

# Case series evaluating the use of the Dolphin Fluid Immersion Simulation<sup>®</sup> mattress

## KEY WORDS

- ▶ Comfort
- ▶ Complex care
- ▶ Dolphin mattress
- ▶ End-of-life care
- ▶ High-risk patients
- ▶ Pressure ulcers

For patients with complex conditions selection of the appropriate pressure redistributing mattress can be complicated by many factors. For groups at significant risk such as those in intensive or critical care, those at the end of life or those who it is difficult to reposition this selection becomes even more complex with only a small range of products able to meet the need to both prevent pressure damage and meet the rest of the patient's care needs. This paper presents a summary of 91 individual evaluations carried out across 12 hospitals in the UK of the Dolphin Fluid Immersion System, a relatively new product which redistributes pressure by immersion as recommended in the international pressure ulcer prevention guideline (NPUAP et al, 2014).

The potential for pressure ulcers to occur has led to significant investment in specific training, awareness programmes such as the Stop the Pressure campaign (<http://nhs.stopthepressure.co.uk/>), international initiatives such as Stop Pressure Ulcer Day ([www.epuap.org/stop-pressure-ulcer-day/](http://www.epuap.org/stop-pressure-ulcer-day/)), and the publication of national (National Institute for Health and Care Excellence, 2014) and international (National Pressure Ulcer Advisory Panel (NPUAP) et al, 2014) guidelines. It has also led to considerable investment in preventative equipment, such as alternating pressure mattresses. For those patients deemed to be most at risk, however, these efforts may not be sufficient. Some patients' particular risk factors mean that an alternating system may not be appropriate.

## HIGH-RISK PATIENTS

The patients who may be considered most at risk of pressure ulcers include those in intensive and critical care units (Tayyob et al, 2015), with prevalence rates ranging from 4 to 49% and incidence rates from 38% to 124% (Shahin et al, 2008). Other groups considered at significant risk include those at the end of life (Searle and McInerney, 2008; NPUAP et al, 2014), those with metastatic cancer (Flattau and Blank, 2014), those at the extremes of weight (both underweight and extremely obese) (Hyun et al, 2014; NPUAP et al, 2014), patients with spinal cord injury

(Lala et al, 2014) and those with complex or multiple trauma.

Many of these patients have risk factors in common, for example diabetes or chronic renal disease (Flattau and Blanks, 2014). Others are considered at risk because of haemodynamic instability (Cooper, 2013); the clinicians' perception of the impact of haemodynamic instability may cause a delay or omission in turning, repositioning and other intervention to promote mobility that may contribute to pressure ulcer formation (Brindle et al, 2013). This delay in or omission of repositioning is also noted in end-of-life care, where the goal may be the individual's comfort and maintaining their quality of life and dignity (NPUAP et al, 2014). Nurses experience difficulties with determining the frequency at which the patient should be turned, especially during the last phase of life (Searle and McInerney, 2008), valuing patient comfort and prioritising patient and family wishes. Searle and McInerney (2008) suggest that the context of care informs clinical practice and complicates decisions that go beyond the consideration of normal clinical needs, such as pressure ulcer prevention. This view is supported by the international guidelines (NPUAP et al, 2014), which state that: "It is important to implement preventive and treatment interventions in accordance with the individual's wishes, and with consideration to overall health status."

In the critically ill patient where repositioning

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**Table 1. Demographic details of the patients included in the Dolphin case series**

Age range	Male	Female
0–20	1	2
21–40	8	4
41–60	9	9
61–70	9	3
71–80	9	4
81–90	3	5
90+	1	2
Age not specified	10	4
Gender not specified	8	

may be complex and turning may not be possible for medical reasons — including a temporary oral-pharyngeal airway, spinal instability and haemodynamic instability — the 2014 guidelines produced by NPUAP, the European Pressure Ulcer Advisory Panel (EPUAP) and Pan Pacific Pressure Injury Alliance (PPPIA) recommend slow, gradual turns allowing sufficient time for the stabilisation of haemodynamic instability and oxygenation, as few individuals are truly too unstable to turn. This should be considered whenever possible. These guidelines also state that more frequent small shifts in position may allow some reperfusion in individuals who cannot tolerate frequent major shifts in body position.

For all of these patients, selection of an appropriate support surface that assists in the prevention of pressure damage and maintains comfort is complex because of their multiple issues. The 2014 NPUAP/EPUAP/PPPIA pressure ulcer prevention and treatment guidelines state that clinicians should “Select a support surface that meets the individual’s needs” and “Identify and prevent potential complications of support surface use”, putting the need of the patient strongly in focus as well as the prevention of pressure ulcers.

The complexity and multiple issues associated with these patients do not lend themselves well to a randomised controlled trial (RCT) to determine an appropriate support surface. A broader range of evidence may need to be considered alongside experiential knowledge. When any new technology comes to the market there is, of course, limited supporting evidence, particularly higher-level evidence such as 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 access to new technology for several years (Leaper, 2009).

This paper presents the results of a 91-patient cohort of individual cases of patients with complex and complicated needs, who were successfully nursed on the Dolphin mattress. Data relating to a further 18 patients have been reported elsewhere and are not included in this review (Fletcher et al, 2014).

**THE DOLPHIN SYSTEM**

Dolphin Fluid Immersion Simulation® system (Joerns Healthcare LLC) is a relatively new technology that keeps the patient in a simulated fluid environment. This system helps to maintain blood flow and tissue perfusion (Evers et al, 2009) and evenly redistributes pressure, thereby eliminating high pressure points, reducing tissue deformation, and improving wound healing (Kohanzadeh et al, 2012; Mayes and Melendez, 2012; Yaguang and Melendez, 2012). The mattress is designed to reduce pressure across the body, maintain an appropriate microclimate and to promote patient comfort. The 2014 NPUAP/EPUAP/PPPIA guidelines identify immersion and envelopment as a recognised method of reducing tissue interface pressure.

**THE DOLPHIN CASE SERIES**

This case series includes 91 patients from 12 hospital sites in the UK. There were 50 males, 33 females. For eight patients the gender was not recorded. The demographic details are summarised in *Table 1*.

The patients’ weight varied. The lowest weight recorded was that of a 9-month-old paediatric patient weighing 6.4kg. The adult weight range was from 36kg up to 133kg. Weight information was not completed in all cases.

The most common clinical conditions experienced by the patients are given in *Table 2*, however patients with a much wider range of conditions were included, including: self-neglect, Huntington’s disease, spina bifida, cerebral palsy, juvenile arthritis, Hailey–Hailey disease, open abdomens, burns and complex trauma (three military and one road traffic incident). The majority of patients had more than one condition.

**RESULTS**

The most commonly cited reasons reported

**Table 2. The most common clinical conditions experienced by patients who were treated on a Dolphin mattress**

Clinical issue	Number of patients
Palliative/end-of-life care/carcinoma	13
Renal disease	7
Diabetes	7
Spinal problems/paralysis	12
Amputee	9
Wound to perineum/genitals	5
Post-surgical patients (wound debridement, abdominal/chest surgery, flap surgery)	15
Existing pressure ulcer	30
Multiple pressure ulcers (maximum 10)	24
Non-concordance with repositioning	5

for being unable to follow a repositioning schedule reflect those identified in the literature: haemodynamic instability, cardiac complications and tracheostomy in situ. There were additional reasons reported in this case series, including:

- ▶▶ Being unable to manage complex abdominal wounds when side lying (both the pain and practicalities of a wound management system)
- ▶▶ Patient comfort
- ▶▶ Patient body shape, particularly where contractures were present.

There were a number of reasons patients were selected for treatment on Dolphin mattresses (Table 3), the most common ones relating to pressure ulcer and pain management and reduced patient movement.

**Wound healing and ulcer prevention**

There were no reports of any deterioration to skin condition or wound healing, with the exception of one patient who was at the end of life and was believed to have skin failure. One patient’s wound remained unchanged, however all other reported wounds showed signs of improvement. No new pressure damage developed.

**Comfort**

Increased comfort was one of the main outcomes for

nearly all patients. Apart from two patients (one had missing data and the other was documented incorrectly), all patients reported good to excellent comfort levels when using the Dolphin mattress. This is promising, as the Dolphin mattress had been chosen for some patients in order to improve their level of comfort as they were in pain or because they had reported that their previous mattress was uncomfortable. The comfort levels of this subgroup improved and/or their responses towards the Dolphin mattress were positive.

**Comparison of mattresses**

All but two evaluations stated that the Dolphin mattress was ‘better’ than the mattress previously used. The reasons given for this included:

- ▶▶ Healed wounds or wounds that showed signs of healing
- ▶▶ No further skin breakdown
- ▶▶ It was easy to reposition patients
- ▶▶ Greater patient comfort.

Other rationales included the ease of use and patients’ skin marking on their previous mattress. The two evaluations in which the Dolphin mattress was found to be the ‘same’ as the previous mattress were due to there being no change to the condition of the patients’ skin.

Other positive outcomes included a patient who was discharge 2 weeks earlier than planned, several patients who were able to be repositioned directly onto existing wounds with no compromise to the wound status, healing of moisture damage and, most importantly, improvement in comfort and quality of life at the end of life. These benefits were valued by staff, who commented for example that: “This promoted and provided patient with great comfort and eased family anxiety as family knew the patient was comfortable with reduced chance of further pressure damage. Would highly recommend this mattress for patient care.” There were also several instances of family members commenting on the benefits of the Dolphin mattress, for example: “My husband appeared more comfortable and content on the new mattress. I felt at ease knowing I was leaving him at night and he was comfortable. I even noticed the difference in his face – he seemed in less pain.” Several patients requested the Dolphin mattress when they were transferred to other areas or discharged home.

**APPROPRIATE USE**

The outcomes of the evaluations appear to be

Table 3. Reasons for placing patients on the Dolphin mattress	
Objective	Frequency
Pressure ulcer management	61
Pain management	30
Palliative care	6
Reduced turning frequency	17
Complex patient	4
Non-concordant patient	4
Microclimate management	6

very positive, but the Dolphin mattress should not be seen as a panacea. In a cost-constrained environment, it is important to ensure that any equipment is used appropriately. The use of more sophisticated equipment must be a considered approach that includes the patient's risk status, existing damage and overall clinical condition. It would seem, however, that there are certain criteria that should be considered when selecting a Dolphin mattress (*Box 1*). If the answer to one or more of the questions in *Box 1* is 'yes', then it may be an appropriate piece of equipment to use.

### DISCUSSION AND CONCLUSION

Equipment is only one aspect of pressure ulcer prevention. It does not replace the fundamentals of care based on the bundle approach, with care of the skin, keeping the patient moving, maintenance of adequate nutrition, and hydration and management of incontinence all being equally important (NHS Scotland, 2009; NHS Midlands and East, 2012). As patients become increasingly complex to manage for myriad reasons, it is important to be aware of all of the options that are available.

When selecting equipment it is important to consider new and emerging technologies and consider the benefits they may have for patients. For many patients, prevention of pressure damage is only one reason for selecting a specialist mattress or cushion; there can be many other objectives of care that need to be considered and addressed.

While in terms of evidence the RCT is optimal, for patients with multiple challenges it is rarely possible to find that level of evidence that applies to their particular situation. In the absence of RCTs, therefore, other forms of evidence such as multiple case studies should be considered. From the case studies reviewed, it appears that the Dolphin mattress may have a strong position in supporting the delivery of clinical care to these patients. **WUK**

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#### Box 1. Questions to ask when deciding whether a Dolphin mattress is suitable

- ▶▶ Does the patient have multiple pressure ulcers already?
- ▶▶ Is pain an issue?
- ▶▶ Is there perineal/perianal/genital damage?
- ▶▶ Has the patient had a bilateral amputation?
- ▶▶ Is the patient difficult to turn due to:
  - ▶▶ Trauma?
  - ▶▶ Medication?
  - ▶▶ Spinal injury?
  - ▶▶ Pain?
  - ▶▶ Differing body shape (e.g. contracture)?
- ▶▶ Does the patient have very complex needs?

If the answer to one or more questions is 'yes' then a Dolphin mattress may be appropriate

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