The role of digitised pressure transducer devices for use with air cushions to assist the consistent management and prevention of pressure ulcers

Benjamin Lee

Additional authors: Mark Bowtell and Lorna Tasker
Rehabilitation Engineering Unit, Department of Medical Physics & Clinical Engineering, ABMU Health Board, Morriston Hospital, Swansea

Summary
An independent evaluation was conducted on a commercially available air cushion transducer device designed to assist set-up and performance of air-cell-based cushions (air cushions). Evidence supporting the device’s reliability and potential benefit in healthcare was found; the potential implications being a way to standardise patient experience.

Aims and objectives
The aim of this investigation was to evaluate a ROHO Smart Check device and assess any potential impact it may have in terms of improving consistency to air cushion users. Testing was divided into three sections:
1. Inter-assessor variability in air cushion set-up: is there a need for assistive air cushion devices?
2. Does the Smart Check device agree with the current (hand) method?
3. How consistent is the Smart Check device at repeatedly finding a set safe range?

Background
Air cushions can be effective in immersion and pressure distribution (Wounds International, 2010) and are widely considered as effective seating support surfaces for those with a high risk of tissue breakdown due to pressure and shear. Air cushions can, however, be susceptible to variation in set-up, affecting ongoing performance (Andreasen et al, 2013). Most users of these cushions have reduced mobility and/or impaired sensation, and some will have limited ability to communicate, which reinforces the importance of reliable cushion performance. Air cushion users are advised to check their cushions daily (ROHO, 2016).

Manufacturers have recently developed attachable devices (containing pressure transducers) that aid users to independently monitor and set up their air cushions in a repeatable manner. This project seeks to go some way to independently verifying the reliability and clinical benefit of one such device. This will inform local clinical guidelines of its use.

Methods
All testing was carried out using a controlled set-up involving a weighted SKELI (skeletal imbedded loading indenter) as a human analogue (Siekman, 2008) that could be lifted and lowered in a repeatable fashion onto a Smart Check enabled single valve air cushion from ROHO (ROHO, 2015). Eleven seating assessors set-up the air cushion to what they believed was an optimal set-up using the well-established ‘hand method’ (ROHO, 2013). Next, the Smart Check device was compared to the assessor group in terms of agreement and internal air pressure. Finally, the air cushion was tested for reliability by repeatedly over and under inflating the cushion, each time recording the internal air pressure when the Smart Check indicated the cushion air was too high or too low. Throughout the investigation internal air pressure was measured using a spring sphygmomanometer, and interface pressure data were collected using Flexible Boditrak 32x32 pressure map (Vista Medical, 2013).
**Results**

Strong agreement was generally seen between assessors with nine of eleven lying within the inter-quartile range of 24-30mmHg. However, one assessor differed slightly by 6 mmHg (38%) greater than the median (26 mmHg), and another greatly differed at 20mmHg (77%) greater than the median. When comparing assessors with Smart Check there was an 82% agreement reported. When assessing Smart Check for reliability, it was observed that fluctuations of internal air pressure safe range varied by 3mmHg. However, the pressure mat data at the recommended high and low threshold pressures fluctuated, depending on whether the cushion was being inflated or deflated. This was particularly evident in PPI (peak pressure index) (Clinical Guidelines for the Use of Interface Pressure Mapping for Seating, 2010).

**Discussion**

From the variability shown in the participant group, there is evidence to suggest that there is a benefit of accessory air cushion transducer devices that can ensure safe and consistent air cushion set up.

The 82% agreement between Smart Check and the assessor group suggests that it agrees with the current method. This study was limited to the use of the SKELI and not clients with more prominent anatomy or postural asymmetries. Further independent testing should be performed on a range of bodyweights, postures and air cushion sizes.

The Smart Check device demonstrated a repeatable “safe range” for an air cushion when testing the device in a single day. Pressure map data did support this, albeit only partially, and experimental error must be acknowledged.

This study suggests there is potential for air cushion transducer devices to aid clients and clinicians in ensuring standardised, consistent set-up of air cushions prescribed for the prevention and management of pressure ulcers.

Authors declare no conflict of interest. This is an independent study receiving no funding or otherwise gain from manufacturers or distributors. Other such devices are available.

**References**


