Acoustic correlates of fatigue in laryngeal muscles: Findings for a criterion-based prevention of acquired voice pathologies

Abstract

The objective was to identify acoustic correlates of laryngeal muscle fatigue in conditions of vocal effort. In a previous study, a technique of electromyography (EMG) served to define physiological signs of "voice fatigue" in laryngeal muscles involved in voicing. These signs correspond to spectral changes in contraction potentials. A corpus of vocalizations from the 7 participants in the EMG study was used to explore the effects of muscle fatigue on voice acoustics. Each participant produced vocalizations at regular intervals (50 in all) extending across a day (12-14 hr). The participants also produced 5 min of loud speech with peaks of 74 dBA at 1 m between each vocalization. Twenty acoustic parameters were measured using the Multi-Dimensional Voice Program (Kay Elemetrics, Lincoln Park, NJ). The analyses showed no consistent correlations between acoustic parameters and estimates of muscle fatigue. However, in all cases, nonlinear jumps occurred in the frequency of amplitude tremor at points where fatigue estimates showed a critical shift. These jumps were robust despite changes in F0 in some individuals. A brief rise in voice tremor can correspond to a critical change in laryngeal muscle tissues seen as a condition where continued vocal effort can increase the risk of lesions or other conditions affecting voice.