International Journal of Health Sciences and Research
www.ijhsr.org ISSN: 2249-9571

Original Research Article

Effect of a Voice Training Program on Acoustic Voice Parameters in Secondary School Teachers

Sadhana A Relekar, Geetha Mukundan

Department of Speech Language Pathology, Ali Yavar Jung National Institute of Speech and Hearing Disabilities (Divyangjan), Bandra, Mumbai 400050

Corresponding Author: Sadhana A Relekar

ABSTRACT

Teachers are known to be vulnerable to voice disorders because of the excessive use of their voice for professional purposes. This study aimed to investigate the effects of a vocal training program on select acoustic voice parameters in secondary school teachers.

The study sample comprised 60 premenopausal female secondary school teachers. The subjects were divided into the experimental (n = 30) and control (n = 30) groups. The experimental group underwent a vocal training program for 15 days, whereas the control group did not receive any training. The training included a combination of yogic and vocal function exercises.

Results showed significant differences in the post-training values of fundamental frequency, jitter (%), relative average perturbation, pitch perturbation quotient, shimmer (dB), amplitude perturbation quotient, and noise-to-harmonic ratio between the experimental and control groups. Thus, the vocal training program showed positive effects on the voice quality of secondary school teachers.

Keywords: acoustic parameters, vocal training program, vocal function exercises, yoga

INTRODUCTION

Effective communication is a basic necessity of human beings. A large group of individuals by the very nature of their occupation are directly dependent on vocal communication for their livelihood. These individuals, classified as professional voice users, [1] include singers, actors, clergy, teachers, receptionists, sales personnel, and physicians. Nearly 14.6% of teachers, compared to 5.6% of other professional voice users, experience voice disorders. The primary cause of voice problems among teachers is prolonged voice use in the presence of background noise. [2] About 50% of teachers experience some degree of voice disorders during their careers, limiting their job performance. [3]

The need for the development of educational, preventive and treatment programs has been highlighted because voice disorders are a relatively common occupational hazard of the teaching profession. [4]

It is evident that among professional voice users, teachers appear to be the most deprived of facilities as well as vulnerable with regard to voice problems, which brings down their performance and therefore work satisfaction. The crucial need for good performance, leads to voice overuse, leading to stress and reduced satisfaction, further leading to stress again, and finally again leading to reduced performance and satisfaction, thus creating a vicious cycle. If teachers are to teach effectively, they need vocal skills that will be able to withstand the demands of prolonged voice use tiring, damaging, or abusing. It is possible, but that presupposes that the conditions under which

one is using their voice are ideal. As this may not be possible to control, it is important to take preventive measures to enable teachers to maintain their voice effectively.

The prevalence of voice problems in secondary school teachers has been found to be 9%. [5]

Vocal training programmes have been tried since a long time by using indirect or direct approach. Ziegler, Gillespie and Abbott [6] the most widely used techniques have been 1. Indirect therapy –a) Vocal Hygiene and Voice amplification (VA). 2. Direct therapy- The physiologic approach- a) Laryngeal massage, - (Aronson), [7] b) Accent method-builds (Kotby) [8] c) Vocal Function exercises (VFE)- (Stemple) [1] and d) Resonant voice Therapy (RVT) (Verdolini, Burke, Lessac, Glaze and Caldwell). [9]

Orla and Hazlett [10] compared impact of preventative care programme direct, indirect therapy for training teachers. Direct training group showed greatest improvement than indirect therapy with respect to acoustic measurement, and indirect training group showed limited change in pre and post recordings

Teixeira and Behlau [11] compared the effectiveness of vocal function exercises (VFEs) versus voice amplification (VA) after a 6-week therapy for teachers diagnosed with behavioral dysphonia improvement in VFEG across all measures.

Some Yogic exercises have been identified by Moore. [12] In the study most clients reported that they experienced enhanced wellbeing and more success and confidence with applying new vocal techniques following the practice of yoga technique.

Rao and Ramarao [13] reported role of yogasanas and pranayama techniques in correcting the functional disorders of voice production. They included breathing exercises, asanas and pranayama practices from the existing literature of yoga that influences the vocal mechanism. The study also reported usefulness of 'om' chanting in strengthening the lung capacity, removing stress and strengthening the mind. It improves the base of the voice and the stamina of the voice.

Thus different methods used for voice training by different researchers show no unanimity about the length of the programme and the type of training. All seem to benefit in terms of self-reports, and acoustic parameters. There is paucity of studies done in India studying effect of such training. It is therefore proposed to develop vocal training programme using direct and adjunctive method (Yoga).

The aim of this study was to assess the effectiveness of a vocal training program (VTP) on selected acoustic voice parameters in secondary school teachers.

MATERIALS AND METHODS

a) Participants

This study included 60 premenopausal female secondary school teachers (age range: 22–45 years) with a minimum teaching experience of ≥1 year (full time) at a regular school. Teachers with no self reported voice complaints, voice disorders, or hearing loss were selected, whereas those teaching physical education or performing arts, or practicing yoga, or receiving voice therapy were excluded from the study.

The subjects were divided into the experimental (n = 30) and control (n = 30) groups.

All the subjects were given information about the VTP and the study. Those who were ready to devote time daily for the program and practice at home were assigned to the experimental group, whereas those who were doubtful were assigned to the control group. All the subjects gave their consent to participate in the study.

b) Instruments

A Sony digital recorder (ICD-UX513F) that records in MP3, WMA, and WAV file formats was employed for recording the voice samples. The multidimensional voice profile (MDVP) program of the Visi-Pitch IV model 3940

(Kay Elemetrics) was used for analyzing the voice samples.

c) Recording procedures

Voice recordings were obtained twice from each participant. In the experimental group, voice recordings were obtained before and after the VTP, whereas in the control group, the second voice recording was obtained 15 days after the initial recording.

Each participant was made to sit in a quiet room on a standard height chair with a backrest and was instructed to sit with their spine erect against the backrest of the chair and with their shoulders relaxed. A microphone was held at a distance of about 5 cm from the participant's mouth, at an angle of 45°. The participant was then asked to perform the sustained vowel phonation task, in which they were asked to phonate /a/ at a comfortable pitch and loudness for as long as possible.

Vocal training program

The treatment program developed for this study included a combination of relaxation exercises, yogic techniques (asanas, mudras, and "Om" chanting), and modified vocal function exercises (VFEs). The yogic techniques were discussed with yoga experts, before inclusion in the program.

The VFEs that were used were a modified version of Stemple's approach. [1] Stemple's VFE program comprises exercises related to warm-up, stretching, contracting, and power, in the given order, and requires production of vowel sounds at specific musical notes at various pitches (high, mid, and low) and gliding on the notes through these pitches. Therefore, knowledge of music is essential in order to recognize various musical notes. To circumvent this problem, Stemple's VFE program was modified by simplifying the instructions and tasks. The participants were asked to produce the vowel /o/ (as in word 'knoll' with 'l' silent) at a comfortable pitch initially and then to produce it at high and low pitches but not at a particular musical note.

A pamphlet for the yogic techniques used was developed on the basis of previous studies. [14,15] The VTP was administered over a period of 15 days at a stretch (excluding Sundays). A minimum attendance of 12 sessions was considered essential for inclusion in further data analysis.

Procedure

Each participant provided detailed data regarding age, occupation or career, voice-related information, and medical history and answered questions related to the teaching environment and methods. Voice samples were collected using the Sony digital recorder (ICD-UX513F).

A Power Point presentation giving information about how the voice is produced and the causes of voice problems in teachers was shown to the participants on day one.

The VTP was carried out with maximum 6 teachers at a time (from the experimental group) by the researcher for 15days at a stretch. A session once daily, included explanation and demonstration of each technique followed by practice with researcher suggesting corrections whenever necessary to the participants.

Table 1: sequence f the vocal training program

No.		
1	Shoulder Relaxation	
2	Forward Focus Exercises	
3	Yogic Techniques	
	a.	Parvatasana
	b.	Jiva Bandha
	c.	Simha Mudra
	d.	Brahma Mudra
4	Vocal Function Exercises	
5	"Om" Chanting	
6	Relaxation Exercises	

The participants were asked to sit in a relaxed position with their back supported while performing the VFEs. They were then instructed as follows. Participants were asked to perform warm-up. After warm-up, they were asked to perform lip trills, which involved production of the sound /brrr/ in the word "brown" or the sound /trrr/ in the word "train" for as long as comfortably possible (without strain). Three repetitions of lip trills were to be performed. Next, they

were asked to produce and sustain the vowel \i\ for as long as comfortably possible (without strain). They were asked to focus on maintaining the tone and not focus on the throat. Three repetitions were to be performed. Further, they were asked to produce and sustain the sound \o\ in the word "knoll" without "l" with a lip buzz through pursed lips, while feeling the lip vibration, for as long as comfortably possible (without strain). They were asked to use a comfortable pitch for sound production. Five repetitions were to be performed. Next, they were asked to produce the sound \o\ at a higher pitch than that used in the earlier exercise and to sustain it for as long as comfortably possible (without strain). Five repetitions were to be performed similarly at a lower pitch.

To learn and perform the exercises better, at the end of the first session, the participants were given the prepared pamphlets on the yogic techniques along with general instructions regarding the VTP for home use, and they were instructed to practice the techniques once at home also. The complete VTP session with the investigator required approximately 45 minutes for the first 3 to 4 days and then gradually reduced to less than 30 minutes by the end of the scheduled training.

After the completion of the VTP, voice samples were obtained from the experimental group, which were used as post-training data for analysis.

On the other hand, voice recordings were obtained from the control group 15 days after the initial recording. Information regarding the VTP was offered to the control group in a session at the end of the study.

The following acoustic voice parameters were analyzed using the MDVP of the Visi-Pitch IV model (Kay Elemetrics): (1) fundamental frequency (F0), (2) jitter %, (3) relative average perturbation (RAP), (4) pitch perturbation quotient (PPQ), (5) shimmer (dB), (6) amplitude perturbation quotient (APQ), and (7) noise-to-harmonic ratio (NHR).

RESULTS

Table 2: Mean age and years of experience of the experimental and control group teachers

Secondary Teachers	Age (years)		Experience (years)	
	Mean	SD	Mean	SD
Experimental	36.20	6.22	12.70	5.79
Control	33.67	6.57	7.60	4.63

Table 3: Comparison of the acoustic parameters before and after the VTP in the experimental group

Parameter	N	Pre/post	Mean	SD	Z value	P value
F0	30	Pre	208.40	15.90	-2.75	0.006
	30	Post	211.38	20.54		
Jitter %	30	Pre	1.08	0.61	-3.21	0.00*
	30	Post	0.76	0.44		
RAP	30	Pre	0.63	0.38	-3.03	0.002
	30	Post	0.48	0.35		
PPQ	30	Pre	0.56	0.32	-3.26	0.001*
	30	Post	0.45	0.27		
Shimmer dB	30	Pre	0.58	0.21	-4.27	0.00*
	30	Post	0.36	0.14		
APQ	30	Pre	3.33	1.41	-3.90	0.00*
	30	Post	2.54	0.77		
NHR	30	Pre	0.20	0.19	-3.67	0.00*
	30	Post	0.12	0.03		

*** P < 0.05.**

Table 4: Comparison of the acoustic parameters in the first and second assessments in the control group

Parameter	N	Mean (Pre)	SD (Pre)	Z value	P value
F0	30	220.67	19.57	-0.59	0.56
		221.17	23.65		
Jitter %	30	1.15	0.76	-0.34	0.73
		1.11	0.73		
RAP	30	0.84	0.61	-1.17	0.24
		0.83	0.61		
PPQ	30	0.53	0.34	-0.28	0.78
		0.50	0.32		
Shimmer dB	30	0.57	0.25	-0.09	0.93
		0.55	0.27		
APQ	30	3.19	1.17	-0.50	0.61
		3.21	1.19		
NHR	30	0.15	0.06	-3.37	0.00*
		0.17	0.05		

*** P < 0.05**

.

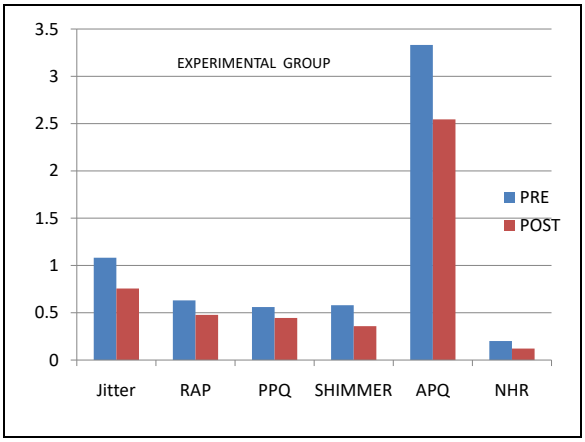

Figure 1: Comparison of the pre- and post-training values of acoustic parameters in the experimental group

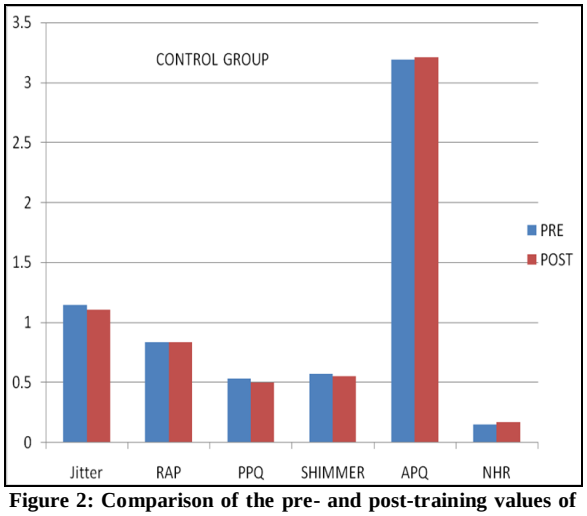

Figure 2: Comparison of the pre- and post-training values of acoustic parameters in the control group

The Wilcoxon signed-rank test was used to compare the pre- and post-training values between the groups.

For the vowel /a/, the mean jitter, RAP, PPQ, shimmer, APQ, and NHR values reduced and the F0 values increased after treatment in the experimental group. Differences in the mean rank were found to be significant for all parameters in the experimental group. However, there was a marginal increase in the mean F0, jitter, RAP, PPQ, shimmer, APQ, and NHR values 15 days after the first recording (i.e., at the second recording) in the control group; this difference was not significant for any parameter, except for NHR.

DISCUSSION

As observed, values of all the voice parameters, i.e., the frequency measure F0, the pitch perturbation measure jitter (%), RAP and PPQ, the amplitude perturbation measures shimmer (dB) and APQ, and the noise measure NHR, increased in both groups at the first evaluation; no significant differences were observed for any parameter, except F0, between the experimental and control groups. However, at the second evaluation, all the acoustic parameters showed significant improvement in the experimental group.

Roy et al [16] studied the effects of VFEs and vocal hygiene in teachers and reported that there was a significant decrease in the voice handicap index scores of the experimental group.

Bovo et al [17] studied effect of preventive programme on female teachers. The results indicated improvement in MPT, Jitter and Shimmer as compared to control group. NHR data did not show significant difference between both the groups.

In contrast to these findings, Chen et al [18] reported no significant differences in jitter, shimmer, and NHR in participants after resonant voice therapy.

In the present study, the VTP was a combination of VFEs and yogic techniques. VFEs lead to a forward focus and allow the stretching and relaxation of the vocal folds. Parvatasana is known to improve and facilitate diaphragmatic breathing.

The Jiva Bandha, Simha Mudra, and Brahma Mudra techniques are said to bring about relaxation of the laryngeal and pharyngeal muscles (resonation). The Simha mudra is known to increase lung capacity. Jiva Bandha and Simha Mudra encourage tongue and lip stretches and are known to increase the capacity of resonation and relieve tension in the chest and diaphragm.

"Om" chanting leads to relaxation (resonation) and a forward focus, thereby improving the balance between the subsystems of voice production, i.e., respiration, phonation, and resonation. [14]

All these effects and administration of VTP for 15days consecutively could have contributed to the significant improvement seen in the experimental group

CONCLUSION

The 15-day direct intervention program, i.e., the VTP led to significant improvements in the acoustic parameters including F0, jitter %, RAP, PPQ, shimmer, APQ, and NHR for the vowel /a/ in secondary school teachers. However, participant compliance to the VTP at home could not be ascertained.

It is suggested that future studies include data on primary and preprimary teachers. Moreover, male teachers could be included, and their results could be

compared with those obtained from female teachers. Furthermore, the effects of the VTP on other vowels and self perception could be studied. Follow-up could be performed after the completion of the program to check if the benefits of the VTP continue to be maintained. This could help to determine the most suitable length of the program for the best results.

REFERENCES

1. Stemple JC, Glaze LE, Klaben B. Clinical Voice Pathology: Theory and Management. Edn 4, Plural Publishing Inc. San Diego, Oxford, Brisbane, 2010.
2. Smith E, Lemke J, Taylor M, Kirchner HL, Hoffman H. Frequency of voice problems among teachers and other occupation. Journal of Voice. 1998; 12(4):480-488.
3. Sapir S, Keidar A, Mathers-Schmidt B. Vocal attrition among teachers: Survey findings. European Journal of Disorders of Communication. 1993; 28(2):177-185.
4. Russell A, Oates J, Greenwood K. Prevalence of voice problems in teachers. Journal of Voice. 1998; 12(4):467-479.
5. Sebastian S, Suresh BA, Simon S, Ballraj A. Risk factors for hyperfunctional voice disorders among teachers. Online Journal of Health Allied Sciences. 2012; 11(2):6.
6. Ziegler A, Gillespie A, Verdolini A. Behavioural treatments of voice disorders in teachers. Folia Phoniatrica et Logopaedica. 2010; 62(1-2):9-23.
7. Aronson AI. Clinical Voice disorders: An Interdisciplinary Approach. Edn 3, Thieme Stratton, New York, 1990, 336.
8. Kotby MN. The Accent Method of Voice Therapy. Singular Publishing Group Inc, San Diego, California, 1995.
9. Verdolini K, Burke MD, Lessac A, Glaze E, Caldwell W. A preliminary study on two methods of treatment for laryngeal nodules. Journal of Voice. 1995; 9(1):74-85.
10. Orla MD, Hazlett DE. The impact of preventive voice care programs for training teachers: A longitudinal study. Journal of Voice. 2003; 18(1):63-70.
11. Teixeira LC, Behlau M. Comparison between vocal function exercises and voice amplification. Journal of Voice. 2015; 29(6):718-726.
12. Moore C. Reflections on clinical applications of yoga in voice therapy with MTD. Logopedics, Phoniatrics, Vocology. 2012; 37(4):144-150.
13. Rao TI, Ramarao HN. The role of Yogasan and Pranayam techniques in correcting the functional disorders of voice production. International Journal of Research in Humanities, Arts and Literature. 2014; 2(7):159-166.
14. Nimbalkar, S. P. (1999). Yoga for Health and Peace (3rd Ed.). Yoga Vidya Niketan. Publishers: Mukund Vasudeo Bedekar, Mumbai.
15. Iyengar, B.K.S. (1997). The Illustrated Light on Yoga. IIarpchnliins Publishers, India.
16. Roy N, Gray SD, Simon M, Dove H, Corbin-Lewis K, Stemple JC. An evaluation of the effects of two treatment approaches for teachers with voice disorders: A prospective randomized clinical trial. Journal of Speech, Language, and Hearing Research. 2001; 44(2):286-296.
17. Bovo, R., Galceran, M., Petruccelli, J., Hatzopoulos, S. (2007). Vocal problems among teachers: evaluation of a preventive voice program. Journal of Voice, 32, 128-140.
18. Chen SH, Chiang, SC, Chung YM, Hasio LH, Hsiao TY. Risk factors and effects of voice problems for teachers. Journal of Voice. 2010; 24(2):183-190.

How to cite this article: Relekar SA, Mukundan G. Effect of a voice training program on acoustic voice parameters in secondary school teachers. Int J Health Sci Res. 2017; 7(5):258-263.

****