Development of an Analysis Protocol for Swallowing Signals from an Ultrasonic Doppler Sensor and Videofluoroscopic Swallowing Study

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SUMMATIVE STATEMENT: The present study developed an analysis protocol to analyze the meaning of ultrasonic signals generated when swallowing by comparing and analyzing results of videofluoroscopic swallowing study (VFSS) using X-rays and a swallong monitoring and assessment system (SMAS) using ultrasonic Doppler sensors.

KEYWORDS: Swallowing, Videofluroscopic swallowing study (VFSS), Swallong monitoring and assessment system (SMAS), Ultrasonic Doppler Sensor

PROBLEM STATEMENT: Dysphagia (swallowing disorder) is a problem that occurs during the swallowing process and food intake is not performed smoothly, causing aspiration pneumonia which can lead to death and thus requiring accurate diagnosis and prompt treatment at its early stage. An ultrasonic Doppler sensor-based swallow measurement device was developed to complement the X-ray based VFSS, the existing swallowing disorder diagnosis technology.

OBJECTIVE/QUESTION: The present study is intended to confirm the validity of SMAS by comparing the swallowing motions found in VFSS and SMAS signals.

METHODOLOGY: The VFSS image was divided into ten sections through an image analysis program, and the position and movement speed of the hyoid bone in each section were extracted. A biomechanical coordinate system was established to correct extra-tracheal movements related to swallowing during swallowing and the relative position of the hyoid bone for each section was extracted through the hyoid bone position measurement protocol. To understand the meaning of the SMAS signal through the VFSS image, the movement speed of the hyoid bone in the swallowing section was calculated and the hyoid bone speed and the SMAS signal were compared and analyzed.

RESULTS: As a result of comparing the hyoid bone movement speed and SMAS intensity, it was confirmed that the correlation between the hyoid anterior-posterir axis speed and the median value of SMAS intensity was the highest ().

DISCUSSION & CONCLUSIONS: The present study identified that the SMAS signal is correlated with the hyoid bone motion by comparing and analyzing the hyoid bone motion and SMAS signal on the VFSS. Furthermore, a protocol was developed to check the hyoid bone movement speed for each section of a ten-step hyoid bone position analysis method that corrects the movement of the participant during VFSS image measurement and checks the relationship between the ultrasonic Doppler sensor and the hyoid bone movement speed. Further research is neeed to establish normative data measured from normal people and patients with various severity levels of dysphagia.