

# ROHO Dry floatation technology: implications for clinical practice

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Pressure ulcers can be referred to as pressure sores, bedsores and decubitus ulcers. These ulcers can range in appearance from mild discolouration of the skin, to a full thickness wound often exposing bone and internal organs (Romanelli, 2006). Pressure damage can be described as:

*'An area of localized damage to the skin and underlying tissue caused by pressure, shear, friction and or a combination of these' (EPUAP, 1998)*

Pressure damage is caused by compression forces on the skin and underlying soft tissues against an unyielding support surface. As the tissues are compressed, the blood supply becomes occluded, preventing oxygen and essential nutrients from reaching the tissues and waste products from being removed (Bridel, 1993). To maintain healthy tissues, cells need a regular supply of nutrients, oxygen and the removal of metabolic waste products—compression forces interrupt this normal process (Hubbard and Mehan, 1997). Tissue damage is caused by a combination of pressure, shear and friction forces—moisture worsens tissue breakdown (European Pressure Ulcer Advisory Panel, 1998a; National Institute of Health and Clinical Excellence (NICE), 2005). Pressure ulcers may develop on any area of the body and most commonly occur on bony prominences, particularly on the ischial tuberosities, sacrum, heels, shoulders and on the head. Pressure damage may also occur as a result of pressure caused by catheter or medical tubing. Pressure ulcers can be graded or staged using the European guidelines (EPUAP, 1998a).

There has been disparity concerning the prevalence of pressure ulcers with suggested prevalence ranging from 10% (O'Dea, 1993) to 18% (Clark and Cullum, 2003). The Department of Health (DH), (1992) estimated that pressure ulcers affect 10% of the UK population. There is a forecast increase in the number of patients with pressure ulcers which ties in with the forecast increase in patients with long-term conditions (EPUAP, 1998b). This has significant socio-economic implications for patients, health-care professionals and policy-makers and has serious financial ramifications for the NHS.

The cost of treating pressure ulcers is estimated at £31.4 to £2.1 billion every year. This equates to £60 per second, which is equivalent to 4% of total NHS expenditure (Bennett et al, 2006).

## Who is at risk?

There are significant health consequences to the individual who develops pressure damage. Such damage can range from mild discolouration to a life threatening wound with the potential for the development of septicaemia. The presence of pressure ulcers has been associated with a two- to four-fold increase in risk of death in older people in intensive care units (NICE, 2005). Patients who are most at risk from developing pressure damage are those who are acutely ill or have undergone major surgery (Cullum et al, 1995; Armstrong, 2001). Pressure ulcers often affect those patients who have restricted mobility, including:

- ♦ Neurologically impaired
- ♦ Spinal cord injury
- ♦ Impaired mobility
- ♦ Immobile
- ♦ Malnutrition
- ♦ Obesity
- ♦ Those that use seating or beds which do not provide appropriate pressure relief.

This list is not definitive as anyone who is ill can potentially be at risk of pressure ulceration.

## Pressure ulcer prevention

The prevention of pressure ulceration requires a multi-factor approach and includes risk assessment, re-positioning, nutritional assessment/management, continence management and the use of pressure relieving equipment (NICE, 2005). It is important to note that pressure ulcers are considered to be largely preventable (Shea, 1975; Hibbs, 1988; Morison, 2001; Walsh and Bennett, 2004; Clark, 2005). The National Pressure Ulcer Prevention Guidelines (NICE,

## ABSTRACT

This article discusses the aetiology of pressure ulcers, the clinical and financial cost of pressure ulcer prevention and the need for pressure reducing equipment. The role of Dry floatation in pressure ulcer prevention and management is explored. How Dry floatation technology works is discussed and its use within clinical practice is highlighted. The evidence to support Dry floatation is presented.

## KEY WORDS

ROHO Dry floatation technology ♦ Pressure ulcer prevention



**Figure 1.** ROHO Quadtro cushion employs Dry Floatation technology.



**Figure 2.** ROHO Heel protectors.

**Box 1. Speciality ROHO products**

Speciality ROHO products are available and offer unique solutions that can help with positioning, comfort, prevention of falls and pressure reduction. Examples of these include the toilet seat cushion which is designed for standard size toilets and portable bedside commodes. These offers stability to the user and protection from skin breakdown. The shower commode cushion which is designed to fit shower chairs offers the therapeutic benefit of the low profile cushion.

A recliner cushion can be custom made to the dimensions of a chair offering seating and back protection.

The ROHO sacral support cushion is custom designed to the user's specification while the lumbar support cushion is available as standard or customized and offers comfort, improved positioning and pressure reduction.

Heel pressure ulcers affect patients' ability to mobilize. Any patients may benefit from the use of ROHO bootees which have the advantage of significant pressure reduction. These useful devices may be used under heels, offering focused protection to the heels and promoting wound healing.

2005) identify the need for the availability of appropriate equipment, including bed-bases, mattresses and cushions.

**Pressure ulceration**

Regular repositioning—when seated or reclining—of the patient redistributes pressure, enabling the blood supply to return to the tissues and thereby maintaining skin integrity; however, if the pressure is prolonged, the skin and the muscle can begin to breakdown. If the person has a tendency to slide, whether in the chair or in bed, then damage is increased by the influence of shear forces and friction (Bliss, 1993).

Nursing a patient in a chair significantly increases the risk of a patient developing a pressure ulcer. Gefen (2007) records that sitting-acquired pressure ulcers also known as 'deep tissue injury' are a difficult medical challenge in permanent wheelchair users and those with traumatic or non-traumatic disorders of the central nervous system. Prolonged nursing in a chair may result in increased tissue pressure due to a reduction in the support surface area. Prolonged sitting can also increased shear force damage to the skin, and tissues and gravitational leg oedema is more likely due to impaired venous return.

Particular care should be taken when nursing a patient in a chair in relation to seat size, height, width, appropriate arm rests and suitable foot rests; getting these right contribute to pressure ulcer prevention. Reducing the time a patient sits in a chair is an essential part of pressure ulcer prevention and guidance recommends no longer than two hours when a pressure ulcer is present (NICE, 2005).

**Pressure relieving equipment**

Risk assessment and the provision of suitable pressure relieving equipment are the two essential components in preventing pressure damage. Risk assessment tools are not intended as an aid to prescribing pressure relieving/reducing devices (Stephen-Haynes, 2004). Equipment provision should be based on holistic assessment and not risk assessment alone (Clark and Cullum, 2003). Pressure reducing devices spread patient's weight over a larger area and include foam, gel, air filled and water mattresses and overlays.

There are a plethora of different pressure relieving cushions and mattresses available for the practitioner to use. However, this article will focus on the ROHO pressure relieving equipment, specifically ROHO's product range that uses 'Dry floatation technology'—this has been shown to contribute significantly to both the prevention and management of pressure ulceration. *Figure 1* shows ROHO's Quadtro cushion which uses Dry floatation technology. While *Figure 2* shows the ROHO heel protectors.

**Dry floatation**

Robert H Graebe, an electrical engineer, invented Dry floatation technology after meeting somebody suffering from an ischaemic ulcer. He initially invented the ROHO Dry floatation cushion and later a range of mattresses (Graebe,1987). He stated that an effective cushion would improve a person's tissue viability, especially in immobile patients or those with reduced sensation. Dry floatation cushions extend seating

times without risking tissue breakdown and facilitate the healing of damaged tissue. *Tables 1 and 2* outline a selection of the ROHO Dry floatation product range. *Box 1* provides information concerning ROHO's speciality products.

ROHO Dry floatation pressure relieving equipment uses individual air-filled compartments which are inflated by means of a hand-pump or come as a sealed unit (static overlay). The soft, flexible, interconnected air cells are made from neoprene which is a hypo-allergenic synthetic rubber. The pressure relieving equipment is robust, non-powered, adjustable, zoned, fire-retardent and hardwearing. ROHO Dry floatation offers the unique factor of being adjustable for a customized fit to a client's sitting or lying shape and as an individual's body shape changes, the cushion adjusts to facilitate blood flow, thus preventing pressure damage.

Particular clinical benefits include the management of

patients with neurological disorders, patients at elevated risk of pressure damage who would be unable to tolerate an alternating surface, due to problems associated with the surface movement, noise and sliding down the surface (Collins and Hampton, 2005).

A range of products are available including mattresses and cushions. A mattress consists of 720 individual air cells and a cushion consists of 122 cells that conform to the body to provide a maximum support area that evenly and comfortably distributes the patient's weight. Importantly, successful cardio-pulmonary resuscitation (CPR) may be performed on the ROHO Dry floatation mattress and this is hosted on the the ROHO website: [www.therohogroup.com](http://www.therohogroup.com) which demonstrates CPR without deflation of the ROHO mattress and without any alteration to the standard CPR technique.

**Table 1. A selection of available cushion solutions from the ROHO group**

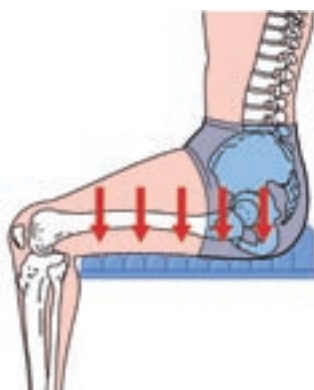
<b>Cushion type</b>	<b>Product description</b>
Quadro Select®	Available in high, medium or low profile. The Quadro Select® cushion allows for quick, simple position selection for every user while seated. By pushing the knob to the open position, you can adjust the user's posture to the desired sitting position. By pushing the knob to the closed position, you can maintain the desired sitting posture for maximum function.
High profile single compartment cushion	10 cm interconnected air cells provide an adjustable, low deformation, counter-pressure environment that assist in the healing of ischemic ulcers. Appropriate for high-risk clients.
High profile dual	10 cm interconnected air cells provide therapeutic properties. Dual cushion compartments can be adjusted independently to increase positioning and stability for either side-to-side (to adjust for an oblique pelvis) or front-to-back control (to adjust bucket or tilt angle).
Contour Select™ cushion	Contour Select is a contoured ROHO cushion with the Isoflow® memory control unit positioned at the front of the cushion, this allows all the benefits of air floatation with the added benefit of enhanced postural control and stability.
Nexus Spirit® cushion	The nexus Spirt provides protection to the ischia, sacrum and coccyx area through the placement of a Dry floatation support pad. The Nexus cushion provides an adjustable, low friction/low shear environment that can protect the user against wounds.
Harmony™ cushion	The Harmony cushion is a lightweight and stable cushioning solution. By combining a lightweight and comfortable ROHO® sealed air-filled component cushion overlay with a pre-contoured foam base, encased within a moisture resistant cover, you can maximize independence.
Mosaic™ cushion	The Mosaic cushion is especially suited for users who require a cushion for basic level skin protection, support and comfort. The Mosaic cushion uses interconnected air cells to distribute forces evenly across the cushion so it can be used for low-risk skin protection.
AirLITE®	By combining a contoured, anatomical-shaped foam with a pre-set, sealed Dry floatation component, the AirLITE® enables users to sit comfortably for an extended time.
ROHO Heal pads™	Can be supplied either in singles or pairs, adjustable therapeutic heel protectors which minimize shear and friction as well as providing pressure relief. Can also be used for elbows
Custom made cushions	Specific clients may want a ROHO cushion which is designed for their unique needs. Many standard cushions may be custom designed with any combination of the following techniques: –Vary number of valves/compartments –Vary cell heights –Add or delete cell rows beyond dimensions of standard size models –Remove sections –Ventilation/ drainage openings through base of cushion



**Figure 3. Properly seated patient.**



**Figure 4. Locate the patient's lowest bony prominence.**



**Figure 5. A 1.5cm air gap avoids 'bottoming out'.**



**Figure 6. Patient properly immersed within the cushion.**

**Mode of action**

Graebe (1987) proposed that several factors should be considered when designing a Dry floatation pressure relieving cushion:

- ◆ The potential for the presence of an open wound
- ◆ Infection
- ◆ Inadequate nutrition
- ◆ Soft tissue atrophy
- ◆ Skin maceration
- ◆ Systemic disease
- ◆ Low blood pressure.

Graebe's aim was to develop a cushion with characteristics similar to fluid-filled floatation cushions. For Dry floatation to occur, the sum of the forces developed by each individual air cell must equal the weight presented to its surface. To allow for the differences in body sizes and weights the cushion needs to be adjustable to give each user maximum immersion depth (Figures 3–6 illustrates the correct technique in adjusting a ROHO Dry floatation cushion).

The Dry floatation cushion minimizes tissue deformation by distributing suspension forces evenly over the contacted area—maintaining blood flow to tissues. The air cells create a floatation environment that lowers the peak interface pressure applied to the skin. This minimizes tissue deformation and reduces interstitial oedema (Economides, 1996).

Dry floatation technology operates under four main principles, as follows:

**Principle 1:** Six Degrees of Freedom. This means that each air cell within a ROHO product will have a complete range of movement. This allows the cushion or mattress to track with the patient, thereby decreasing friction and shear.

**Principle 2:** Constant Restoring Forces. Provides floatation and constant pressure independent of time.

**Principle 3:** Low Surface Tension. Allows immersion and envelopment. Decreases tissue deformation during immersion.

**Principle 4:** Low Friction and Shear. Neoprene is treated to reduce friction. Small individual cells reduce shearing. Cells move with the client to improve ease of movement.

**Adjusting a ROHO cushion**

When using an adjustable ROHO cushion ensure the valve is open, then over-inflate the cushion. Next position the person as far back as possible in a normal sitting position, ensuring armrests and footrests are properly adjusted (Figure 3). Next slide your hand (palm-side down) between the buttocks and the cushion to locate the patient's lowest bony prominence (Figure 4). With your hand still in position, release the valve until your hand touches the base of the cushion. At this point, close the valve. This will ensure 1.5cm of air remains between the patient and the base of the cushion—thus avoiding 'bottoming out' (Figure 5). The patient will now be properly 'immersed' in the cushion, not sat on top of it (Figure 6). Always hand test the cushion regularly to make sure the correct adjustment is maintained.

**Table 2. A selection of available dry floatation mattresses from the ROHO group**

Mattress type	Product description
ROHO Dry floatation mattress	A non-powered, adjustable, zoned, advanced pressure-relieving mattress overlay. Helps heal advanced stage (II & III) ischemic ulcers; friction and shear relief surface; four sections each 51 cm x 86 cm. Fully adjustable. 8 cm high air cells can be adjusted to the patient's body shape and size. Drainage holes pull fluids away from incontinent clients. Durable neoprene rubber is flame-resistant and can be easily cleaned.
ROHO Dry floatation bariatric kit	Works in conjunction with a standard size ROHO Dry floatation mattress overlay to widen the mattress for use with bariatric bed frames. Add-on sections allow the bariatric patient the therapeutic benefits of the ROHO Dry floatation technology. No user weight limit.
ROHO Dry floatation isolette	5 cm interconnected air cells conform and shape to an infant providing a low pressure, low shear environment ideal for the at-risk infant. This non-powered, adjustable overlay fits standard hospital or home-based isolettes.

**Evidence-based research**

Thompson-Bishop and Mottola (1992) undertook research with 13 healthy adults (nine males, four females) with weight ranging from 110–250lbs with mean height 69.2 inches. Significant correlations were found between the height of the individual and heel pressure and also between the weight of the individual and heel pressure. The mean trochanteric pressure ranged from 37.2mmHg to 55.1mmHg on the pressure reducing surface compared to 83.6mmHg on a standard hospital mattress. The mean trochanteric pressure for the ROHO mattress was 36.1mmHg. Mean heel pressure readings ranged from 28.1mmHg to 62.1mmHg on the pressure reducing surfaces compared to 93.9mmHg on the standard hospital mattresses. The mean recording for the ROHO was 43.3mmHg. Thompson-Bishop and Mottola (1992) concluded that pressure reducing surfaces that re-distribute pressure at bony prominences are necessary in preventing and treating pressure ulcers, and that pressure relieving support surfaces may need to be adjusted for different sized individuals.

A later study by Economides et al (1995) involved a clinical controlled trial using 12 patients with grade four pressure ulcers who were scheduled for myocutaneous flap surgery. The patients, who were planned for a two week hospitalization, demonstrated that either Dry floatation or high-tech fluidized support surfaces were adequate to prevent flap breakdown in the immediate post-operative period. This is significant as patients are most at risk from developing pressure damage when acutely ill or undergoing major surgery.

Cooper et al (1998) undertook a randomized controlled trial of two Dry floatation pressure-reducing surfaces evaluating pressure sore incidence, patient comfort and the appropriate use of equipment in 100 orthopaedic patients. The trial involved five ROHO mattresses, five Sofflex mattresses and ten ROHO Quadtro® cushions—used in conjunction with the mattresses. Both provided a similar level of comfort, with the majority of patients finding them either comfortable or very comfortable. A crucial issue was raised in the research in relation to the initial setting of the equip-

ment which was unsatisfactory at the outset of the study, but this was overcome with education and clinical support.

A novel study by Yuen and Garrett (2001) compared the effectiveness of the short-term pressure-relieving ability of three commonly prescribed wheelchair cushions (ROHO, Jay, Pindot) for a person with spinal cord injury. They used a number of pressure sensors to determine the effectiveness of the cushions. The data analysis indicated that the number of pressure sensors that registered potential harmful levels of pressure at the buttock-cushion interface was significantly less for the ROHO cushion.

Seating interface pressures were studied by Hamanami et al (2004), who undertook research exploring the pressure distribution patterns of a multi-cell air cushion (ROHO High Profile®) for 36 adults with spinal cord injury (Vertebral level: Thoracic 3 to Lumbar 1). The research used a pressure mat to analyse stress distribution relative to the inflated air pressure in the air cushion on the patients' wheelchair; this determined the appropriate inflated air pressure of the cushion for the patients. The maximum pressure points in all subjects were at the areas of the ischial tuberosities (82mmHg to 347mmHg). The optimal reduction in interface pressure at the ischial tuberosities was obtained prior to bottoming out, with the cushion air pressure being between 17mmHg and 42mmHg, which correlated with body weight ( $r = 0.495, P=0.0021$ ). In contrast, the maximum pressure levels did not correlate with body weight or the Body Mass Index. Pressure at the ischial area could be reduced, but not eliminated, by adjusting the air pressure. The maximum pressure levels seemed to be related to the shape of the buttocks, especially the amount of soft tissue, and exceeded the defined threshold for pressure ulcers ( $>80\text{g/cm}^2$ ). This demonstrates the appropriateness of Graebe's (1987) proposal that to allow for the differentiation in body sizes and weights the cushion must be adjusted to give the user maximum immersion depth (Figures 3–6).

It can be seen from the above studies that Dry floatation cushioning has clinical evidence which supports its use. The fact that the cushions can be adjusted seems to make a significant difference in the ability of the product to off-

load and disperse interface pressure and thereby reduce the likelihood of pressure ulceration.

### Conclusion

A holistic assessment and specific risk assessment should influence the selection of appropriate equipment. While, there is limited high quality, well constructed evidence to support equipment selection in general, ROHO's range of Dry floatation mattresses and cushions are cost effective in the prevention and management of pressure ulcers, and are supported by significant clinical data. ROHO produce a range of good quality, adjustable and effective pressure relieving mattresses and cushions to meet a variety of patient needs.

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### KEY POINTS

- ◆ The prevention of pressure ulceration is multi-factorial and includes risk assessment, re-positioning, nutritional assessment or management, continence management and the use of equipment.
- ◆ Most pressure ulcers are preventable.
- ◆ Education and training is appropriate for all equipment and is particularly important to ensure appropriate 'immersion' in the products.
- ◆ A range of mattresses and cushions, in addition to bespoke products, are available that may be tailored to individual needs and are clinically and cost effective.
- ◆ ROHO Dry floatation is supported by the evidence to assist health-care professionals to prevent and manage pressure ulcers.

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