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Wearable Monitoring and Treatment System for Parkinson's Disease

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Abstract : Electromyography measures the electrical activity of muscles using surface electrodes or needle electrodes to monitor various disease conditions. Recent developments in the signal acquisition of electromyograms using textile electrodes facilitate wearable devices, enabling patients to monitor and control their health status outside of healthcare facilities. Here, we have developed and tested wearable textile electrodes to acquire electromyography signals from patients suffering from Parkinson's disease and incorporated a feedback-control system to relieve muscle cramping through thermal stimulus. In brief, the textile electrodes made of stainless steel was knitted into a textile fabric as a sleeve, and their electrical characteristic, such as signal-to-noise ratio, was compared with traditional electrodes. To relieve muscle cramping, a heating element made of stainless-steel conductive yarn sewn onto a cotton fabric, coupled with a vibration system, was developed. The system integrated a microcontroller and a Myoware muscle sensor to activate the heating element as well as the vibration motor when cramping occurred. At the same time, the element gets deactivated when the muscle cramping subsides. An optimum therapeutic temperature of 35.5°C is regulated and maintained continuously by a heating device. The textile electrode exhibited a signal-to-noise ratio of 6.38dB, comparable to that of the traditional electrode's value of 7.05 dB. For a given 9 V power supply, the rise time for the developed heating element was about 6 minutes to reach an optimum temperature.

Keywords : smart textile system, wearable electronic textile, electromyography, heating textile, vibration therapy, Parkinson's disease
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