QUANTIFICATION OF GLOTTAL WIDTH VIA VIDEOKYMOGRAPHIC AND HIGH SPEED IMAGES WITH BIDIRECTIONAL ILLUMINATION

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I. INTRODUCTION

Laryngeal image assessment techniques have evolved from the initial endeavours to observe the vibration of the vocal folds in slow motion by means of stroboscopy [1] through to the implementation of state-of-art high-speed video (HSV) [2] devices. Among other renowned laryngeal visualization methods, videokymography (VKG) has shown to provide a practical and efficient way to visualize a number of important features of the vocal fold vibration [3]. A common feature often taken into consideration for describing the vocal cycle is the variability of the glottal width. The glottal width is related to the impedance of the glottis and it is an important parameter for understanding and modelling the vocal fold vibration. This report is about the implementation of bidirectional illumination (BI) technique with videokymography (VKG) and high-speed video (HSV) for visualization of the medial displacement of the lower vocal fold edges during glottal adduction, hence the estimation of the glottal width via image analysis. We hypothesised a reduction of the estimated glottal width using BI when compared to traditional techniques. Furthermore, we also hypothesised that changes in glottal width between the two techniques would be correlated to changes in fundamental frequency.

II. METHODS

A secondary light source was placed at the level of the cricothryroid space in addition to conventional VKG and HSV light sources (i.e. above the glottis). The participants were asked to sustain a series of different pitches whilst producing an [i:] vowel. The secondary light source was manually removed from the participant's neck during a single sustained phonation, hence images were obtained with BI and traditional illumination for the same phonation. The images obtained with and without BI were analysed using GIMP software and Octave. Statistical analysis was then performed using the statistical software R.

III. RESULTS

Results showed that VKG and HSV + BI allows for a better visual identification of the lower vocal fold edges during adduction. In addition, the glottal width was shown to be reduced for recordings using BI when compared to traditional illuminated methods. No correlation was found between changes in glottal width and fundamental frequency using BI versus traditional illumination.

IV. DISCUSSION AND CONCLUSION

The present implementation of a bidirectional illumination setup for VKG and HSV highlights the possible pitfalls of current measurements of the size of the glottis (i.e. inaccurate detection of the medial lower edge of the vocal folds, hence glottal space and width). This technique may be implemented for more accurate quantification of glottal area and glottal width in support to further investigating different aspects of vocal fold vibration as for example the different modes of vibration of the vocal folds.

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