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Mucosal wave analysis of a human vocal fold in the hemilarynx experiment

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The mucosal wave propagation was investigated in laboratory experiments across a variety of phonatory conditions. The focus was on the medial and superior surface dynamics of the vocal fold, which quantify mucosal wave propagation, but have been relatively little studied. High-speed, digital imaging of the entire surface of the vocal fold was performed using an excised human hemilarynx setup. Surface dynamics were characterized and differentiated across a variety of phonatory conditions. During sustained, flow-induced oscillation, the local maxima of vocal fold mucosal displacements, velocities and acceleration and their particular phase delays in the glottal cycle were investigated. Statistical analysis was performed, examining the influence of applied stimulations. Increasing the airflow yielded higher values for lateral displacements as well as higher velocity/acceleration values. Elongating the vocal fold resulted in decreased lateral displacements. The mucosal wave propagation apparently increased for higher flow, elongated folds, and higher adduction forces. While an understanding of the correlation between vocal fold dynamics and phonatory physiology/pathology is still in its infancy, the data presented here help to establish such connections. The data are also useful for the development and evaluation of physical and numerical models of vocal fold vibration.