Research Paper: Designing and Evaluating the Validity and Reliability of the Biofeedback Tool for Healthy People With Postural Kyphosis

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ABSTRACT

Objective Kyphosis is one of the common abnormalities of the spine. However, correct preservation of the posture can play an important role in preventing and treating kyphosis. Biofeedback systems are among the methods used to prevent postural dysfunction. This study aimed to design a biofeedback tool to prevent kyphosis and evaluated reliability and validity of this tool.

Materials & Methods total of 17 students aged between 18 and 30 years participated in the study as inappropriately. In this study, a flexible ruler was used as a golden standard to measure the kyphosis. First, a microcontroller-based kyphosis control biofeedback device was designed using a flexural sensor. This device consists of a vibration generator that activates when microcontroller detects a kyphotic situation. In other words, by changing the physical condition, the flexural sensor resistance used in the smart biofeedback tool changes accordingly and the data collected by the flexural sensor are converted into a voltage variation with a simple resistance circuit. The output of the flexural sensor is input to the microcontroller so that as soon as the microcontroller detects an incorrect physical condition, it sends a control signal (based on the predefined threshold for the microcontroller) in a vibration feedback. If the curvature value is more than the threshold and lasts for at least 30 seconds, it will alert the user with vibration feedback. Vibration alert continues as long as the user is in the kyphotic situation and stops as soon as the user leaves the kyphotic situation and returns to the natural state. After installing the designed biofeedback tool on the target area of the body, the tool error is evaluated by counting the number of warnings in the normal state and lack of warning in the kyphotic condition. In addition, to check the repeatability of the biofeedback tool, measurements were made in two neutral conditions and a tissue for each situation twice, with a distance of 2 hours. In this research, the tool validity was measured by Kappa coefficient based on sensitivity, specificity, and reliability.

Results Correction of the physical condition is an effective technique used to reduce mechanical stress on the neck and shoulders by taking a natural state of the body. Wearable technology is a way to achieve this objective by continuously monitoring the physical condition of the person and giving him or her the needed feedback when the person's physical condition deviates from normal condition. In this research, a wearable tool was designed that people can use it very easily. Therefore, it can be used as a useful, simple, and non-invasive tool for clinical evaluation and measurement of kyphotic postural information. With further development of data recordings and feedback mechanisms, this system can be transformed into a portable tracking and posturing system to educate patients with spine deviations. This system is an inexpensive user-friendly device.

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The results showed that the sensitivity of the designed biofeedback tool was 17.64% and its property was 100%. The kappa index was calculated at 100% for both neutral states, but in the first one, 17.64% was measured in the first load and 12% in the second time. Regarding the repeatability of the biofeedback tool, the studies showed that the results of the first and second times did not differ significantly.

Conclusion To the results, the biofeedback tool has sufficient validity in the neutral state, but it was not sufficient in the paper situation . In other words, the designed biofeedback device does not correctly diagnose the physical condition of the body in accordance with the golden standard (flexible ruler). In this regard, further consideration should be given to address its deficiencies. In addition, Kappa index values showed that the biofeedback tool was not well-suited to the kyphotic condition. However, this tool has a great deal of reliability at the time.

Keywords:
Spine, Kyphosis, Biofeedback tool, Reliability, Validity