Chapter VI

Summary and Conclusions

A professional voice user may be defined as someone who uses his/her voice as a primary tool to communicate with others. A large portion of the working population falls under this umbrella. Actors, public speakers, politicians, announcers, singers, lawyers, salespeople, telephone operators and teachers are few examples. Among teaching profession, primary school teachers are often the most who suffer from voice problem owing to several reasons such as more than one course/subject to teach, more working hours, increase in intensity to control children in lower grade/class, reiterated teaching to little ones who are difficult to control, unfavorable working conditions like small classroom with poor acoustics, high background noise, and so on are some of the reasons for primary school teachers to be the vulnerable group to develop voice problems often. Vocal loading is a combination of vocal loading time and factors affecting voice like size of the group, size of work space, reverberation properties, and background noise. Change of voice and vocal fatigue are the two common manifestations due to prolonged use of loud voice. Occupational vocal loading studies are very scanty in Indian context which would appear as a useful base in exploring the real life manifestation of vocal fatigue. Hence the present study measured the time dose using voicing periods of daily and weekly speech of primary school teachers.

The objectives of the present study was three fold and were to investigate (a) the prevalence of vocal fatigue symptoms, (b) measure time dose using voicing periods, and (c) measure the vocal recovery index in primary school teachers. The study was done in two phases; in phase I, filled questionnaires from 482 primary school teachers out of 725, were collected and tabulated in order to compute the prevalence of vocal
fatigue symptoms. In phase II, ten primary school teachers from the 482 teachers volunteered for measuring voicing periods. Of these ten teachers, group I consisted of five teachers who were referred as few complaint group (FC group) and group II consisted of five teachers who were referred as the most complaint group (MC group). The grouping of teachers was done based on the scores obtained in vocal fatigue symptoms questionnaire.

The speech/voice was recorded using digital audio-tape recorder for five consecutive days i.e. from Monday to Friday during the entire working hours. The teachers were instructed to wear the digital audio-tape recorder around the neck and speak/teach as normally as possible and were instructed to phonate vowel /a/ for about 5-6 seconds at the beginning of the day/morning and at the end of the day/evening. The recorded samples were transferred on to the computer memory and truncated into ten minutes tokens. These tokens were analyzed using PRAAT software for voicing periods.

**Sixty six percent of primary school teachers responded to the questionnaire.** Among them, 79% of the teachers experienced lesser vocal fatigue symptoms (termed few complaint group-FC) and 21% experienced more vocal fatigue symptoms termed more complaint group-MC). This difference was significant at 0.05 level. This indicated that 21% of primary school teachers were at risk/suffering from vocal fatigue symptoms.

**Mean, SD and median vocal fatigue symptom scores were significantly lower in FC group compared to MC group.** Lesser vocal fatigue symptoms scores in FC group indicated that they use optimum use of voice that in turn facilitates them to use their voice effectively without any fatiguing symptoms compared to MC group teachers.
The reported *vocal fatigue symptoms were significantly higher in MC group teachers* owing to several possible reasons like, poor vocal hygiene practices, environmental issues, poor acoustics of the classroom, poor posture while teaching, and so on. The results indicated that MC group was more susceptible to develop voice disorders due to higher presence of vocal fatigue symptoms.

*The ‘years of teaching experience’ positively and significantly correlated with vocal fatigue symptoms scores in MC group.* In general, it is known that increase in teaching experience increases the chances of developing voice problem due to long history of excessive voice use. Subsequently, it may likely lead to organic voice disorders because of repeated collision forces between the vocal folds.

Few factors like *shouting while watching sports, history of GERD, frequent visits to ENT, medical treatment, classroom noise, and difficulty speaking loudly were more reported by MC group teachers than by FC group teachers*. Shouting, classroom noise, GERD and others are precipitating factors of voice problems. Greater presence of these factors in MC group teachers sourced higher vocal fatigue symptoms.

Of the ten participants in two groups, data of two participants were outliers and hence were not included for statistical analysis. *Voicing periods measured from eight teachers (4 in each group) were significantly longer in group II* (median: 1 hour 38 minutes or 98 minutes) *for daily as well as for a week’s duration compared to that in group I* (median: 1 hour 6 minutes or 66 minutes). The difference indicated that group II teachers excessively spoke/taught in the school settings; that is, the vocal fold vibration was surplus in group II that signify more vocal loading. But, there was no significant effect of days (Monday to Friday) on voicing periods observed in both groups. Longer voicing duration in group II indicated that the duration of active vocal
fold vibration was longer in group II. Longer the voicing period or time dose or F0 time more will be the vocal fatigue symptoms. Also, longer voicing periods causes more collision forces between the vocal folds where there is increased stress imposed on the vocal folds. The end result could be potential tissue damage in the laryngeal apparatus.

_The percent voicing was higher in group II_ (mean 27% and median: 25%) _compared to that in group I_ (mean: 18.6% and median: 19%), though not significantly. Also, no significant effect of days (Monday to Friday) on percent voicing was found in both groups. In addition, combined mean percent of voicing in primary school teachers was 22-23%. Higher voicing percent in group II indicated higher vocal loading in group II. Percent voicing was also higher in the present study compared to that in the Western counterparts.

_Frequency related measures were higher in group I compared to group II. On the other hand, intensity related measures were higher in group II than in group I._ But there was no significant difference between groups on both frequency and intensity related measures. Also, _there was no effect of days (Monday to Friday) and conditions (Morning/Beginning of the day Vs Evening/End of the day) on frequency and intensity related measures in both groups._ Increased frequency related measures in group I teachers could be due to three reasons - weakness of thyro-arytenoid muscle, compensatory reaction to alteration in voice and acoustic convergence behavior or accommodation. Physiological reason of muscle weakness due to loading remains unclear in acoustic study and it could be possible in electromyography. Hence, the F0 rise could be because of compensatory explanation and/or acoustic convergent behavior. Also, the increased intensity parameters in group
II could be due to accommodation effect and adaptation effect where demand was placed on the vocal system in the working environment.

*Vocal short term recovery index was significantly lower in group II (mean: 0.72 and median: 0.75) compared to group I (mean: 0.81 and median: 0.80).* Lower index value indicates higher risk of voice problems. The risks could be reduction in the blood supply, water as well as calcium circulation to tissue and poor removal of lactic acid which probably leads to organic damage to laryngeal tissues.

No significant difference was obtained on some of the measures which may be attributed to small sample size and large inter-individual variations which are well-known predicaments in voice studies.

The results of the present study highlights the need for improved preventive voice care in the training programs for these professions at an earlier stage, i.e. during their training period to educate upon the precipitating, and causative factors for vocal fatigue and voice problems. Also, educating them on conservation of voice would be beneficial for retaining them in the teaching profession.

To conclude, the results of the present study has provided data on vocal fatigue symptoms in primary school teachers, the voicing periods in FC and MC teachers and the short-term vocal recovery index. Definitely there are occupational hazards in primary school teachers who need to be educated and counseled about their voice use. Also, policy decisions on the line of occupational hearing loss for occupational voice loss/ disorder is warranted. The present study used data on eight of ten teachers only. With the method used in the present study it is difficult to include more teachers. However, using a different method, more number of teachers could be included in
future studies. Future studies considering the effects of grade, subjects taught and the teaching method/style on voicing periods are warranted. Also, future investigations are warranted on voice dose measurements in musicians, and other professional voice users.