Measurement and Correction of Stooped Posture during Gait Using Wearable Sensors in Patients with Parkinsonism

Se Hoon Kim
Department of Rehabilitation Medicine
Seoul National University Hospital
Seoul 03080, Korea
whyamihappy@naver.com

Han Gil Seo
Department of Rehabilitation Medicine
Seoul National University Hospital
Seoul 03080, Korea
hgseo80@gmail.com

Keewon Kim
Department of Rehabilitation Medicine
Seoul National University Hospital
Seoul 03080, Korea
keewonkimm.d@gmail.com

Keywords—posture; neurologic disorders; gait/balance

I. Introduction

Stooped posture, which is usually aggravated during walking, is one of the typical postural deformities in patients with Parkinsonism. However, the degree of stooped posture is difficult to quantitatively measure during walking. Furthermore, continuous feedback on posture is also difficult to provide. The purpose of this study is to measure the degree of stooped posture during gait and to investigate whether vibration feedback from sensor modules can improve a patient's posture.

II. Methods

A. Patietns

10 parkinsonian patients with stooped posture were recruited for this study. The study protocol was approved by our institutional review board.

B. Experimental Setting

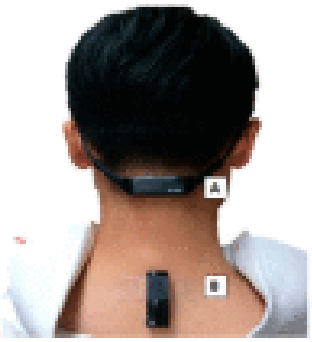
Two wearable sensors with three-axis accelerometers were attached, one at the upper neck and the other just below the C7 spinous process of the patients. After being calibrated in the most upright posture, the sensors continuously recorded the sagittal angles at 20 Hz and averaged the data at every second during a 6 min walk test. In the control session, the patients walked with the sensors as usual. In the vibration session, sensory feedback was provided through vibrations from the neck sensor module when the sagittal angle exceeded a programmable threshold value.

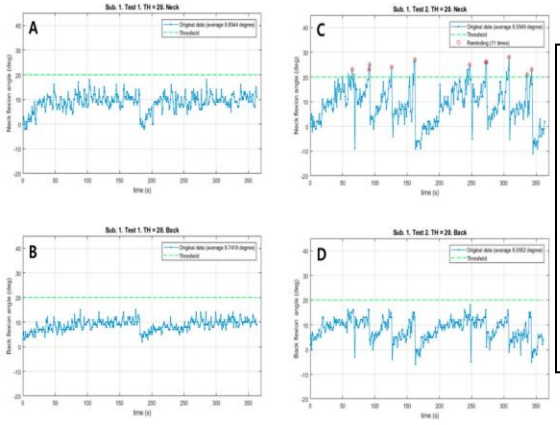
III. Results

Data were collected and analyzed successfully in a total of 10 patients. The neck flexion and back flexion were slightly aggravated during gait, although the average change was <10 in most patients in both measurement sessions. Therefore, it was difficult to evaluate the effect of sensory feedback through vibration. However, some patients showed immediate response to the feedback and corrected their posture during gait.

IV. Conclusion

In conclusion, this preliminary study suggests that stooped posture could be quantitatively measured during gait by using wearable sensors in patients with Parkinsonism. Sensory feedback through vibration from sensor modules may help in correcting posture during gait in selected patients.





The changes of neck and back flexion angles continuously measured during 6 min walk test in patient #1. (A) The changes of neck flexion angles in the control session. (B) The changes of back flexion angles in the control session. (C) The changes of neck flexion angles in the vibration session. (D) The changes of back flexion angles in the vibration session. Red circles: Reminding the patient by vibration feedback.