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Abstract

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Grant Number:	1R01DC005522-01
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PI Title:	ASSOCIATE PROFESSOR
Project Title:	Physiology & Measurement of Vocal Fold Vibration

Abstract: Biomechanical research approaches have contributed information about vocal fold vibration that has become important to clinical decision making. However, the increasingly sophisticated surgical techniques available to clinicians will make it critical to improve the scientific base understanding specific abnormalities of vocal production. This application requests support to continue development of research in the related fields of laryngeal physiology, pathophysiology and biomechanics. The long- range goals of this experimental work are to better understand both normal and pathological phonation and to contribute to the development of valid, comprehensive and noninvasive clinically feasible methods of representing and measuring the physiology of phonation. This proposal has two related parts. The first addresses the physiology of specific vocal fold pathologies and how particular biomechanical variations cause pathological phonation. An excised larynx model will be used to stimulate abnormal variations in vocal fold mechanical properties such as stiffness, tension, variations in approximation, and alterations in the vertical tension of vocal fold cover. The studies will measure the effects of stiffness, variations in the adduction of upper and lower lips of the folds and asymmetry of the glottis and of vocal fold tension. The results of vocal fold mass changes, the specific effects of surgical augmentation of the vocal folds and changes associated with dehydration of the vocal folds will be examined. Measurements will be made of vocal fold stiffness, amplitude of vocal fold vibration and mucosal epithelial wave. Additional measures will assess stability and efficiency of vibration, phonation threshold pressure, vocal fold contact area and the spatial distribution of the contact area and intraglottal stress. As a supplement to the excised larynx model, a finite element analysis (FEA) computer model and a mucosal wave model will be studied. The purpose of these series of systematic measurements of the effects of specific biomechanical variables is to better understand the mechanisms that result in abnormal phonation. The second part of this proposal focuses on development of a multiple-measurement approach in order to non-invasively evaluate the characteristics of vocal fold vibration patterns. This part of the study will integrate data from high-speed video, PGG and EGG to improve the measurement of vocal fold vibration based upon system analyses. Measurements using non-invasive methodologies will be compared with direct measurements in the excised larynx model of pathological conditions in order to

establish validity and calibration for the noninvasive measures. The data from these controlled experimental studies will be compared to data from a large database of simultaneously recorded multiple measurements from patients with known laryngeal pathologies.

Thesaurus Terms:
biomechanics, diagnosis design /evaluation, larynx disorder, measurement, noninvasive diagnosis, pathology, physiology, speech, speech disorder, technology /technique development, vibration, vocal cord
biological model, body water dehydration, computer simulation, epiglottis, epithelium, larynx, model design /development, mucosa, otolaryngologic surgery
animal tissue, electrical measurement, information system, video recording system

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