

The effect of long term care bed design on body migration, pressure redistribution and comfort

Introduction

Pressure injuries affect millions of people each year, causing distress to the individual and their families, as well as incurring a high level of healthcare resources.¹⁻³

Increasing age, significant cognitive impairment, limited mobility and inability to change position without help, are just some of the risk factors associated with pressure injury development.¹ Consequently many nursing home residents are at high risk of pressure injury making prevention a priority.

The use of pressure redistribution mattresses for those at risk is a well-established component of a pressure injury prevention protocol. While this is well recognised, the role the underlying bed frame plays on mattress performance, comfort, and migration down the bed is less well understood.

As the backrest section is raised and the bed articulated, the movement can cause the resident to migrate or slide down in bed. This can create shear and friction forces that causes distortion and damage to the skin and underlying structures. As a result soft tissues are pulled and deformed, and skin tears and pressure injuries can occur.⁴

Resident movement down the bed usually leads to increased need for repositioning.⁴ This results in increased work, and can contribute to negative health outcomes for carers as in bed repositioning has been identified as one of the riskiest care tasks and a leading cause of musculoskeletal injury.⁴

During the development of the Evenda, a new bed for the long term care sector, Arjo conducted product testing to better understand the impact of bed design on mattress performance, comfort and the potential for resident migration down the bed during bedframe articulation. This was compared to three commonly used beds in the nursing home sector.

Evenda and two of the other beds have an auto-regression function that, in different ways, retract the backrest and thigh rest from the seat section during profiling, whereas one of the beds (bed B) has not.



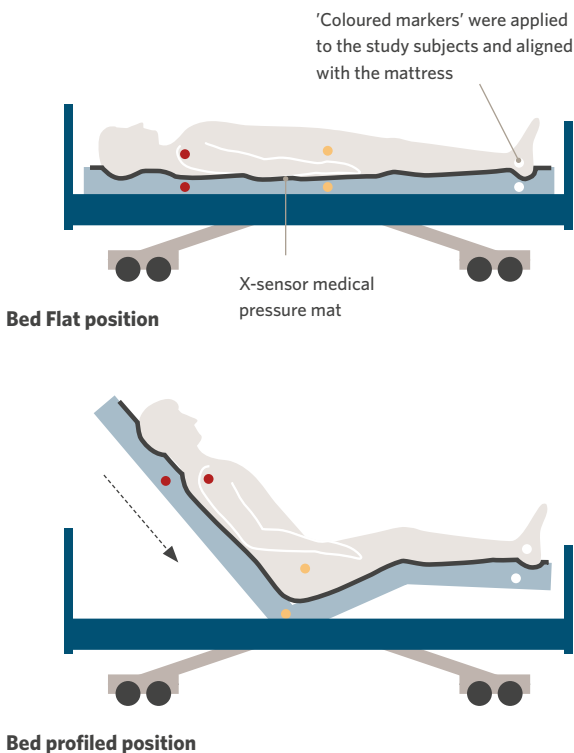
Image of Evenda bed with mobility assist handle

Method

A laboratory study was undertaken at an Arjo research and development facility in Cardiff, UK with a view to emulate similar studies carried out.^{4,5}

The main focus was to investigate subject migration, the change in interface pressures during bed articulation and reported comfort. All beds to be tested were fitted with new Pentaflex pressure redistribution foam mattresses from Arjo.

Interface pressure measurements were taken at the beginning of the process with the bed in a flat position, then during the articulation process with a fully profiled bed, and finally when the bed was lowered back into the flat position. For this process an X-Sensor medical pressure mat was used. The data was captured as a continuous stream of data, with 5 frames captured per second to gain more insight into the pressure changes throughout the bed articulation process. Figures 4 and 5.



The study also assessed subject migration down the bed during bed frame articulation. The data collection method employed captured movement in a single direction. The mattress and human volunteer were both marked with coloured tape on the heel, waist and shoulder at the beginning of the process, and measurements were taken when the bed was articulated and on return to the flat position. The distance moved at each stage was recorded, and these were summed to generate a total movement amount for each subject. Figures 2 and 3.

Each of the study subjects were asked at the end of the process to rank the beds in order of how comfortable they felt as they articulated between flat and profiled positions. Figure 1. This was a blind study so no participant had any knowledge regarding the make or model of beds.

PERCEIVED COMFORT (WHILST PROFILING)	MALE	FEMALE
1 (most comfortable)	Evenda	Evenda
2	Bed B	Bed D
3	Bed C	Bed C
4 (least comfortable)	Bed D	Bed B

Figure 1. Perceived comfort during bed profiling process

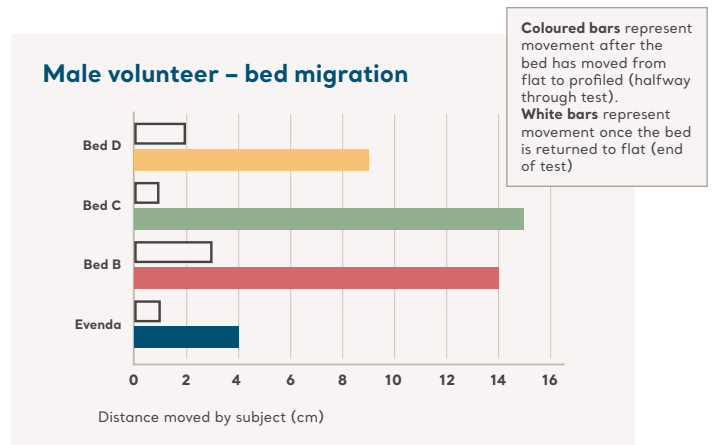


Figure 2.

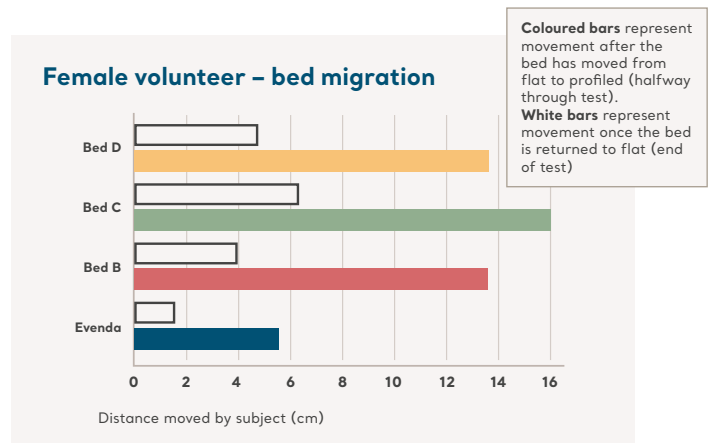


Figure 3.

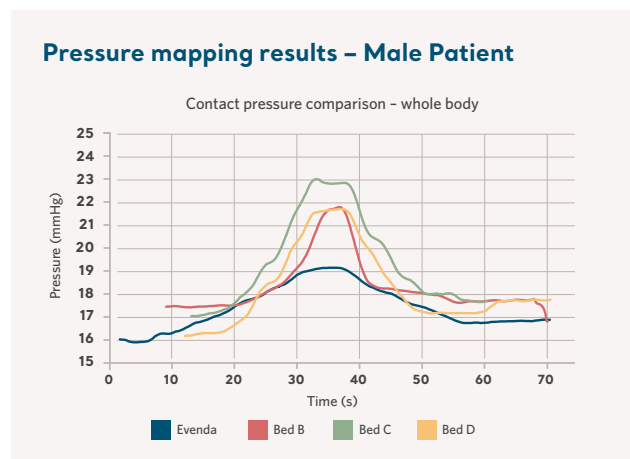


Figure 4.

Pressure mapping results – Female Patient

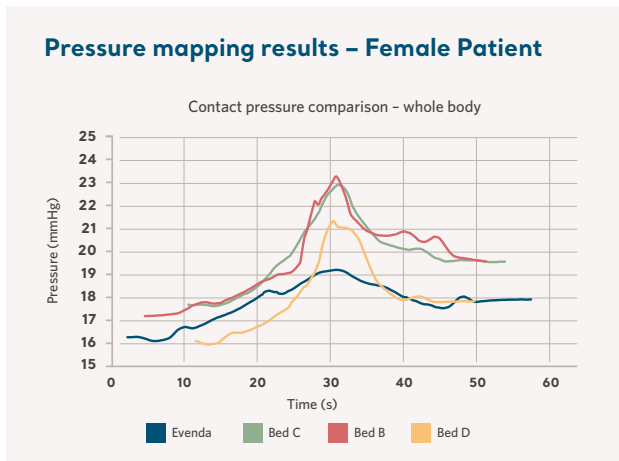


Figure 5.

Discussion

Patient Migration:

During the bed articulation process both volunteers exhibited the least amount of migration on the Evenda bed, for all 3 anatomical sites, and in total. The bed without an auto-regression function showed the most overall migration on both volunteers. This migration effect is likely to introduce a shear force on the skin of the resident as they transition upwards or downwards along the mattress, which could be investigated further by using specific S3i shear force testing methods.

Pressure Tracking:

The change in contact pressures across the body was lowest for both patients on the Evenda bed. The pressure difference was also lower individually for the torso and lower body sections on the Evenda bed than any other bed. For all beds the pressure differences in the torso section were consistently higher than those in the lower body section, suggesting the articulation process affects the patient contact pressure more above the waist. The change in contact pressures was highest on the only bed without auto-regression for the male volunteer, and highest on Bed B for the female volunteer.

Comfort:

Both study subjects ranked the Evenda the most comfortable. Specifically the male study subject commented that the Evenda bed felt like it 'applied the least force onto his body as it moved.' Neither study subject was comfortable on Bed C; the female volunteer commented that she felt as if Bed C was 'trying to pull her in different directions' as it went from profiled back to flat.

Conclusion:

When all the results are considered together, it can be seen that lower levels of patient movement were correlated to lower pressure differences during the bed profiling process, as well as increased comfort levels experienced by the study subjects.

Interestingly, the Evenda bed showed significantly less patient migration and contact pressure compared to the other beds with an autoregression function.

This suggests that the way an autoregression function is implemented could be an important design factor to minimize patient migration.

References

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Arjo AB • Hans Michelsensgatan 10 • 211 20 Malmö • Sweden • +46 10 335 4500

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