Analysis of factors affecting vocal fold impact stress using a mechanical model

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High mechanical stress levels in the vocal folds likely contribute to pathological changes to the tissue such as vocal nodules. Vocal fold collision during phonation was modeled as a dynamic contact problem in order to calculate stress levels during impact. The model incorporated a three dimensional, linear elastic, finite element representation of a single vocal fold, a rigid midline surface and a simplified aerodynamic waveform. The effects of fold geometry, material properties, and sub-glottal pressure on peak impact stress were calculated. Impact stress time course and the relationship between sub-glottal pressure and peak impact stress agree with published experimental measurements [Jiang and Titze, J. voice 8, 132-133(1994)]. Identification of high stress configurations will promote better understanding of the etiology, persistence and treatment of certain pathological voice changes. [work supported by the Whitaker Foundation]