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Calculation model of the influence of the vocal fold shape on the vocal fold oscillation form

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Vocal fold (VF) oscillation is driven by fluid-structure interaction effects. A possible way of modeling these effects is the finite-element (FE) method. The presented FE model consists of two coupled domains: A fluid domain representing the air, and a structural domain representing the VFs. In principle, each of the domains is a stand-alone simulation model. In the current implementation a thin three-dimensional frontal slice of the vocal folds and the sub- and supraglottal areas is modeled. Flow calculation is done using the standard Navier-Stokes equations. The air is modeled as a transient, viscous, and laminar flow. Constant physiologic values of pressure are used as driving force. For structural analysis, linear volume elements are used. There are two different models which differ in the VF shape. The first one is an assumed shape of a normal voice while the second shape was measured at an excised larynx and resembles more a falsetto voice. The results support two observations and assumptions: During normal phonation the VF touch each other in a constantly changing converging and diverging shape while during the more falsetto-like phonation, no converging/diverging shape is visible and no closure occurs.