Can the design and articulation of the bed frame positively influence patient migration, heel travel and consequently help to reduce heel pressure ulcers?

Objective

The objective of this study was to determine whether the design of a hospital profiling bed's head of bed (HOB) articulation can reduce patient migration down the bed when the backrest is elevated.

Introduction

Pressure ulcers are the single most costly chronic wounds in the NHS, estimated to cost between £1.4 - £2.2 billion annually, which is 4% of the NHS total expenditure[1]. Apart from causing pain and discomfort to the patient, tissue damage places a major burden on healthcare through increased nursing time, hospitalisation, equipment provision, consumables and pharmaceuticals.

Pressure, shear and friction are the main external factors that contribute to the development of tissue damage. Positioning a patient in bed has the potential to cause shear and friction, particularly when the HOB is elevated to improve patient comfort and to facilitate respiratory and nutritional function. This HOB movement has the potential to migrate the patient down the bed over time. The negative effect of this action results in two common adverse events. Firstly, there is an increase in shear and friction as the patient migrates across the mattress, which can lead to pressure ulcers, particularly on heels. Secondly, the migration can have an effect on the patient's torso. The elevation and therapeutic angle of the torso decreases and tends to flatten to the extent that it no longer receives the benefits of the HOB as this position diminishes respiratory function and increases patient discomfort.

The impact of patient migration down the bed in both the acute and community setting is not fully understood by nurses/carers and manufacturers. Preventing migration will not only improve a patient's outcomes, but may also reduce the incidence of tissue damage and musculoskeletal disorders experienced by the nurse/carers when repositioning the patient back up the bed several times a shift[2].

Understanding the effects of patient migration might encourage better bed design and provide objective data to enable an organisation to make informed decisions when specifying and procuring hospital beds[3].

This study will measure the amount of migration of the heels that occurs after head of bed articulation and will seek to determine if a particular design of backrest delivers a more favourable result.

Method

Seven acute hospital beds by various manufacturers and the MMO 5000 were included in the study. A healthy female individual agreed to take part in the evaluation, which involved them lying on each bed in a supine position with their head on a pillow. Coloured markers were used to mark the position of the heels, with an initial measurement taken in the supine position from the foot board to the heel. Task one was to articulate the backrest to 30° and the amount of heel travel was determined by measuring the distance from the foot board to the heel. The bed was returned to flat and any residual heel travel was measured.

The backrest articulation of 30° was determined by the angle indicator or by the pre-programmed pause, depending on the bed. If present, the auto-contour feature was then used to elevate the knees and backrest to 30°. If auto-contour was not present on the handset, the knee break was raised to its maximum level before the HOB was elevated to 30°. Heel travel was then measured again as above.

The same static mattress was used on all eight beds.
A pre-determined evaluation form was used to record the quantitative data of migration distance and qualitative data in relation patient comfort during the process i.e. did the subject experience shear and friction or torso discomfort, including abdominal crunching, during the articulation?

Results

This evaluation demonstrated that the bed design had a significant impact on the subject's migration down the bed. Where migration occurred this resulted in increased pressure, particularly behind the shoulders, calves, heels and sacrum. Torso impact was recorded as qualitative data (Figure 1).

Bed	1	2	3	4	5	6	7 MMO 5000	8
Does backrest have horizontal extension, 2D elliptical action or none	Horizontal	Horizontal	None	Horizontal	Horizontal	Horizontal	2D elliptical action	Horizontal
Degree of horizontal extension	6.3cm (2½")	9.5cm (3¾")		-1.2cm (-½") (shrinks)	13.3cm (5¼")	8.2cm (3¼")	17.7cm (7")	5cm (2")
Degree of heel travel when only the backrest is raised	Function was not working	12.7cm (5")	20.3cm (8")	7.6cm (3")	14cm (5½")	15.2cm (6")	10cm (4")	12.7cm (5")
Degree of heel travel when auto-contour is used	17.7cm (7")	10cm (4")	8.8cm (3.5")	10cm (4")	12.7cm (5")	11.4cm (4½")	None – Static	10cm (4")
Was any shear and friction observed when auto-contour was used?	Shoulders, calves, heels.	Shoulders, heels, major abdominal crunching.	Shoulders, calves, heels, sacrum, major abdominal crunching.	Heels, shoulders, sacrum, calves, neck discomfort for subject, abdominal crunching	Shoulders, heels, sacrum. Subject experienced constricted chest.	Sliding on sacrum, heels, shoulders knees and thighs.	No	Heels juddering on surface, shoulders, major abdominal crunching.
Did the subject feel the need to be repositioned?	Yes	Yes	Yes	Yes	Yes	Yes	No	Yes
Comments	Independent backrest functionality wasn't working.	Controls for auto-contour did not work simult.	Fixed backrest, worked on a pivot point.	Backrest only raised to approx. 25-30 degrees. More un-comfortable, heels dug into surface.	When auto-contoured the patient's heels raised off the surface, experiencing loading and pressure on calves and knees.	When auto-contoured the patient's heels raised off the surface as with bed 5.	Patient looked visibly more comfortable, no need to reposition.	Major crunching patient looked un- comfortable when auto-contoured.

Net migration – Head of bed only up:

The results identified that HOB horizontal extension ranged from 6.3cm - 17.7cm. On bed 1 this function did not work. On bed 3 the backrest was fixed. The degree of extension had a pronounced effect on the individual's migration down the bed, the range being 7.6cm – 20.3cm with bed 4 having the lowest and bed 3 the highest migration.

Net migration – Auto-contour:

When the auto-contour function was used the range was from zero to 17.7cm, with bed 7 generating zero migration and bed 1 generating the highest. The individual perception of torso discomfort ranged from a combination of discomfort across the torso and the individual needing to be repositioned and lower limb tissue unloading being undertaken by the carer. However with bed 7 the individual looked visibly comfortable, with no repositioning or lower limb tissue unloading required.

Discussion

Several reasons exist as to why HOB elevation is required; patient comfort and respiratory function to name just two. This evaluation has demonstrated that when the HOB is raised, if the backrest does not extend to fully accommodate the lengthening of the patient's spine it will cause them to slide down the bed, resulting in increased shear, friction and pressure, particularly to the sacrum and heels. This is compounded if the patient's migration results in contact with the footboard, resulting in further, significant pressure on the heels and limbs and knees bending to accommodate the space they have. Some patients will rotate on their side resulting in their trochanter area being at risk of increased pressure.

It is highly likely that carers would have to continuously reposition the patient to reduce the amount of time they spend in a compromised position which then increases the carer's risk of musculoskeletal injury.

Patient migration towards the foot of the bed has shown to significantly vary because of the design difference in hospital beds. Seven out of the eight beds included in this evaluation caused the subject to migrate down the bed. When they were articulated from flat to a 30° angle the bed design did not alleviate or minimise the individual's migration down the bed it actually contributed to it by the nature of its design pushing the individual from the back downwards.

The practice of needing to reposition patients in bed needs improvement, for several reasons:-

- Patient comfort, nutritional and respiratory functionality
- Reduction of nursing and carer's time to reposition patients
- Reduction of the manual handling injuries associated with repositioning patients[4]

The backrest design does influence the degree of migration. Migration and torso compression was much higher on the beds that had a shorter backrest extension and only a horizontal action.

The MMO 5000 with its elliptical backrest enables a 17.7cm HOB extension and is fit for purpose. The auto-contour function creates zero migration, promoting patient comfort, reducing torso compression and can be a cost-effective addition to pressure ulcer prevention for the institution whilst potentially improving a patient's quality of life. It will also help to reduce staff musculoskeletal injuries by reducing the frequency of the repositioning task of moving the patient up the bed.

When deciding to purchase beds, objective measurements are the only true way to understand the impact of HOB articulation on patients.

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“ The auto-contour function (on the MMO 5000) creates zero migration, creating comfort, reducing torso compression and can be a cost-effective addition to pressure ulcer prevention for the institution whilst potentially improving a patient's quality of life.”

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