Physiologic features of vocal fatigue: Electromyographic spectral-compression in laryngeal muscles

Abstract

Objectives: This study addresses the problem of defining observable attributes of “vocal fatigue” as a physiologic condition. The aim was to determine the applicability of electromyography (EMG) spectral compression in observing fatigue in laryngeal muscles arising from prolonged vocal effort.

Study Design: Single institution, nonrandomized, prospective analysis of subjects evaluated in an academic, tertiary care center.

Methods: In adapting EMG techniques, we report pretest observations that bear on the choice of voicing tasks serving to induce and estimate muscle fatigue and the selection of muscles that are particularly involved in effortful vocalization. On this basis, an experiment was designed where intramuscular EMG was used to record lateral cricoarytenoid potentials of seven subjects at regular intervals across a 12 to 14 hour period (50 samples per subject). Between each of these samples, the participants were required to produce loud speech for 3 minutes with peaks of 74 dBA at 1 meter.

Results: The results show fatigue-related spectral compression for all subjects and nonlinear changes across time indicating critical values beyond which fatigue is persistent.

Conclusion: Spectral compression appears to present a robust attribute of fatigue-related changes in muscles involved in vocalization. There are several implications with respect to research on the prevention of acquired voice pathologies.