A Normative Study of the Adult Voice

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Abstract
Acoustic analyses of voice have been questioned due to equipment concerns, high intra- and inter-subject variability, inconsistent sound collection techniques, and variability in program algorithms. The purpose of this study was to establish normative data for the adult population using a newly developed acoustic measurement system (Voice Evaluation Suite, Vocal Innovations). 60 participants, ages 18 to 65, were enrolled. Acoustic measures were taken during sustained phonation, connected speech, and maximum performance tasks.

Background
• Acoustic measurement of the voice signal provides an indirect measure of laryngeal functioning and offers a degree of objective information regarding voice production and pathology.

• The widespread and consistent use of acoustic measurement has been limited by:
  – cost of specialized equipment and software
  – lack of equipment portability
  – acoustic measurement has not been readily accessible to all clients.

• Recent technological advances have permitted the development of more cost-effective, portable acoustic systems appropriate for clinical use.

• As these systems emerge, there exists a need to examine the systems for reliability and to establish normative data for the products.

Methods
Participants
• Group A (18-39 years): Female N=15, Male N=14
• Group B (40-59 years): Female N=13, Male N=7

Inclusion Criteria
• English as primary language for communication

• Passed a pure-tone hearing screening prior to participation.

• No history of voice disorder per self report and

• No current voice disorder per score of less than 1 on each subscale of the GRBAS.

• Non-singers

• Non-smokers for the past 5 years.

Procedures
Equipment
• Shure Beta 53 omnidirectional headset mounted microphone

• The Voice Evaluation SuiteTM (VES), by Vocal InnovationsTM

• TASCAM US-122 16 bit 48 kHz digitizer with a 20 Hz to 20 kHz +/- 1 dB frequency response.

Subjects were seated in a sound-treated room and fitted with the microphone at a 3 cm mouth to microphone distance.

Measures
• Sustained phonation on the vowel /a/ (3 trials),

• Engaged in a 10+ second sample of conversational speech

• Maximum performance measures of:
  – phonation time on /a/, duration of /d/ and /l/,
  – dynamic frequency range, dynamic intensity range, laryngeal diadochokinesis rate

• Productions were automatically recorded and analyzed and a profile of each participant’s acoustic data was automatically produced and saved.

• Data were combined and analyzed to obtain normative information (mean and S.D.) for each age group and gender for each of the measures noted above.

Results
• Mean values and standard deviations for the various measures of fundamental frequency, average intensity, jitter, shimmer, harmonic- to-noise ratio, maximum phonation time, /z/ ratio and diadochokineti rate are given below for the 4 groups.

Conclusions
• Information from the study offers normative data on a new system of acoustic analysis: The Voice Evaluation Suite™ (VES), by Vocal Innovations™. This data is part of a multi- institutional study and adds to the pool of normative data being collected.

• Information gained during the study will:
  – Serve as a guiding tool for the engineers and programmers to fine-tune the software.

  – Offer clinicians reference values for male and female voices of various age groups and assist in the clinical assessment of voice production using this system.

The consideration of normative information from this study against established norms in the literature will speak to the suitability of these emerging systems for more widespread clinical use.

References