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The evolution of viscous flow structures in the esophagus during tracheoesophageal speech BYRON ERATH, FRANK HEMSING, Clarkson University — A laryngectomy is an invasive surgical procedure whereby the entire larynx is removed, usually as a result of cancer. Removal of the larynx renders conventional voiced speech impossible, with the most common remediation following surgery being tracheoeosphageal (TE) speech. TE speech is produced by inserting a one-way valve to connect the posterior wall of the trachea with the anterior wall of the esophagus. As air is forced up from the lungs it passes through the prosthesis and into the esophagus. The resulting esophageal pressure field incites self-sustained oscillations of the pharyngoesophageal segment (PES), which ultimately produces sound. Unfortunately, the physics of TE speech are not well understood, with up to 50% of individuals unable to produce intelligible sound. This failure can be related to a lack of understanding regarding the esophageal flow field, where all previous scientific investigations have assumed the flow is one-dimensional and steady. An experimental TE speech flow facility was constructed and particle image velocimetry measurements were acquired at the exit of the model prosthesis (entrance of the esophagus). The flow is observed to be highly unsteady, and the formation and propagation of vortical flow structures through the esophageal tract are identified. Observations regarding the influence of the flow dynamics on the esophageal pressure field and its relation to the successful production of TE speech are discussed.

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