Evaluation of Mucosal Waves Through Sharpness of Lateral Peaks in Videokymographic Images

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Introduction: Sharpness of lateral peaks is a visually helpful clinical feature in high-speed videokymographic (VKG) images indicating vertical phase differences and mucosal waves on the vibrating vocal folds and giving insights into the health and pliability of vocal fold mucosa. Sharp lateral peaks indicate that the mucosa is pliable whereas rounded peaks indicate the mucosa is stiff. This study aims at investigating parameters that can be helpful in objectively quantifying the lateral peak sharpness from the VKG images.

Method: Forty-five clinical VKG images with different degrees of sharpness of lateral peaks were independently evaluated visually by three raters. The ratings were compared to parameters obtained by automatic image analysis of the vocal fold contours: Open Time Percentage Quotients (OTQ) and Plateau Quotients (PQ). The OTQ parameters were derived as fractions of the period during which the vocal fold displacement exceeds a predetermined percentage of the vibratory amplitude. The PQ parameters were derived similarly but as a fraction of the open phase instead of a period.

Results: The best correspondence between the visual ratings and the automatically derived quotients were found for the OTQ and PQ parameters derived at 95% and 80% of the amplitude, named OTQ95, PQ95, OTQ80 and PQ80. Their Spearman's rank correlation coefficients were in the range of 0.73 to 0.77 ($P < 0.001$) indicating strong relationships with the visual ratings. The strengths of these correlations were similar to those found from inter-rater comparisons of visual evaluations of peak sharpness.

Conclusion: The Open time percentage and Plateau quotients at 95% and 80% of the amplitude stood out as the possible candidates for capturing the sharpness of the lateral peaks with their reliability comparable to that of visual ratings. These quotients provide the means to quantify the properties of mucosal waves on the vocal folds.

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Real-Time Visual Feedback of Vocal Fold Contact

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Objective: Phonation can be highly variable across the voice range, which poses a challenge when we try to analyze voices in a representative way. To cope with this inherent variability, we demonstrate a tool that automatically identifies different regimes of phonation.

Methods/Design: FonaDyn displays in real time how the electroglottographic (EGG) waveshape varies across the voice range. It produces colour maps over fo and SPL of the contact quotient, the contacting speed, and several other metrics. In addition, the system 'learns' and automatically categorizes incoming or recorded EGG pulses on the fly. Several modes of visual feedback of the EGG pulse shape are given, including a multicolored VRP-like plot from soft-to-loud and low-to-high. For research work, all outputs of FonaDyn can be exported to files of text tables, images or multichannel time-series. Technically, the categorization is based on data-driven statistical clustering of spectral features of every EGG cycle, normalized in both duration and amplitude.