Abstract

Objective: To assess the usefulness of acoustic analysis of voice in patients undergoing microiaryngeal surgery at R.G Kar Medical College and to support the current practice of subjective voice evaluation in such patients.

Methods: A prospective observational study was carried out at R.G. Kar Medical College involving 17 patients undergoing microiaryngeal surgery for benign vocal cord lesions in the department of Otorhinolaryngology. Using Dr. Speech software, pre-operative and 6 weeks post-operative acoustic analysis of voice of each patient was done and the data thus collected was statistically analysed and evaluated.

Results: A statistical significant change occurs in the basic voice parameters postoperatively. Mean fundamental frequency changed from 226.40 to 198.60, mean standard deviation of fundamental frequency changed from 3.18 to 2.50, mean jitter from 0.56 to 0.37, mean shimmer from 4.43 to 3.00, Singnal to noise ratio (SNR) from 16.48 to 20.98 and Harmonic to noise ratio (HNR) from 16.5 to 20.57. These changes reflect an improvement in voice quality, hoarseness and roughness with lesser perturbations during speech.

Conclusion: Voice is a multi-dimensional modality. Perceptual evaluation of voice by itself is not sufficient. Acoustic analysis of voice should be used by surgeons to supplement the perceptual analysis in both pre-operative and post-operative period.

Key words: Acoustic analysis; micro Laryngeal surgery; post-operative assessment.

Introduction: Man is unique, as he has the gift of voice. Voice reflects both the personality and emotional state of man. It is a barometer of emotional and physical health. It is no wonder then, that voice disorders can be extremely distressing and a big handicap, especially for people involved in voice intensive professions. These disorders are inherently complex. Currently, there exist various tools to objectively and subjectively measure voice. Perceptual evaluation by a trained listener, acoustic measures, electrolaryngography/electroglottography, stroboscopic evaluation, aerodynamic measures and self-assessment voice handicap surveys offer different perspectives on describing vocal function. However, in most government run hospitals in our country just an auditory perception of voice is done without any quantification of the auditory data. This lack, of standard voice measure compromises the evaluation of different treatments and their outcomes and becomes particularly important in this day of medical liability. In order to effectively evaluate their outcome a quantitative measure of voice function providing relevant information is needed. So an attempt has been made to study and evaluate some of the basic quantitative parameters of voice using a computer-based software called Dr. Speech, see how they change post-operatively and provide a support to the already existing system of perceptual evaluation of voice.

Materials and methods: A hospital based prospective, observational study was carried out for a period of 1 year involving patients presenting to R.G. Kar Medical College, Department of Otorhinolaryngology with hoarseness of voice. Patient selection was random, however, patients meeting any of the following criteria were excluded from the study: 1) Extremes of age (age <16 and >60 years), 2) Functional voice disorders, 3) Dysphonia plica ventricularis, 4) Spasmodic dysphonia, 5) Muscle tension dysphonia, 6) Suspected malignancy or carcinoma-in-situ, 7) Cases not requiring surgical intervention. 8) Presence of Upper respiratory tract infection. The inclusion criterion was: 1) Patients presenting with vocal nodule resulting in hoarseness of voice and/or voice fatigue, not responding to conservative therapy, 2) Age between 16 and 60 years, 3) No other significant co-morbidities. Preoperative and 6 weeks postoperative voice was recorded in 34 patients using a standard built in microphone of a computer laptop in a sound proofroom to eliminate any external voice interferences. Voice analysis was done using a computer-based software called Dr. Speech. The following parameters
Results: All the parameters studied showed a statistically significant change post operatively. The Parameters and their changes are as below:

i) Mean Fundamental Frequency (F0) was 226.40 Hz (preoperatively) and 198.60 Hz (postoperatively), paired t test value of 7.37, p<0.001 showing statistically significant change.

ii) Standard Deviation of Fundamental frequency (SD F0) was 3.18 (preoperatively) and 2.50 (postoperatively), paired t test value of 9.71, p<0.001 showing statistically significant change.

iii) Mean Jitter was 0.56 (preoperatively) and 0.37 (postoperatively), paired t test value of 11.81, p<0.001 showing statistically significant change.

iv) Mean Shimmer was 4.43 (preoperatively) and 3.00 (postoperatively), paired t test values of 5.96, p<0.001 showing statistically significant change.

v) Mean Signal to Noise ratio (SNR) was 16.48 (preoperatively) and 20.98 (postoperatively), paired t test value of 10.71, p<0.001 showing statistically significant change.

vi) Mean Harmonics to Noise ratio (HNR) was 16.5 (preoperatively) and 20.57 (postoperatively), paired t test value of 11.28, p<0.001 showing statistically significant change.

Discussion: In the developing nations of the world the need felt today is not just quality healthcare, but quality healthcare at an affordable cost. Although perceptual evaluation of the patients’ voice remains one of the most important evaluation tools, it is not devoid of drawbacks. Lack of trained listeners, subjective bias and inter-listener variations in assessment are some of the most commonly faced difficulties. Therefore, the need was felt to devise a system that would be free of the above fallacies. Although videostroscopy is a good alternative, it is prohibitively expensive for the Government set-up. Although this data can be used to determine the outcome of surgery and support the perceptual analysis, the present study should be complemented with a more detailed analysis using more parameters in a larger population size for better and effective understanding of how acoustic analysis may be used to support and gradually replace the perceptual analysis of voice. This is because the parameters used in this study do not correlate well with the perceptual GRBAS (Grade, Roughness, Breathiness, Ashythmia, Strain) scale which is the gold standard at present (Martin et al had found a correlation between HNR and roughness of voice). Then, the other test measures of voice including physiological and psychological parameters can be correlated to develop a standard reliable, valid, and consistent measure of voice.

Conclusion: A standard measure of voice is necessary in the current health-care environment. Because voice is a multidimensional function, perceptual and objective measures are necessary to “grade” voice. Acoustic measurement of voice is a simple yet powerful tool to analyse the patients with hoarseness of voice, and the present study shows the implementation of some of the basic parameters to quantify the pre- and post-operative characteristics of voice. Acoustic measurement can support and gradually replace the perceptual analysis of voice. This is because the parameters used in this study do not correlate well with the perceptual GRBAS (Grade, Roughness, Breathiness, Ashythmia, Strain) scale which is the gold standard at present (Martin et al had found a correlation between HNR and roughness of voice). Then, the other test measures of voice including physiological and psychological parameters can be correlated to develop a standard reliable, valid, and consistent measure of voice.

References:
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