A Multidisciplinary Approach to Prevent Seating Acquired Pressure Ulcers

Peter Worsley, Dan Bader

Introduction

In 2011 the Faculty of Health Sciences at the University of Southampton appointed Dan Bader as Professor of Bioengineering and Tissue Health; his task was to create a new multidisciplinary team (MDT) focused on maintaining skin health and preventing pressure ulcers. The team currently includes a research fellow (Peter Worsley, physiotherapist), a senior nurse from the Netherlands (Lisette Schoonhoven, also a current Trustee of the European Pressure Ulcer Advisory Panel), and three PhD students with backgrounds in hospital/ community nursing and physiology. These researchers complement existing academics with expertise in physiological monitoring and continence technologies. The research group is based at the University Hospital Trust in Southampton where a new clinical academic facility has been created to provide the platform for translational research (Fig 1). There is close collaboration with clinicians working in both the acute hospital and community settings. The research, encompassing both physical models and human studies, is conducted in new purpose-designed facility at Southampton General Hospital and a recently installed environmentally-controlled room within the Wellcome Trust Clinical Research Facility in the Southampton Centre for Biomedical Research. One of our primary aims is to address the range of factors associated with seating acquired pressure ulcers (SAPUs).

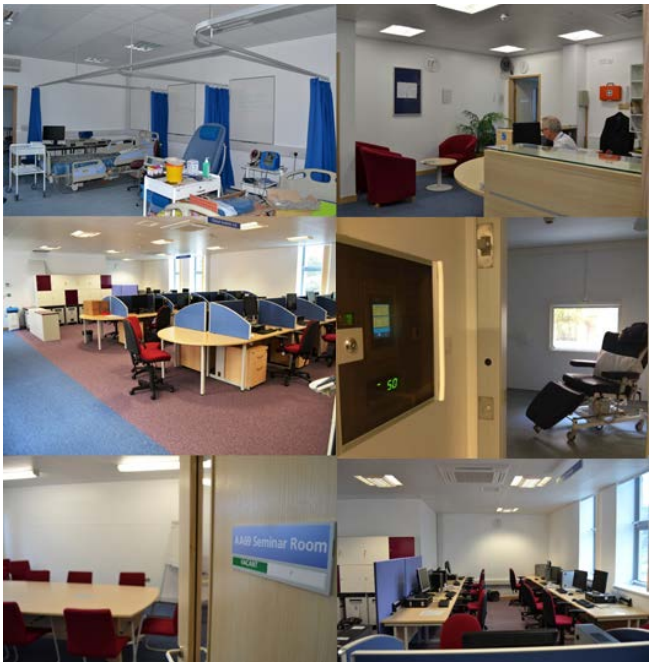

Figure 1. The new Clinical Academic Facility in the Faculty of Health Sciences, University of Southampton.

Why the interest in seating acquired pressure ulcers?

Traditionally, research associated with the prevention and management of pressure ulcers has focused primarily on those relatively immobile subjects confined to bed. This has led to the development of preventative strategies in the form of low pressure and alternative pressure mattresses (McInnes et al., 2012) and evidence based guidelines on mobility whilst patients are bed-bound (National Institute for Health and Clinical Excellence, 2005). By contrast, there has been relatively little clinical emphasis on examining pressure ulcer risk and prevention whilst a person is sitting, despite the well-established associated risk (Garber and Rintala, 2003). This has resulted in clinical guidelines derived from research with a limited evidence base (Stockton et al., 2009) and, thus, it is not surprising that few UK guidelines exist to inform prevention associated with seating (National Institute for Health and Clinical Excellence, 2005). Immobility represents a key risk factor in pressure ulcers. However, a study examining pressure ulcer prevalence across university hospitals in Europe showed as much as 80% of 'at risk' patients were not frequently repositioned in a chair (Vanderwee et al., 2007). Additionally, few studies associated with SAPUs have been led by allied health professionals (AHPs). An exception was research which examined existing pressure relief strategies of patients attending a seating clinic, as prescribed by senior physiotherapists at the UK National Spinal Injuries Centre (NSIC), (Coggrave and Rose, 2003). Their assessment protocols were developed by adopting bioengineering techniques which had been proven in a research study on spinal cord injured subjects (Bogie et al., 1995).

Our research initiatives

Our research group in Southampton is addressing the clinical problem in a series of parallel studies. These involve performing carefully controlled laboratory tests, as well as clinical studies in hospital wards and, ideally, the community setting. We have adopted a mixed method approach (qualitative and quantitative) in these studies, where we can both elicit the views of patients and carers as well as accurately measure key pressure-related parameters. The primary aim of all the research is to translate findings into clinical practice, and contribute to improving the prevention of SAPUs. Ultimately we would aim to provide evidence for national and international guidelines e.g. NICE (National Institute for Health and Clinical Excellence) and EPUAP (European Pressure Ulcer Advisory Panel).

Laboratory testing: what do we measure and why?

Many centres have used laboratory testing to assess the performance of support surfaces, employing a range of standardised test protocols using simulated indenters and mannequins.

We, however, favour the use of tests using healthy individuals and sub-populations of patients as a more realistic means of translating findings to the clinical setting (Fig 2).

Figure 2. Example of the laboratory tests which are undertaken within the facility.

We are currently performing laboratory tests on cushion product designs assessing posture and monitoring movement strategies used during prolonged sitting, with the aim of further examining the relationship between prolonged sitting and soft tissue damage. It is well known that both intrinsic (patient-centred) and extrinsic (environmental) factors can contribute to pressure ulcer formation (Bader et al., 2005). During our laboratory testing we use several different biomechanical and physiological parameters which reflect tissue viability at the loaded patient-support interface. These include:

- mapping of interface pressures (Swain and Bader, 2002)
- measures of transcutaneous blood gas tensions (Bader, 1990)
- posture positions
- biomarkers in sweat (Knight et al., 2001)
- microclimate at the loaded interface (temperature and humidity).

Assessment of interface pressure using mapping devices is becoming more common in the clinical setting (Stinson and Crawford, 2009). Traditionally, clinicians have often used parameters such as peak and mean pressures to evaluate the performance of support surfaces (Fig 3). Other factors, such as peak pressure gradients, should also be considered (Brienza et al., 2001).However, there are several reasons why the use of interface pressure measurement alone must be viewed with caution. As an example, relatively small pressures at the skin surface may produce sufficiently large internal stresses and strains in the underlying muscles adjacent to bony prominences to cause local damage (Linder-Ganz et al., 2007). This exemplifies the

importance of examining the effects of external pressures and time on the internal mechanical state of the tissue. One way to do this is to measure physiological markers such as transcutaneous blood gases, particularly oxygen and carbon dioxide, which reflect the viability of loaded soft tissues (Bader and Gant, 1988).

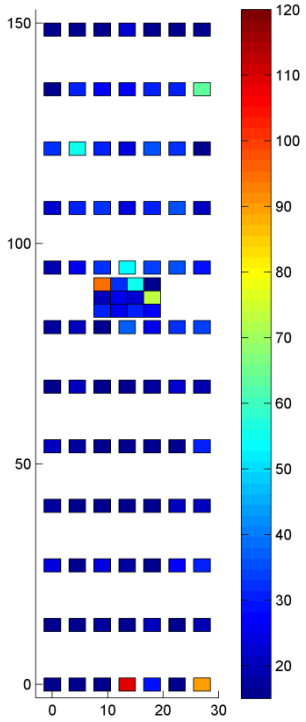

Figure 3. Example of peak pressure measurement during a supine bed assessment.

In addition to interface pressure, shear or friction are also important factors and can be greatly affected by posture in the chair. There is also the microclimate at the interface between the body and the support surface, in particular temperature, moisture, urine and faeces, each of which have been implicated in pressure ulcer development (Clark et al., 2010). The environmental chamber housed in the Wellcome Trust Facility enables us to accurately control both temperature and humidity, which is critical in evaluating the microclimate at the loaded interface. By measuring the microclimate, blood gas tensions, and sweat markers, in addition to interface pressure, we aim to provide a comprehensive assessment of how, why, and under which conditions soft tissue damage occurs.

We are also developing techniques to monitor movement in the seating position. Small sensors, effectively accelerometers, can be used to track movements of an individual for a period of up to several days. In order to verify the usefulness of tracking movements, both the validity and reliability of various devices must be established. Once this is achieved, we plan to assess the nature of movements, in terms of magnitude and frequency, of different sub-populations.

Research has shown that current recommendations for relieving pressure are not adequate for all patients to achieve complete physiological recovery of the soft tissues. This has been observed in spinal cord injury patients where the perception is that pressure relief for 30 seconds, for example lift-off from the wheelchair cushion, is enough to allow soft tissue to recover during prolonged sitting. However, results have indicated that the time needed for adequate soft tissue reperfusion (oxygen levels returning to normal basal levels in soft tissues) is closer to 2 minutes (Coggrave and Rose, 2003). Therefore, establishing the required protocols for adequate pressure relief is particularly important.

Clinical trials

In terms of pressure ulcer prevention, allied health care professionals (AHPs) provide an important resource related to equipment selection, positioning, mobilisation, and education of seat-bound patients (McCulloch, 1998). One of our clinical studies involves working with clinicians on hospital wards to develop a consensus regarding the appropriate composition of an effective MDT for pressure ulcer prevention and to define how each profession can contribute to training and education. This research encompasses on-going focus groups and a Delphi survey, involving AHPs and nurses from elderly care wards of the Southampton University Hospital Trust. We will use the gathered views of clinicians (focus groups) to design an MDT approach to pressure ulcer prevention and then create a consensus document between the staff on the ward as to the role of each health care professional. Subsequently, a clinical study will be devised where we will establish the effects of the new MDT approach in terms of preventing pressure ulcers, educating patients in self-care and regular pressure relief, and increasing the knowledge of staff working on the wards.

Future plans

Our research surrounding pressure ulcer prevention will continue to strive towards increasing the understanding of the aetiology of pressure ulcers and developing an effective MDT approach to its prevention. Currently the majority of the projects are taking place in the hospital setting, but we intend to translate our strategy into the community. Indeed, we are keen to collect views of health care workers who have a particular interest in pressure ulcer prevention/management and plan to subsequently develop collaborations which could attract research funding. Ultimately, our concern is to reduce the suffering of patients and carers afflicted with the burden of pressure ulcers.

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