

## Original Research Article

# Aerodynamic measurement-Maximum Phonation Time in young patients with benign vocal fold lesions and with normal voice: a comparative analysis

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**Received:** 05 May 2019

**Accepted:** 31 May 2019

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## ABSTRACT

**Background:** Clinicians use Maximum Phonatory Time (MPT) as one of tool to verify the glottic efficiency objectively. Impairment of vocal fold mucosa integrity due to lesions results in alteration in MPT. The aim of current study was to compare MPT in young adults with vocal fold lesions and age and sex matched normal subjects.

**Methods:** This study was conducted in the Department of ENT & Head and Neck surgery of Government Medical College Srinagar on 41 adult patients with benign vocal fold lesions and 41 healthy subjects matched for age and sex for a period of 2 years from April 2017- April 2019. The aerodynamic measure was measured as maximum phonation time in seconds and the results were analysed statistically. Both patients and controls were explained the procedure.

**Results:** Mean MPT in seconds in males with vocal fold lesion was 14.42 seconds with SD of 5.62 seconds and in females was 10.81 seconds with SD of 3.44 seconds. Coefficients of variation (CV) was 0.35 and 0.21 respectively. In control group it was 18.15 seconds with SD of 5.88 in males and in females it was 15.72 seconds with a SD of 6.21. Mean difference between patients and controls in males and females was 3.8 and 4.9 respectively. P-Value in males and females was 0.053 and 0.003 respectively.

**Conclusion:** Vocal cord lesions decrease MPT in both sexes even in young adults.

**Keywords:** Comparison, Lesions, Normal, Maximum phonation time, Vocal cord, Young adults

## INTRODUCTION

Clinicians have different tools to assess vocal function. Aerodynamic measures of voice include maximum phonation time in seconds which is a simple and easy to use as clinical tool. MPT is the longest period during which a person can sustain phonation of a vowel sound; e.g., ee/aa. Three such readings are taken and highest among them is taken as MPT for that patient.<sup>1</sup> When integrity of vocal fold mucosa is impaired as in dysphonia by benign true vocal cord lesions like nodule, polyps and cysts, the microwave movement of vocal fold

mucosa does not occur in harmony. These kinds of lesions increase the mass in the free margin of the vocal cords due to edema. Such increase damages the glottal closure, which may interfere in maximum phonation time.<sup>2,3</sup>

The present study aims to provide data on MPT in adult male and female patients with benign vocal cord lesions and compare them with age and sex matched healthy volunteers.

## METHODS

This study was conducted in the Department of ENT and head and Neck Surgery of Government Medical College Srinagar, Kashmir, India on 41 patients and 41 controls for a period of two years from April 2017 to April 2019. Patients and controls were selected as per following inclusion and exclusion criteria.

### Inclusion criteria

Both male and female patients and controls in the age group of 20 to 42 years. Patients with benign lesions (nodule, cyst and polyp) in the true vocal cord and controls with normal voice and without any lesion on cords. No chronic systemic disease in both patients and controls.

### Exclusion criteria

The patient of age <20 yrs or > 42yrs. Patients with hyperkeratotic and malignant looking lesions. Vocal cord palsy/paralysis. Vocal cord sulci, atrophy. Chronic laryngitis and reinkes edema. Based on the above-mentioned selection criteria 41 patients and 41 controls were included in the study. Besides clinical diagnosis, the following measurement of patients was recorded, patients

were asked to take a deep breath and phonate a steady state vowel sound (ee/aa) for maximum time possible in seconds.

Three such readings were taken and the highest among them is taken as MPT for that particular subject. Data obtained was tabulated and statistically analysed.

## RESULTS

The A total of 41 patients both males and females in the age range 20-42 years. There were 19 male patients within the age range 24-42 years with mean age 33.94 yrs and 22 female patients within age range of 20-42 years with mean age 33.68 years (Table 1).

In control group, range of age in males was 22-42 with mean age of 30.00 years and in females was 22-41 with mean age of 29.57 years. The mean MPT (in sec) in male patients was found 14.42 with standard deviation of 5.62 and in female patients was found 10.81 with S.D. of 3.44 sec. In control group mean MPT was found to be 18.15 seconds with S.D. of 5.88 in males and in females it was 15.72 seconds with a S.D of 6.21. Difference in mean between patients and controls in males and females was 3.8 and 4.9, respectively. P-value between two groups in males and females was 0.053 and 0.003 respectively.

**Table 1: MPT in seconds.**

MPT in seconds	Patients, Mean (SD)	Controls, Mean (SD)	Difference in mean (95%CI)	P-value
Males (n=19)	14.4 (5.62)	18.2 (5.88)	3.8	0.053
Females(n=22)	10.8 (3.44)	15.7 (6.21)	4.9	0.003

## DISCUSSION

Maximum phonation time (MPT) is one of the aerodynamic measurements of voice production which also includes vital capacity and phonation quotient. MPT has been found to be the most sensitive measure of these.<sup>4</sup> MPT depends on various variables, including phonation volume (which itself varies with age, sex and stature); mean air flow rate, comprehension of the task and maximal effort.<sup>5</sup> If the instructions and demonstrations are clear for the subjects, then three trials are sufficient to elicit a truly maximum duration of phonation.<sup>6</sup> In the present study, there were total of 41 patients both males and females in the age range 20-42 years out of which, 19 were male patients within the age range 24-42 years with mean age 33.94 yrs and 22 were female patients within age range of 20-42 years with mean age 33.68 years. In control group, range of age in males was 22-42 with mean age of 30.00 years and in females was 22-41 with mean age of 29.57 years. Since age causes change in MPT due to global change in anatomy and physiology in voice box and related organ systems. The changes

include decrease in the power of respiratory muscles, less pulmonary elasticity, and/or sarcopenia in laryngeal muscles.<sup>7</sup> Because of above-mentioned reason we have selected age matched control group. In the present study, the mean MPT (in sec) in males was found 14.42 with standard deviation of 5.62 and in female patients was found 10.81 with S.D. of 3.44 sec. In control group mean MPT was found to be 18.15 seconds with S.D. of 5.88 in males and in females it was 15.72 seconds with a S.D of 6.21. Results showed in the both groups (patient as well as control MPT is higher in males as compared to females. The reason for this, is increased vital capacity in males as compared to females. Similar findings by Maslan J et al, in his study i.e., MPT of males greater than in females<sup>6</sup> Ptacek PH et al, found range of MPT of 17.7-25.7 seconds for males and 11.5-24.1 seconds for females.<sup>1</sup> Difference in mean between patients and controls in males and females was 3.8 and 4.9, respectively. P-value between two groups in males and females was 0.053 and 0.003, respectively. Presence of lesions like vocal nodules or vocal polyps has two effects a) decrease glottal resistance, increase air flow due to glottal gap and

reduce MPT. b) bring alteration in the firmness of glottis, which makes it necessary to redirect air pressure to start and keep phonation. Therefore it is believed that decreased value of MPT are not only attributed to presence of lesion but also to the lack of pneumophonic coordination.<sup>2,8,9</sup> Also epithelial hyperplasia, thickness of basal membrane, edema and fibrosis, all contribute to decreased value of MPT.<sup>10</sup> The above mentioned reasons explain finding of our study with mean decrease of 3.8 and 4.9 sec in MPT in males and females. More decrease in female may be due to their decreased disease tolerance as compared to males.

## CONCLUSION

MPT is a useful and simple test which gives a hint about the status of vocal cords. Vocal cord lesions decrease MPT in both sexes even in young adults.

*Funding: No funding sources*

*Conflict of interest: None declared*

*Ethical approval: The study was approved by the Institutional Ethics Committee*

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**Cite this article as:** Dar NH, Ahmad M, Lone ZA, Patigaroo SA. Aerodynamic measurement-Maximum Phonation Time in young patients with benign vocal fold lesions and with normal voice: a comparative analysis. Int J Res Med Sci 2019;7:2725-7.