

Jitter and shimmer of Voice in Normal Egyptian Children and Young Adults

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Introduction

“Voice” is the sound that the listener perceives when the adducted vocal folds are driven into vibration by the pulmonary air stream. Voice production is based on the coordination of three factors: breathing, phonation and resonance. The basic tone of the voice can be varied in many different ways, depending on the way in which we use the vocal folds and other parts of the voice mechanism. The main aspects of the voice that can be varied are: pitch, loudness and quality. Also there are other physical factors that affect voice production which are body posture and relaxation of the muscles of the body and the larynx (Jody et al., 2004).

The four most common approaches for clinically assessing the various aspects of voice production include: 1) auditory perceptual assessment of voice quality, 2) acoustic assessment of voiced sound production, 3) aerodynamic assessment of subglottal air pressures and glottal air flow rates during voicing, and 4) endoscopic imaging of vocal fold tissue vibration (Daryush et al., 2008).

Acoustic analysis is one of the components of computerized voice labs, and it is useful to supplement voice assessment band to assess speech (Fernandes, 1999).

Many of the acoustic parameters are evaluated in this analysis, and the most commonly used for voice assessment are: fundamental frequency, jitter, shimmer and the harmony-noise ratio.

Material and Method

This study was approved by the Ethics Committee for Research in the Faculty of

Medicine, Minia University. The subjects were informed about the goal, procedure and disclosure of its results. After agreeing, they signed an informed.

This study was carried out on 300 normal subjects divided into two groups(children group& adults group), 150 children from age 7 to age 11 years, and 150 young adults from age 20 to age 40 years, from both genders. They all went to the outpatient clinic in the Unit of Phoniatics at Minia University Hospital. The included subjects are physicians, nurses, some medical students, workers or those coming to the unit either for speech or language problem, or relative to patients who came for laryngoscopic assessment in the unit.

As regard adults, Minimum age was of 20 years, since puberty brings about voice alterations stemming from the voice change. Maximum age was of 40 years, because of possible voice changes caused by aging of the vocal apparatus as of this age. Age is a relevant variable in vocal assessment.

As regard children, Minimum age was of 6 years, Maximum age was of 11 years just before change of voice caused by puberty.

We exclude Smokers, vocal abusers (only in adults), recent history of cough, singers and neurological or psychological or hearing problems (only in adults),

Other exclusion criteria for the subjects included not having any signs and symptoms of voice change.

Besides not presenting voice alterations signs and symptoms (checked by the

questionnaire), the participant's voice was also assessed by three experienced phoneticians and only data from the individuals considered with normal voice became part of the present study.

This study aims to find out the results of measurement of jitter and shimmer in normal voice in age groups (children and adults) to make accurate measurements of the proper voice in children and adults category for use in the diagnosis and follow-up the patient's voices during and after treatment.

Data collection was carried out in a sound treated room, using Multidimensional voice program software, at Phoniatics Unit at Minia University Hospital. The microphone used was kept at a fixed distance of 10 cm in front of the subject's mouth. We used the sustained vowels /a/, /i/ and /u/ in a comfortable and habitual way, after deep inhaling.

All groups will be analyzed by modified GRBAS scale (Kotby, 1995), those with rating more than 0 will be excluded.

Speech Studio is a Windows based, real time, multimedia, speech display and replay system linked to statistical analysis programs for the assessment of speech production and perception. Speech Studio facilitates work with real, continuous speech.

The multi-dimensional voice profile, MVDP, provides a comprehensive analysis of continuous vowel sounds.

In order to analyze the samples, we used the time of 3-6 seconds, and irregularities in both the beginning and end of the vowel uttering were eliminated.

These vowels were analyzed as to their acoustic parameters: jitter (%) and shimmer (dB). Each one of these parameters was analyzed as to gender and vowel.

Results

Statistical method:

The collected data were coded, tabulated, and statistically analyzed using SPSS program (Statistical Package for Social Sciences) software version 20.

Descriptive statistics were done for numerical data by mean, standard deviation and minimum & maximum of the range, while they were done for categorical data by number and percentage.

The normality of data distribution of each parameter was estimated by Kolmogorov-Smirnov test and revealed that the data were not normally distributed.

jitter

In children; there were insignificant differences between males and females as regarding Jitter /a/ and /i/ (male jitter /a/ and /i/ 1.99% and 1.26%) (female jitter /a/ and /i/ 2.11% and 1.51%) but Jitter /u/ showed significant increase in females (2%) compared to males (1.17%), while in adults; there were a significant increase in Jitter /a/, /i/ and /u/ in females (2.83%, 2.52% and 2.31%) compare to males (0.77%, 0.68% and 0.61%).

Shimmer

In children; there were insignificant differences between males and females as regarding Shimmer /a/, /i/ and /u/, (male shimmer /a/, /i/ and /u/ 1.11dB, 1.6dB and 1.38 dB) (female shimmer /a/, /i/ and /u/ 1.56dB, 1.97dB and 1.73dB) while in adults; females showed significant decrease in Shimmer /a/, /i/ and /u/ (female shimmer /a/, /i/ and /u/ 1 dB, 1.48 dB and 1.15 dB) compared to males (male shimmer /a/, /i/ and /u/ 1.54 dB, 1.81 dB and 1.49 dB)

Discussion

Instrumental acoustic analysis of the human voice is a common assessment technique used in the study of voice pathology (Carding et al., 2009). In general, instrumental acoustic voice analysis refers

to a family of computer-based techniques which measure defined acoustic signal properties of a spoken (prolonged) vowel or speech (Carding et al., 2004).

Speech Studio is a Windows based, real time, multimedia, speech display and replay system linked to statistical analysis programs for the assessment of speech production and perception. Speech Studio facilitates work with real, continuous speech. The multi-dimensional voice profile (MVDP) provides a comprehensive analysis of continuous vowel sounds. (Maturó et al., 2012)

Because of the dramatic advances in voice research, acoustic perturbation analyses of sustained vowels, including jitter and shimmer, have been widely used in determining phonatory stability characteristics. Increased jitter or shimmer values have been associated with phonatory instability due to aging, (Linville, SE., 1987) amyotrophic lateral sclerosis, (Kent et al., 1992) and various laryngeal pathologies (Wolfe et al., 1991).

Hence, voice perturbation seems to be a probable indicator for a physiological disorder. However, we should note that several factors, including frequency, intensity, and vowel selection, would affect various phonatory stability measures and that the highest perturbation values almost always occur in low frequency-low intensity situations. (Araújo et al., 2002)

The jitter average regarding vowel /a/, for men was 0.77%, higher than the one found by (Horii, 1982), which was 0.66%, also it was higher than the average found by (Tajada, 1999) which was 0.23% and by (Araújo et al., 2002) which was 0.37%.

As to the average jitter regarding vowel /a/, for females, our result was (2.83%) which was higher than the one found by (Araújo et al., 2002) which was 0.85%.

jitter value was significantly different between the two gender groups add this support the hypothesis about which would

be the reasons for the better sound control shown by females (Behlau & Tosi., 1985)

The shimmer average for men, producing the vowel /a/, was 1.54dB, and such value was higher than the one found by (Horii, 1980), which was 0.47 dB and the one found by than the one found by (Horii, 1982), which was 0.132dB. But lower than the one found by (Araújo et al., 2002), which was 2.37dB.

Average shimmer for females producing the vowel /a/, in the present study was 1dB. This value was much lower than the one found by (Araújo et al., 2002), which was 2.52dB

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