

Acoustic Parameters of Normal Voice*

VANAJA, C. S.

Within recent years, speech science has focussed on changes in patient speech that accompany laryngeal pathology. Researchers have tried to show that voice of patients carry sufficient information for differentiating various laryngeal pathologies. Efforts to develop clinically feasible, objective and quantifiable methods for evaluation of voice disorder have focussed on acoustic analysis. The production of voice in the larynx is disturbed by organic or functional changes in the larynx and also by changes in the respiratory system to certain extent.

Different parameters of voice reflect different aspects of physiological mechanisms. Hence different pathologies differentially affecting the physiological mechanisms will bring about different changes in different parameters. Therefore study of different parameters of voice may aid in differential diagnosis of voice disorders. However before any parameter can be used in differential diagnosis, study on normal population is required.

Therefore the present investigation was undertaken to study certain acoustic parameters of normal voice of Indian adults.

The parameters considered were :

1. Fundamental frequency.
2. Fluctuations in intensity.

3. Fluctuations in frequency.
4. Rise and fall time of phonation.
5. Maximum phonation duration.
6. Maximum duration of sustained [s], [z] and s/z ratio.

Subjects were one hundred and forty normal adults, both males and females, ranging in age from 16 years to 65 years. They did not have any speech, hearing or respiratory problems.

Subjects were instructed to phonate three vowels [a], [i] and [u] as long as possible and sustain two fricative continuants [s] and [z] as long as possible. Three trials of each phonation were recorded in a quiet room of the building.

By feeding the recorded signals to pitch analyzer PM-100, fundamental frequency of phonation, fluctuations in intensity and frequency in initial, medial and final segments of phonation, rise and fall time of phonation were measured.

The maximum duration of phonation and maximum duration of [s] and [z] were obtained using a stop-watch.

By applying suitable statistical methods to the results obtained mean, standard deviation and significance of difference were calculated.

The following conclusions were drawn from the results obtained :

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t. *fundamental Frequency*

- (1) Fundamental frequency of males was significantly lower than that of females.
- (2) Fundamental frequency in females decreased with increase in age. No such change was observed in fundamental frequency of males.
- (3) Though the fundamental frequency of [a] was lower than that of [i] and [u], there was no significant difference between the three vowels [a], [i] and [u], in terms of fundamental frequency.

II. *Fluctuations in Intensity of Phonation*

- (1) The fluctuations in intensity of the initial and the final segments were significantly greater than that observed in the medial segment.
- (2) Fluctuations in the initial and the final segments of phonation increased in older age group. Fluctuations in the medial segment did not change as a function of age.
- (3) There was no significant difference between males and females, when compared for fluctuations in intensity.

III. *Fluctuations in Frequency of Phonation*

- (1) The initial and the final segments of phonation had significantly greater fluctuations than that in the medial segment. No difference was found between the initial and the final segments of phonation.
- (2) As age increased fluctuations in frequency of the initial and the final segment increased. This change was

more significant in females, there was no change in fluctuations in frequency of the medial segment as a function of age.

- (3) There was no significant difference between males and females in terms of fluctuations in frequency.

IV. *Rise and Fall Time of Phonation*

- (1) There was no significant difference between males and females, when compared for rise and fall time of phonation.
- (2) There was no change in rise and fall time of phonation as a function of age.

V. *Maximum Phonation Duration*

- (1) Maximum phonation duration decreased as a function of age and this change was more significant in females.
- (2) There was no significant difference between males and females, when compared for maximum phonation duration.

VI. *Maximum Duration of [s], [z] and s/z Ratio*

- (1) In normal adults, s/z ratio was approximately equal to one.
- (2) There was no difference between males and females for maximum duration of [s], [z] and s/z ratio.
- (3) There was no change in maximum duration of [s], [z] and s/z ratio as a function of age.

Implications of the Study

- (1) The results of the study can be used as norms for the purpose of comparison of clinical population.
- (2) The methodology used in the present study can be used for future studies.
- (3) The study of parameters, as done in this study, can be used to study normal and best voice.

Recommendations

- (1) The same parameters can be studied in a clinical population, to investigate the diagnostic value of those parameters.
- (2) Similar study can be carried out using a larger population in each age group and also by extending the age beyond 65 years.