775

CONSTRAINTS OF VOCAL PRODUCTION IN NONHUMAN PRI MATES

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The functional morphology of vocal organs sets constraints for the complexity of vocalizations, and it contributes to the variation of acoustic signals. Vocal tract geometry and flexibility as well as vocal fold anatomy critically influence sound variability. There is a basic understanding of the vocal tract filter mechanisms, but very little is known about how the nonhuman laryngeal sound source contributes to the acoustic variability. Vocal fold length and tension can be directly linked to changes in fundamental frequency. For an understanding of fundamental frequency regulations, it is not only necessary to describe the active control by intrinsic laryngeal muscles but also the passive viscoelastic properties of the vocal folds. In rhesus monkey vocal folds, we have investigated the tissue stress-strain response under cyclic strain, and the time dependent stress response under constant strain. Results demonstrate the typical nonlinear response for soft biological tissue, but quantitative differences exist between sexes and individuals. Predictions of fundamental frequencies with the string model of phonation suggest that viscoelastic properties can provide a basis for individual and sexual differences in the fundamental frequency contour. Viscoelastic tissue properties are subject to various additional influences, such as hormones, physical exercise or hydration, all of which are liable to changes. Such factors could be reflected in the vocal output, depending on how tight the relationship between such influences and the viscoelastic tissue properties.

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