identified with RE (Stage II or III) were included. Inclusion criteria: diagnosis of bilateral RE by primary investigator (MP), men and women ages 18-70, who refused or failed a trial of conservative medical therapy and voice therapy.

**Evaluation.**
- Patients underwent videostroboscopy and laryngeal function testing.
- The voice quality was subjectively evaluated using the Voice Handicap Index - 10 (VHI) and the GRBAS scales (blindly rated by 2 trained laryngologists and a speech-language pathologist).
- Laryngeal function was assessed by several acoustic and physiologic measures, at the same time points as the subjective evaluations.

**Treatment.** In the office endoscopy suite, the vocal fold was treated with the KTP laser set at 35 watts with a pulsed width of 15 milliseconds.
- The end point was visualized Blanching of the vocal fold at the time of laser treatment (Figure 1).
- An average of 93.1 joules (range 44-141) was delivered at a given session.
- Five patients were staged, receiving an average of 91 joules delivered per side.
- Two patients received an average of 103 joules to bilateral vocal folds in one setting.
- Staged patients underwent a total of 2 treatments while those who were not staged underwent a single treatment.

Objective voice testing was available for 5 of the 7 patients in our cohort. In this group, Average Maximum Phonation Time increased from 4.522 seconds to 7.53 seconds. Median fundamental frequency increased from 162 (range 96-199) to 186 (range 101-253) is shown in Figure 2. Changes in other acoustic/aerodynamic measures were statistically insignificant.

### DISCUSSION

• VHI and GRBAS scoring demonstrated subjective improvement at an average of 17.8 weeks (range 5-78) after a single KTP laser treatment to each vocal fold.
• Decrease in the median VHI score is promising and includes one patient (patient #6) who was evaluated at 12 weeks post-treatment with KTP laser which suggests potential long-term benefit.
• Trend toward improvement in maximum phonation time may reflect a decrease in the edema of Reinke’s space, allowing for improved glottic efficiency.
• Median fundamental frequency increased from 162 to 186 which would change a voice perceived as masculine to one perceived as desirable feminine.
• Histologic analysis of 3 RE patients managed differently allowed an assessment of the tissue effect of the KTP laser on the human vocal fold.
• Findings support the use of the KTP laser as a photothermolysis laser targeting the vasculature without collateral damage to the surrounding tissue.
• Evaluation one year post-laser treatment shows persistent vessel wall injury and a decrease in the myxoid and edematous stromal changes seen in RE.

### CONCLUSIONS

Treatment of bilateral Reinke’s edema with the 532nm KTP laser is promising. It results in quantitative and qualitative improvement of voice, including elevation of the fundamental after one treatment per vocal fold. Based on histologic analysis, the laser can be considered safe with acute preservation of the vocal fold vibratory epithelium, persistence of mucosal wave and the presence of normal epithelium and one year after treatment.

### SELECTED REFERENCES


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**RESULTS**

<table>
<thead>
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**Figure 1.** Vocal folds pre-treatment (1A). Demonstrating the isochronic end point immediately post-treatment (1B). Six weeks post-treatment the vocal folds are completely healed with mild residual RE. (1C) This result is representative of the general reduction achieved in Reinke’s edema after a single KTP laser treatment.

**Figure 2.** Pre- and Post- Treatment Fundamental Frequency

**Figure 3.** H&E stain Untreated Vocal Folds with RE (3A). H&E slides from a patient who underwent in-office KTP laser treatments and then opted for excision in the Operating Room 1 year later (3B&3C). There is decreased edematous and myxoid stroma, completely intact epithelium, and small caliber blood vessels just under the epithelium. Smooth Muscle Actin (SMA) stain (3D) highlights incomplete vessel structure (black arrow).

**Figure 4.** H&E stains 20x (4A) and 40x (4B) magnification of vocal folds with RE after KTP laser was applied in the Operating Room immediately prior to excision. H&E demonstrates unaltered myxoid and edematous change of Reinke’s space with an unaltered epithelium. Early clot formation is seen in the blood vessels and is evidence of blood vessel injury (black arrow). Periodic acid-Schiff (PAS) stain (4C) and Smooth Muscle Actin (SMA) stain (3D) shows mild degeneration of blood vessels wall (black arrow).