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# Quantum Molecular Resonance–Assisted Phonomicrosurgery: Preliminary Experience

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## Abstract

The objective of this study was to evaluate the use of quantum molecular resonance (QMR) energy in phonomicrosurgery. Quantum molecular resonance energy (QMRE) is an innovative technology that provides low temperature cutting and coagulation of tissues and causes minimal tissue damage during the procedure. Because of these features, this technology may offer new possibilities in phonomicrosurgery. Twelve patients with vocal fold polyps underwent QMR-assisted phonomicrosurgery. The patients were evaluated before and after surgery at 1 and 3 months postoperatively by using the voice handicap index, laryngeal stroboscopy rating, acoustic voice analysis, and perceptual voice evaluation. The subjects were also evaluated by a patient self-assessment questionnaire at 3 months postoperatively. All parameters significantly improved after QMR-assisted phonomicrosurgery ( $P < .05$ ). All of the patients also subjectively improved by self-rating. These results suggest that QMRE is a safe and potentially promising treatment in phonomicrosurgery. Yet, further studies should be conducted to confirm these results.

## Keywords

voice, molecular resonance, phonomicrosurgery, vocal polyp, stroboscope

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Quantum molecular resonance (QMR) technology has been introduced as a new tool in otolaryngological procedures.<sup>1-3</sup> The first experimental study of QMR energy (QMRE) was performed by Schiavon et al<sup>4</sup> in 2007. They performed thoracotomy in rats and evaluated its effect histologically.<sup>4</sup> Quantum molecular resonance energy is generated by means of alternate currents and high-frequency electron waves and characterized at precise and well-defined 8-, 12-, and 16-MHz waves with decreasing amplitudes.

This process creates energy packs, better called quanta of energy, to break the molecular bonds without increasing the kinetic energy of the molecules, thus without raising the temperature.<sup>1</sup> Thus, it provides minimal tissue damage and less scar tissue.<sup>1</sup> The present study was designed to show the efficiency of this innovative technology in phonomicrosurgery.

## Methods

Institutional review board approval was obtained from the local committee of our hospital. Patients with vocal fold (VF) polyps who failed conservative treatment were included. Exclusion criteria consisted of the following: (1) age <18 or >60 years, (2) smoking or substance abuse, (3) pregnancy or breastfeeding, (4) neurological problems, (5) contraindications to general anesthesia, and (6) healthy mucosa over the polyp. The patients with healthy mucosa over the polyp were excluded from the study because in these patients, we had to preserve the mucosa, and we preferred the microflap approach. All patients underwent the following tests before and after surgery (1 and 3 months postoperatively): (1) laryngeal stroboscopy rating, (2) acoustic voice analysis (AVA; jitter, shimmer, harmonics-to-noise ratio), (3) perceptual voice evaluation (GRBAS [G, overall grade of hoarseness; R, roughness; B, breathiness; A, asthenia; S, strain] scale), and (4) voice handicap index (VHI; shortened form of the Turkish VHI was used). A self-assessment questionnaire was administered at 3 months postoperatively. In this questionnaire, patients were asked to choose one of the following: my voice (1) gets worse, (2) is

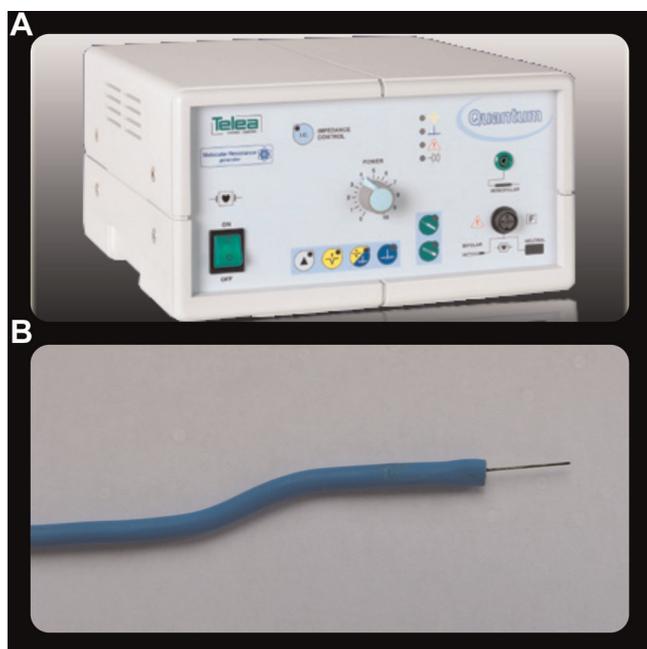
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**Figure 1.** (A) Quantum molecular resonance generator. (B) Needle tip of the specially designed laryngeal probe.

the same, (3) gets better, and (4) gets much better after treatment.

A total of 36 stroboscopy recordings (preoperative and 1- and 3-month postoperative recordings of 12 patients) were randomized as to order. Three otorhinolaryngologists evaluated these videos 2 times with a 1-week interval. The parameters of glottal closure, regularity, mucosal wave, and symmetry were rated with a 4-point grading scale (0, no deviance; 3, severe deviance).

The AVA was performed by a voice assessment program, the Doctor Speech software version 4 (Tiger DRS Inc, Seattle, Washington, USA). A total of 36 voice samples were randomized as to order before the GRBAS assessment by a speech language pathologist.

### Surgical Procedure

The truncation approach was preferred for all patients because none of the patients had healthy mucosa over the polyp. The vocal polyp was grasped gently with small triangular forceps and incised at the junction of the polyp and VF with the specially designed laryngeal probe that is

attached to the QMR generator (Quantum, Telea Electronic Engineering Srl, Vicenza, Italy) (**Figure 1**). It was used in the monopolar blend mode with the wand set on the setting of 3.5. This setting is explained as the safest starting power setting for otolaryngological procedures in the instructional guide of the device.

Complete voice rest was advised to patients for 3 days, and 4 weeks of voice therapy was provided for all patients.

### Statistical Analysis

Data of the VHI, AVA, and stroboscopic assessment were compared by the Wilcoxon signed-rank test and the GRBAS assessment by the Friedman test. We evaluated the interrater and intrarater reliability for stroboscopic analysis by the  $\kappa$  statistic. SPSS software package version 11.0 (SPSS Inc, Chicago, Illinois, USA) was used, and  $P < .05$  was considered statistically significant for all comparisons.

### Results

Twelve patients were treated with QMR-assisted phonomicrosurgery. Dysphonia was the main symptom of all patients, including 10 men and 2 women with a mean age of 40 years (range, 31-63 years). Data of the stroboscopic evaluation and intrarater and interrater reliability are presented in **Table 1**. Data of all other parameters are presented in **Table 2**. All parameters significantly improved after surgery ( $P < .05$ ). All patients also subjectively improved with the self-assessment questionnaire (2 patients reported “being better,” and 10 patients reported “being much better”). Endoscopic views are presented in **Figure 2**.

### Discussion

Coblation was reported as a viable method for the removal of tissue from the VFs with superficial penetration in an experimental study on canine larynges.<sup>5</sup> We hypothesized that the removal of tissue from the VFs can be also possible with QMRE. The favorable effects of QMRE compared to coblation were supported in 2 clinical studies.<sup>1,3</sup> D’Eredità and Bozzola<sup>1</sup> reported a mean  $43 \pm 9$   $\mu\text{m}$  depth of injury with QMRE, while the depth of injury was  $126 \pm 11$   $\mu\text{m}$  with coblation in the histopathological evaluation of tonsillectomy specimens. Further, QMRE causes almost 3 times less collateral tissue damage than coblation according to this study.

**Table 1.** Data of Stroboscopic Evaluation.

	Preoperatively	1 Month Postoperatively	3 Months Postoperatively	Intrarater $\kappa$ Values			Free-Marginal Interrater $\kappa$ Value
				Rater 1	Rater 2	Rater 3	
Glottal closure	2.0 (1.0-2.0) <sup>a</sup>	1.0 (0-2.0) <sup>a</sup>	0 (0-2.0) <sup>a</sup>	0.75	0.75	0.87	0.73
Regularity	2.0 (1.0-3.0) <sup>a</sup>	1.0 (0-2.0) <sup>a</sup>	0.5 (0-2.0) <sup>a</sup>	0.81	0.84	0.89	0.51
Mucosal wave	2.0 (1.0-3.0) <sup>a</sup>	1.0 (0-2.0) <sup>a</sup>	0 (0-1.0) <sup>a</sup>	0.83	0.86	0.91	0.62
Symmetry	2.0 (1.0-3.0) <sup>a</sup>	1.0 (0-2.0) <sup>a</sup>	0 (0-1.0) <sup>a</sup>	0.88	0.79	0.96	0.59

<sup>a</sup>Mean (minimum-maximum) values of all 3 raters.

**Table 2.** Data of VHI and Acoustic and Perceptual Analyses.

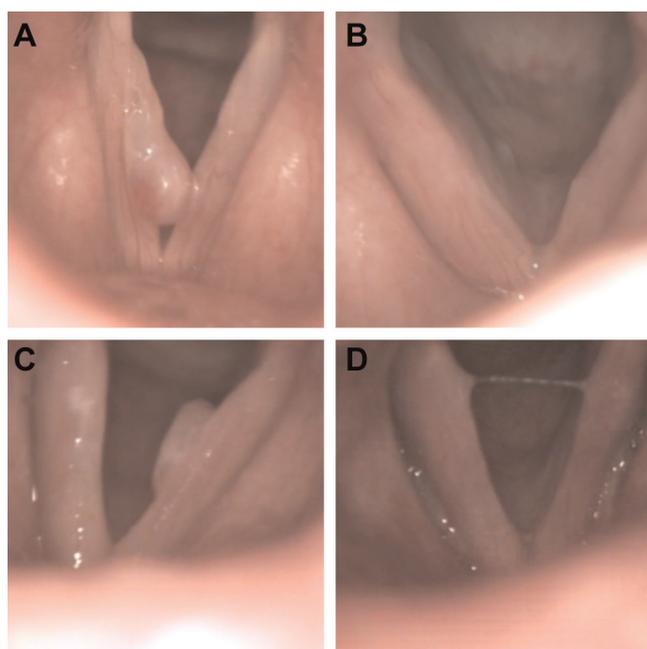
	Preoperatively <sup>a</sup>	1 Month Postoperatively <sup>a</sup>	P Value <sup>b</sup>	3 Months Postoperatively <sup>a</sup>	P Value <sup>c</sup>
VHI	21.91 ± 7.54	4.83 ± 2.98	<.05	2.25 ± 2.63	<.05
HNR	22.99 ± 4.55	27.31 ± 3.95	<.05	29.25 ± 3.97	<.05
Jitter	0.34 ± 0.31	0.16 ± 0.07	<.05	0.15 ± 0.04	<.05
Shimmer	3.20 ± 1.50	1.63 ± 0.53	<.05	1.45 ± 0.56	<.05
GRBAS values					
G	2.50 ± 0.52	1.25 ± 0.75	<.05	0.42 ± 0.67	<.05
R	2.08 ± 0.79	1.00 ± 0.85	<.05	0.33 ± 0.65	<.05
B	2.50 ± 0.52	1.17 ± 0.83	<.05	0.67 ± 0.78	<.05
A	2.50 ± 0.52	1.25 ± 0.75	<.05	0.50 ± 0.80	<.05
S	2.00 ± 0.74	1.08 ± 0.79	<.05	0.42 ± 0.67	<.05

Abbreviations: A, asthenia; B, breathiness; G, overall grade of hoarseness; HNR, harmonics-to-noise ratio; R, roughness; S, strain; VHI, voice handicap index.

<sup>a</sup>Values are presented as mean ± standard deviation.

<sup>b</sup>Comparison between preoperative and postoperative 1-month values.

<sup>c</sup>Comparison between preoperative and postoperative 3-month values.



**Figure 2.** Preoperative (A) and postoperative 3-month (B) endoscopic view of patient number 1 and preoperative (C) and postoperative 3-month (D) endoscopic view of patient number 5.

The price of a QMR generator is comparable to coblation devices (approximately €10,000). Moreover, QMRE provides excellent hemostasis during surgery. None of our patients had vocal scars postoperatively, and this finding supports less collateral thermal damage. In fact, bleeding is not a major problem during vocal polyp surgery, but bleeding can obscure visualization particularly during the excision of large exophytic and vascular lesions. Thus, this technology may have additional benefits on respiratory papilloma and vascular tumor cases.

The small sample size and lack of a control group are the limitations of this study. The other limitations are the lack of optimally designed laryngeal probes and the application

power of QMRE. We used the safest power setting and did not observe any complications. Yet, experimental studies on VFs comparing tissue responses according to the amount of applied QMRE will give us more information about the optimal doses of QMRE. After that, randomized controlled studies comparing QMRE with other phonosurgical techniques should be conducted for the widespread use of this technology in phonosurgery.

This study supports the favorable effects of QMRE. Yet, well-designed probes for laryngeal QMR application should be developed, and further studies should be conducted to confirm these results.

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### Authors' Note

Orhan Gazi Yigitbasi is no longer affiliated with Tepecik Training and Research Hospital, but did work there during the study period.

### Author Contributions

**Erhan Demirhan**, study design, writing/editing, revising, and approving final article; **İbrahim Çukurova**, study design, editing, and approving final article; **İlker Burak Arslan**, editing, data acquisition, and approving final article; **Elcin Tadihan Ozkan**, data acquisition, language editing, and approving final article; **Erdem Mengi**, data acquisition, editing, and approving final article; **Orhan Gazi Yigitbasi**, study design, editing, and approving final article.

### Disclosures

**Competing interests:** None.

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