

Development of an Ergonomic Nasometer with a Touchless Separator for Speech Assessment and Therapy

Xiaopeng Yang¹, Younggeun Choi¹, Heecheon You¹, Nguyen Phuoc Minh Tam², Gi-Wook Kim^{3,4},
Yun-Ju Jo⁴, and Myoung-Hwan Ko^{3,4}

¹Department of Industrial and Management Engineering, Pohang University of Science and Technology, Korea

²Department of Medicine, Chonbuk National University Medical School, Korea

³Department of Physical Medicine & Rehabilitation, Chonbuk National University Medical School, Korea

⁴Research Institute of Clinical Medicine of Chonbuk National University-Biomedical Research Institute of Chonbuk National University Hospital, Korea

ABSTRACT

The present study developed a user-friendly nasometer with a touchless separator to measure nasalance for speech assessment and therapy. The commonly used KayPENTAX Nasometer as a golden standard device in nasalance measurement needs to be improved in terms of intrusiveness due to a significant pressure at the philtrum caused by a contact separator (0-mm gap between the philtrum and the separator). This study improved the KayPENTAX Nasometer by providing a 5-mm gap between the philtrum and the separator for better comfort. An experiment was conducted to find difference in nasalance between 0-mm gap and 5-mm gap nasometers using nasal and oral stimuli with 10 females and 10 males. The proposed nasometer generated a decreased nasalance by 8.3% for nasal stimulus and an increased nasalance by 4.2% for oral stimulus compared to the KayPENTAX Nasometer. Multipliers of 1.17 for nasal stimulus and 0.71 for oral stimulus were obtained for the proposed nasometer to provide an equivalent nasalance to the KayPENTAX Nasometer. An experiment was conducted to validate the proposed nasometer after applying the multipliers in terms of mean nasalance using nasal and oral stimuli with 2 females and 2 males. Similar mean nasalance values were obtained from the proposed nasometer (mean nasalance = $51.3\% \pm 8.5\%$ for nasal stimulus and $7.3\% \pm 1.8\%$ for oral stimulus) and the KayPENTAX Nasometer (mean nasalance = $53.0\% \pm 13.0\%$ for nasal stimulus and $6.0\% \pm 3.0\%$ for oral stimulus). The proposed nasometer can provide better comfort while maintaining an equivalent nasalance to the KayPENTAX Nasometer during speech assessment and therapy.

Keywords: Ergonomic Nasometer, touchless separator, speech assessment, speech therapy