THE USE OF GYROMETRY TO CORRECTLY INTERPRET ACCELEROMETRY IN DYSPHAGIA

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Introduction

Use of accelerometry for dysphagia assessment and treatment was first proposed in 1991 and has been developed in many studies since, but has yet to gain wide acceptance in a clinical setting[1].

Recent studies[2,3] attempting to build systems using accelerometers which measure larynx movement fail to report how the inevitable rotation of the sensor during measurement is accounted for.

Accelerometry has enormous potential to be the basis for a portable, low-cost, safe and non-invasive dysphagia assessment tool, if it can be properly understood.

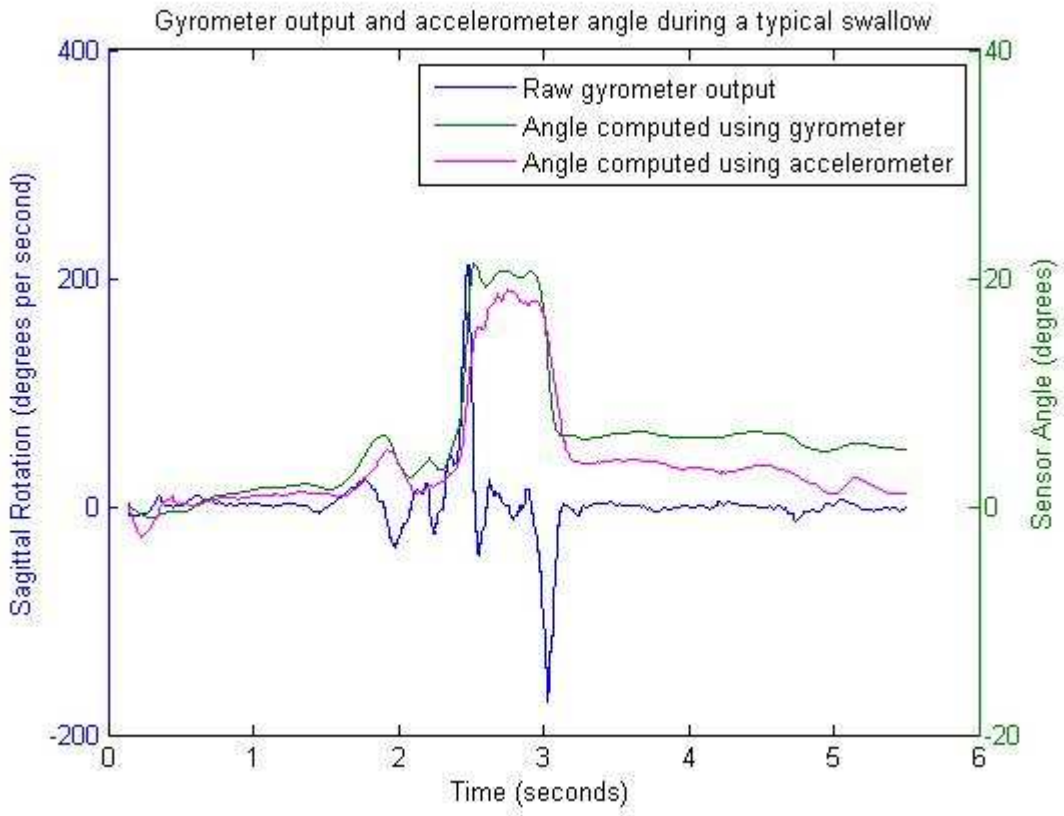
Materials and Methods

Sensors which combine an accelerometer with a gyrometer (which measures rotational velocity) were placed on a group of healthy subjects. Tri-axial accelerometer data was collected simultaneously with gyrometer data during swallowing.

The data was examined for evidence of a rotational component. The gyrometer output is used to calculate the true Anterior-Posterior and Superior-Inferior axis acceleration of the larynx.

Results

A significant sagittal rotation can be observed during swallowing.



Gyrometer and accelerometer data show high correlation, which would not be the case if rotation had little influence on the accelerometer output.

A significant correlation between the shape of the gyrometer signal and speed, height and hold duration of larynx elevation can also be observed.

Conclusions

Our study shows that rotation of the sensor in response to larynx movement is a large contributing factor to the accelerometry signal.

This has important implications for the interpretation of the accelerometry signal: a gyrometer is essential for the correct interpretation of accelerometry of the throat.

With our approach, several characteristics of a patient's swallow can be distinguished, such as speed of larynx elevation, height of elevation, duration and strength of hold at maximum elevation. Viewing these characteristics separately can provide the clinician with a far clearer understanding of an individual's swallowing physiology.

References

[1] Corbin-Lewis et al, *Clinical Anatomy & Physiology of the Swallow Mechanism* 2015

[2] Greco et al, *Proceedings 32nd Conf IEEE EMBS* 2010; 923

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