A small-scale evaluation of the Dolphin Fluid Immersion Simulation® Mattress

The introduction of new technologies can be hugely beneficial to clinicians, but these technologies must be be adequately evaluated before they become fixtures in everyday treatment regimens. The aim of this evaluation was to the performance of the Dolphin Fluid Immersion Simulation® system (Joerns) to determine whether the product provided an effective alternative to existing standard pressure ulcer treatment. The system appeared to provide a useful addition to the specialist equipment available for patients at high risk of pressure ulcers who may have other complex needs.

KEY WORDS
- Mattress
- Pressure ulcer prevention
- Questionnaire

Pressure ulcer prevention is high on the quality agenda across the UK at present (NHS England, 2013; Ousey and Fletcher, 2013). Prevention strategies can be costly and resource intensive (Mathiesen, 2013) and a key component of any prevention strategy is the use of specialist mattresses and beds. This equipment can prove expensive and needs to be deployed in a cost-effective manner. Although there are many different companies producing this type of equipment, the basic design has changed very little since the 1980s (Clancy, 2013; Demarré et al, 2013; Huang et al, 2013; Smith et al, 2013).

Clinicians need to ensure they are providing the most appropriate equipment for their patients so they must remain up to date with new technologies. Recently, a small number of innovations have started to appear in the pressure ulcer prevention market, such as combination/convertible mattresses (i.e. foam mattresses that can easily convert to powered), and immersion technology (Clancy, 2013).

When any new technology comes to the market there is, of course, limited supporting evidence, particularly higher-level evidence, such as a randomised controlled trials (RCTs). Clinicians must use lower-level evidence and a good understanding of the principles of how the equipment works to make rational informed decisions about whether it is safe and reasonable to evaluate the product, as waiting for RCT-level evidence may deny patients new technology for several years (Leaper, 2009).

BACKGROUND

Since January 2010, Cardiff and Vale Health Board have operated a Total Bed Management contract, which is managed by Medstrom Ltd, ensuring patients have access to a wide range of therapeutic beds and mattresses, including bariatric equipment, ultra low beds, dynamic therapy mattresses for high acuity patients, intensive therapy unit equipment replacement, community beds and mattress provision, and foam mattress replacement programme.

Pressure ulcer prevention is a top priority within the Cardiff and Vale Health Board and in order to ensure that health board patients have rapid access to any required equipment the contract has also evolved to include a "one-stop shop" service (*box 1*).

Under the terms of the contract, equipment is used from a range of different manufacturers and to ensure that the equipment provision is always up to date and meets patients' needs, the contract between the Cardiff and Vale University Health Board and Medstrom contains a "state of the art" clause enabling the Health Board to access the latest "like-for-like" technologies, provided that the new technology is subject to an evaluation that demonstrates equivalence in safety and performance. Requests to evaluate new products can be generated by either Health Board staff or Medstrom. As part of this continual updating of equipment, Medstrom introduced the Health Board to the Dolphin Fluid Immersion Simulation® (FIS) system (Joerns).

Dolphin FIS is a relatively new technology that maintains the patient in a simulated fluid environment,

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Box 1. The one-stop shop service.

This service comprises the following:

- Seven-day service for delivery of equipment into acute sites.
- Responsibility for the management of all bed frames, including bariatric and low beds ensuring speedy turnaround to facilitate rapid return to availability.
- Seven-day service for response to product faults in the community
- A management service for university health board-owned bariatric equipment (e.g. bed frame, mattress, and commode) is always available for staff to prevent the complicated system of ordering several pieces of bariatric equipment from different manufacturers when a patient is very high risk.

which helps to maintain blood flow and tissue perfusion (Evers et al, 2009), and evenly redistributes pressure, thereby eliminating high points of pressure, reducing tissue deformation, and improving wound healing (Kohanzadeh et al, 2012; Mayes and Melendez, 2012; Yaguang and Melendez, 2012). National Pressure Ulcer Advisory Panel-European Pressure Ulcer Advisory Panel (NPUAP-EPUAP)'s Pressure Ulcer prevention and Treatment Guidelines (EPUAP/NPUAP, 2009) identify immersion and envelopment as a recognised method of reducing tissue interface pressure. The air fluidised bed is the most recognised technology that can deliver immersion and envelopment. Software that drives the technology in the Dolphin FIS system attempts to mimic similar levels of immersion and envelopment as in the air fluidised bed and some patients in this evaluation would potentially otherwise have been treated on the air fluidised bed.

As this is a new technology there is limited published supporting evidence. An RCT is under way, but results are not likely to be available until December 2014. However, the clinical team deemed the technology to be of sufficient interest to conduct a small preliminary evaluation.

It was suggested that the Dolphin FIS may be a suitable piece of equipment to replace or complement the current provision for patients at very high risk (i.e. Waterlow of 20+), but were also considered to have complex wounds. These patients are always referred to the clinical nurse specialist – wound healing (CNS) to select the correct equipment and frequently require high specification bed/mattress provision, such as low air loss beds or air fluidised beds although some could be managed on higher specification alternating systems.

AIM

The aim of this evaluation was, therefore, to demonstrate that the Dolphin FIS provided equivalent pressure ulcer prevention to the existing standard treatment (a powered mattress replacement). This small-scale evaluation, aimed at determining adverse effects, ease of use, patient tolerability, and skin damage compared to the norm, is always completed prior to investing in a larger-scale evaluation. It was not intended to demonstrate improved healing of existing pressure damage or to demonstrate superiority to existing equipment.

METHOD

The Dolphin FIS was allocated to patients following the standard referral procedures (i.e. clinical staff identified patients at very high risk with complex needs and referred directly to the CNSs for guidance). Patients were reviewed by the CNS who then made a clinical decision regarding suitability for use of the therapy. Patients may have been managed on a powered replacement while waiting for the CNS review, but were allocated to the Dolphin as quickly as was possible. Once on the therapy, ward staff completed a paper-based evaluation form at start, transfer between wards/units, and end of therapy.

The staff questionnaire collected patient demographics, risk status, skin evaluation, and frequency of repositioning at the start and end point (an end point could be a transfer to another department). Staff were asked to record their views on the Dolphin FIS, using closed-ended questions (*box 2*), general feelings (staff and patient) about the Dolphin FIS, using open-ended questions (*box 3*), as well on how Dolphin FIS compared to the standard equipment (*box 4*). Staff were also asked to report any patient comments on the equipment as it was noted that patients often have strong views on their mattresses.

RESULTS

Eighteen patients completed the evaluation. In addition to being at high risk, this patient group was selected by the CNS as being particularly challenging or complex. Several patients were cared for in more than one clinical area including hospital through to community, and 32 completed evaluation forms were returned. Patients cared for on the system ranged in age from 18 to 78 (14 were male and 4 female). The Waterlow risk scores (Waterlow, 2005) ranged from 11 to 37. The average age of patient was quite low with over 50% (n=8) of the males being 41 years of age or younger. The mattresses were in use between 2 days and 7 months. Primary diagnoses included spina bifida, multiple sclerosis, Hodgkin's lymphoma, ovarian mass, and brain tumour.

Neither of the patients that were pressure ulcer free went on to develop one. Of the patients with existing pressure ulcers, two healed, seven improved and five remained static. Two very high

risk patients developed new pressure ulcers (one of which also had a deterioration in their existing pressure ulcer). One patient died in theatre (this patient who was in the evaluation for 2 days) and there was no further details of their pressure ulcer. One of these patients had more than one pressure ulcer, one healed, and the others improved – therefore, numbers do not add up to 18.

The majority of patients displayed no skin deterioration and 50% of those with pressure damage (8 out of 16 patients) either healed or improved. Three patients continued to be turned twice per hour, others had their turning period extended to up to 5 or 6 hours. One patient in the community was turned 4 times during the day but not at all from 9pm until 10am. This patient had deterioration in their existing pressure ulcer and a new pressure ulcer had developed.

Staff consistently commented positively on the ease of use of the equipment and patient comfort. Comments included "assisted in the healing process tremendously" and "not alarmed since start of use. Didn't wake people up!" Staff were sufficiently confident to use the Dolphin FIS for one patient in place of an air fluidised bed, which would have been heavy and created manual handling issues when the patient needed to transfer wards and go to theatre.

Patient comfort was assessed very positively by staff and patients. In response to the question "did the patient like Dolphin?" comments included "yes and made a comment several hours after being on the mattress that it was very comfortable" and "yes and patient remained comfortable throughout their stay". These comments were based on simple questioning as part of the SKIN bundle care rounds where patients are routinely asked if they are comfortable and have any additional needs.

Although this had not been included in the evaluation and staff had not been asked to comment on it, several staff included comments about perceived improvement in healing of pressure ulcers, such as "assisted in the healing process tremendously". Comments were also made about patients being able to reposition themselves more easily. Further patient details can be seen in the two case selected case studies (*Box 5*).

DISCUSSION

A problem occurred with one patient who was a bilateral amputee, who staff felt was bottoming out through the mattress. On investigation, the mattress had not been set appropriately for the patient's height to weight ratio, once this was resolved the patient went on to stay on the mattress for several months and, in fact, was incredibly reluctant to be stepped down from the therapy when they returned home. This highlights clearly the importance of ensuring staff are fully trained in the set up, operation, and ongoing management of any new equipment used in clinical areas.

Although small scale, this evaluation highlighted key areas for future investigation. Pressure ulcer prevention remains a high priority but pressure ulcer healing is equally if not more challenging. For many patients with existing damage finding equipment that is well tolerated and assists in the healing process is difficult anecdotally it appears that the Dolphin FIS may have a role to play.

Many of the patients at very high risk and/or with complex needs required considerable nursing input to maintain skin integrity but also to maintain comfort. There is frequently tension between these two objectives, with the repositioning required to maintain intact skin conflicting with the need to remain in a comfortable position or sleep undisturbed (Moore and Cowman, 2012). The initial views of the staff suggest it may be possible for many of the patients to prolong the turning period, thus reducing the frequency with which they are disturbed. This has benefits for both patients and staff.

CONCLUSION

There are many systems that provide pressure redistribution for patients. In this evaluation, it was the opinion of the clinical staff that the Dolphin FIS system demonstrated the ability to perform equally well as the equipment currently used in both hospital and community settings.

The Dolphin FIS system appears to provide a useful addition to the specialist equipment available for patients at high risk of pressure ulcers who may have other complex needs. The ease of use was noted and reduced turning frequency both reduced staff workload and increased patient comfort.

Box 2. Questionnaire questions for clinicians (closed-ended).

- Did Dolphin therapy meet your objectives?
- How comfortable was the patient?
- How easy was it to reposition the patient?
- How easy was Dolphin therapy to use?
- How effective was Dolphin therapy at preventing pressure ulcers.
- (If applicable) How effective was Dolphin therapy at treating pressure ulcers?
- Were turning times reduced during treatment?

Box 3. Questionnaire questions for clinicians (open-ended).

- What do you like most about the Dolphin product?
- Did the patient like the Dolphin product?
- What, if anything, did you not like about the Dolphin product?

Box 4. Questionnaire Questions comparing standard equipment with Dolphin FIS.

- Effectiveness in pressure redistribution.
- Moving and handling the patient.
- Transport mode.
- Alarm functions.
- Comfort level of the patient.
- Noise.
- Ease of cleaning.
- The fully enclosed cover.
- Simplicity of use.

Box 5: Case Studies.

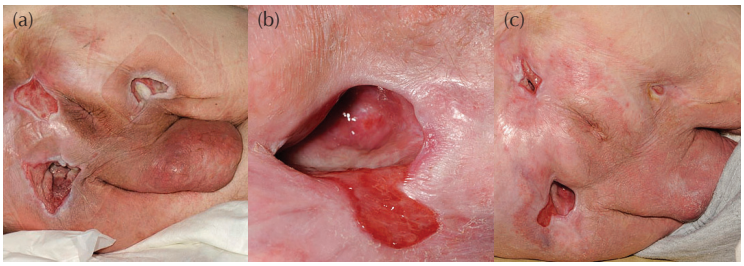
CASE STUDY 1

MW is a19-year-old male who was repatriated from a local hospital after a road traffic accident involving his motorbike, with crush injuries and polytrauma, sustained from collision with a lorry. He underwent six operations for fixation of multiple fractures, perforated bowel, incision, and drainage of ischial abscesses and psoas abscesses, resulting in 16 hours in theatre. He was unable to be repositioned regularly due to the severity of his injuries and unstable condition. This patient was not expected to survive due to the extent and severity of his injuries. He developed a combined lesion in the natal cleft due to copious wound exudate levels from corrugated drains and extensive multiple wounds left open for free drainage. An air-fluidised bed was requested at this time but, due to frequent transportations to theatre, this was impracticable and, therefore, a Dolphin mattress was implemented. The combined lesion evolved into a category IV pressure ulcer – 6cm × 5cm × 0.5cm with bone visible at the base of the wound. No osteomyelitis developed. Negative pressure wound therapy (NPWT) was initiated and the patient was fed enterally while in Critical Care and during his admission to Critical Care he had lost 13kg in weight. He was subsequently moved to a Trauma Ward then a Rehabilitation Unit and his pressure ulcer healed after 6 months. The Dolphin mattress was positively evaluated by the patient, which he found more comfortable than the previous mattress. He also found movement easier. The ward staff also positively evaluated the mattress due to ease of use, the lack of manual handling issues they had previously experienced with air fluidised beds, the positive patient outcomes and ease of transportation. This patient would previously have been nursed on an air fluidised bed, which would have made transportation to theatre and other areas impossible. When the patient was discharged after eight months in hospital, all wounds except his abdominal wound had healed.

CASE STUDY 2

MH is a 40-year-old male with spina bifida. He developed a category IV pressure ulcer to his left buttock in 2012. He had previously been known by the wound care team for pressure damage and his care had been plagued by his non-compliance with treatment and prolonged seating in his wheelchair. He was under the care of the district nurses, who constantly raised concerns at his lack of compliance, failure to carry out everyday self care, and deterioration of the wound, despite having access to a high-specification mattress. The main reason for these issues were that he had recently lost his wife, majorly influencing his attitude towards his social circumstances. He had several admissions to hospital that were usually longer than several months in duration. He developed osteomylitis and was treated with intravenous antibiotics and NPWT. During his last admission, MH developed a further category IV ulcer (*Figure 1a*). It was decided that his care include a trial of the Dolphin mattress. The pressure ulcers began to improve (*Figure 1b*) and it was agreed that he could go home with the Dolphin mattress ensuring seamless care from hospital to community. His social circumstances also changed and he started to look after himself and be more compliant with treatment. The Dolphin therapy was due to be discontinued after 4 weeks, but the patient was convinced that stopping the therapy would mean a deterioration in the wound, which he was very concerned about. It was agreed to continue with the therapy until full healing had occurred. The patient is still being cared for on this mattress, and his pressure ulcers have almost healed (*Figure 1c*).

Figure 1. (a) MH's category IV pressure ulcer (b) improvement to MH's ulcer (c) MH's almost healed pressure ulcer.



More detailed evaluation of the equipment can be planned now that lack of adverse effects, ease of use, patient tolerability, and no increase in skin damage have been demonstrated. WUK

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