

The smart medical stockings: An objective compliance monitoring

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Introduction

Compliance of venous compression is reported as mediocre in different works from different countries: 37% in a UK study,¹ 37.4% in a Polish study² and 68.5% in a French study.³

So far, the only way to evaluate compliance is to use questionnaire filled by patients. Thus, a doubt on the confidence of the results always exists. Recently, a French team proposed, for the first time an objective way to monitor the wear of compression stockings using an *electronic spy*, called Thermotrack, inserted in the stockings.⁴ This spy records the temperature over time and its analysis leads to identify the period of time the stockings are worn. A pilot study with this device showed a 96% of concordance between thermotrack recording and exact wear time of the compression stockings.⁵ However, this method has an important limitation : the ambient temperature. Above 28°C, it is not possible to isolate the wear period from the rest.

The goal of our present work is to evaluate a smart medical stocking with an embeded compliance sensor in order to verify its compatibility with everyday life situations. Thus, in this short study, we tested it in several situations.

Materials and Methods

Tests have been performed on two healthy subjects, one man and one woman wearing the prototype device inside the hem of one of their below-knee compression

stockings. The device never came into contact with the skin but detects the presence of the wearer's leg, records the wear time and sends it to a smartphone. This reported wear time was compared with the one measured by a stopwatch.

In a first series of tests, the subjects were sitted for 10 min and the wear times reported by the device and timed by the stopwatch were noted every 2 min. These short tests were performed in the following conditions: i) at low skin temperature with an ice pack applied to the leg; ii) at high temperature with an IR lamp warming up the leg; iii) with wet skin; and iv) with creamed skin. A last short test consisted in walking for 10 min, with both times noted every 2 min.

In a last test, both subjects wore the stocking with a device for about 7 hours while attending to their daily activities. The reported and stopwatch times were noted about every hour.

Results and Discussion

For the low skin temperature (down to 19°C) and the high skin temperature (up to 40°C), the wear times reported by the device and timed by the stopwatch were very well correlated. Similar results were obtained with wet and creamed skin. The walking didn't disturb the detection which still showed very good correlation. The 7 hour test also faithfully reported the wear time.

Conclusions

Although this is a preliminary study, the device performed adequately in various conditions and its performance isn't impaired by high or low temperatures, nor by movement. The effects of washing are still to be tested and further development and testings are required to complete this

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promising device. Other studies should be devoted to compare the device with other technologies which could be alternatively adopted in the field.⁶

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