

# Beneath the Surface: New Hospital Mattress Solutions to Transform Patient-Surface Interface Pressure Management

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## Summary

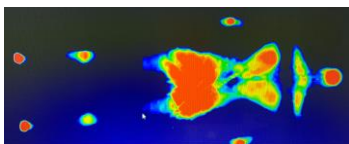
Pressure ulcers are preventable, affecting both the hospital and community care in the UK. Current use of general healthcare mattresses may not be a cost-effective solution to provide optimal pressure relief. This within-subject comparative study explored the effect of different lying surfaces on interface pressure and subjective comfort. Results showed two new low-tech mattresses further improved pressure redistribution whilst maintaining comfort and suggested incorporating castellation within foam mattress structures may not always be beneficial.

## Introduction

Pressure ulcers develop through sustained pressure, force or shear applied to tissue in sitting or lying positions [1]. Pressure can impact significantly upon blood flow, causing partial or even complete blood vessel occlusion, affecting different layers of the skin leading to ulcer formation [2]. Pressure management is key in hospital and community care for the successful prevention of pressure ulcer occurrence. Pressure redistributing devices can be “low-tech” (e.g., memory foam) or “high-tech” (e.g., low pressure or rolling systems to constantly redistribute the patients’ weight) [3]. Recent research has suggested that gold standard mattress solutions such as air or memory foam solutions may not provide optimal pressure relief [4]. This project aimed to assess the pressure redistribution and comfort properties of two new clinical mattresses compared to existing low-tech solutions.

## Methods

Healthy participants (n=20) volunteered for this study. A single session lab-based experimental study explored patient-surface interface pressures and subjective comfort for Subjective comfort and quantitative measures for surface area, peak and mean interface pressure and peak pressure index (PPI) at the head, shoulders, sacrum and heels using an advanced Xsensor pressure mapping system (Fig. 1; Sumed, UK). Each intervention lasted for 21 minutes to allow a 6-minute settling time. There were four hospital mattress conditions tested: (1) Castellated Memory Foam (MFC); (2) New Castellated Foam (LFC, Levitex Foams Ltd., UK); (3) Standard foam (STAN.) and (4) a New Foam, U-Core Mattress (LUC, Levitex Foams Ltd., UK).



**Figure 1:** Example X-sensor data showing interface pressure points.

## Results and Discussion

Compared to the STAN mattress, all mattresses showed a lower average interface pressure ( $P<0.001$ ), with MFC, LFC and LUC mattresses significantly reducing pressure by 14-18%. LFC and LUC mattresses significantly increased in contact area ( $P<0.001$ ), allowing better pressure redistribution with weight being distributed over a larger surface area. Furthermore, head shoulder and heel PPI significantly reduced for all conditions compared to the STAN mattress. PPI and average pressure results fell within or below the threshold between 60-80 mmHg which has been shown to prevent tissue damage or necrosis. The ability to maintain comfort in addition to improving pressure redistribution raise the potential for further testing and to be utilized in clinical setting. Subjective comfort did not alter between conditions.

Table 1: Mean ( $\sigma$ ) data for all body interface outcomes.

	CONDITIONS			
	SURFACE 1 (MFC)	SURFACE 2 (LFC)	SURFACE 3 (STAN.)	SURFACE 4 (LUC)
Full Body Peak Pressure (mmHg)	91.9 (27.4)*	87.6 (29.5)*	107.0 (46.1)*	89.8 (30)*
Head PPI (mmHg)	34.1 (2.7)*	33.6 (3.4)*	35.7 (3.6)*	34.7 (2.7)*
Sacrum PPI (mmHg)	36.0 (4.0)	34.8 (3.2)	38.0 (5.7)	37.0 (6.1)
Shoulders PPI (mmHg)	27.6 (6.7)*	26.6 (4.1)*	30.6 (5.0)*	26.7 (4.3)*
Right heel PPI (mmHg)	37.3 (8.1)*	38.1 (8.8)*	46.8 (20.5)*	39.9 (11.1)*
Left heel PPI (mmHg)	50.3 (12.2)*	47.0 (13.0)*	61.3 (29.1)*	49.4 (14.1)*
Full Body Average Pressure (mmHg)	20.2 (1.2)*	20.2 (1.1)*	23.44 (2.0)*	20.1 (1.3)*
Total Full Body Contact Area (cm <sup>2</sup> )	3307.5(647.0)*	3530.2(662.6)*	3114.5(588.9)*	3541.5(611.8)*
Comfort score (0-10)	7.5 (1.1)	7.8 (1.0)	7.0 (1.7)	7.85 (1.3)

## Conclusions

The two new mattress solutions preformed comparably, showing little to no benefit of castellation within the foam structure. Whilst the alternative mattress solutions tested have the potential to reduce pressure sore incidence, they are not a replacement for patient centered care and regular repositioning. Further studies should explore the impact of mattress castellation on patient mobility, to optimise care.

## Acknowledgments

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## References

- [1] Sprigle S & Sonenblum S et al. (2011). *J. Rehabil Res Dev*, **48**: 203-13.
- [2] McInnes E et al. (2018) *CDSR*, **10**: CD009490
- [3] National Institute for Clinical Excellence (NICE) (2014). CG179 London.
- [4] Webb JA. & Chohan A. (2023) *J Wound Care*, **32**:513-18