

Real-time monitoring of the pressures at the seat-buttock interface

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Introduction

Pressure sores represent one of the most common, disruptive, disabling life threatening conditions affecting persons with spinal cord injury (SCI) and wheelchair users. Whereas it can take only a few hours for a pressure sore to develop, complete healing may require a months' hospital stay, involving difficult and expensive medical and/or surgical treatments. Accordingly, clinicians fully agree that it is far better to prevent pressure sores than to treat them. This paper aims at introducing the embedded TexiMat device that has been installed onto the wheelchair of a paraplegic volunteer during a six months period. This device monitors in real-time the pressures occurring at the cushion / buttock interface. Our goal was to evaluate to which extent such a device can be useful in observing the person's behavior, yielding clues to estimate any risks for pressure sores.

Methods

The *TexiMat* device is made of a 100% textile fabric able to continuously measure the pressures at the interface between the cushion and the buttock area (figure 1). This textile is comfortable, washable and can be seen as consumable since its fabrication process makes it low cost. The textile is connected to a small central unit embedded onto the wheelchair. This unit analyses in real time the pressures, with the objective to estimate the risks for internal over-stresses and if necessary to alert the wheelchair user.



Figure 1: the *TexiMat* device



A volunteer paraplegic person (male, 70 years old, 70 kgs, level of injury: T4, six pressure sores developed since his injury in 1985, none since this experiment carried out in 2009) was equipped at home with the *TexiMat* device during a six months period. The textile was put on top of a Jay[®] Active gel wheelchair cushion. Video cameras were installed inside the house in order to a posteriori correlate the recorded

pressure patterns with the activity of the volunteer (agreement from the Grenoble Hospital Ethic Committee, – HAD, Prof. A. Franco).

Results

General trends were observed such as regular (sleep, naps, awake hours) and non-regular events (changes during the day, transfers, relief maneuvers). These trends were confirmed by the video recordings.

In particular, two results should be carefully analyzed and should probably lead the person to change his habits. First, it was observed that overpressures around the ischia appeared systematically at the end of the day i.e. after many hours spent in the wheelchair. This is probably due to the fact that the volunteer uses a cushion which includes a gel that tends to migrate towards the edges of the cushion after being compressed by the buttock area. Second, it was clearly observed that the person did very few relief maneuvers during the day (figure 2). A mean number of 4.3 (s.d. 2.7) lift off maneuvers were observed every day, with a mean time of 9.8 hours per day during which the person was seated onto the wheelchair. Moreover, the mean duration for such lift off maneuvers was 7.7 seconds (s.d. 5.4 seconds) which is very short compared to what is usually recommended by clinicians.

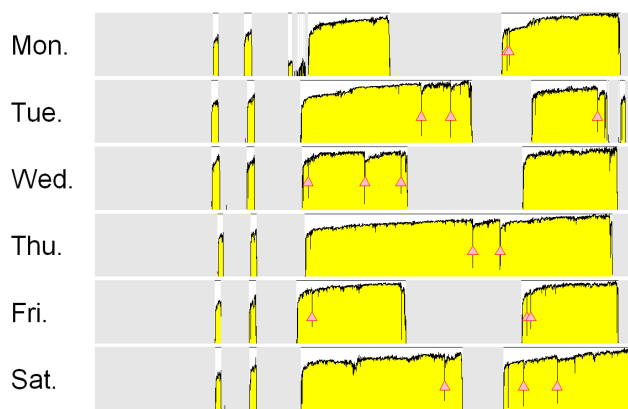


Figure 2: A week record for the total load and the automatic detection of the lift off maneuvers.

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Conflict of Interest

Some authors are involved in the Taxisense Company (www.taxisense.com).