

PHONATORY VS. RESPIRATORY BREATHING STRATEGIES IN PROFESSIONAL SINGERS

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The respiratory system is a central part of voice production, but details in breath control and respiratory dynamics during phonation are not yet fully understood. This study therefore aims to investigate phonatory in comparison to respiratory breathing strategies in regards to lung movement and ventilation in professional singers.

For this purpose regional ventilation was analyzed in 11 professional singers using electrical impedance tomography, a technique which monitors changes in the electrical impedance of the chest, indicating the regional air content inside the lung during breathing and phonation. Additionally dynamic magnetic resonance imaging was used for imaging of the breathing apparatus of 6 professional singers in a 1.5 T MRI system in supine position during vital capacity breathing and maximal long sustained phonation at 3 different pitches and loudness conditions. In a dynamic series of cross-sectional images of the lung, distances between characteristic anatomical landmarks were measured.

Our results show differences in the courses of time and amplitude normalized curves of impedance as well as diaphragm/ rib cage movement between phonation and exhalation. During exhalation in normal breathing the diaphragm and rib cage moved synchronously, but during phonation different functional units could be identified: the anterior diaphragm and rib cage behaved differently compared to posterior diaphragm. This allocation could support phonation by facilitating the control of subglottic pressure. Furthermore, differences related to gender and professionalism were found in the temporal and spatial profiles of regional ventilation. For female singers (sopranos and mezzo-sopranos) the anterior region participated less at the start of ventilation, and was more stable at the midpoint compared to male singers (tenors). This might be an expression of a smaller relative movement in rib cage and anterior diaphragm, primarily in early phonation.