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Original Citation

Ousey, Karen, Stephenson, John and Fleming, Leigh (2016) Evaluating the Trezzo range of static foam surfaces: results of a comparative study. *Wounds UK*, 12 (4). pp. 66-73. ISSN 1746-6814

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Evaluating the Trezzo range of static foam surfaces: results of a comparative study

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This paper presents analysis from a 6-week prospective product evaluation of the Trezzo range of mattresses, compared to standard foam mattresses, in use on two clinical areas within Pennine Acute NHS Trust. Data were collected via distribution of three questionnaires. A patient experience questionnaire was completed by patients after using their mattress. This questionnaire elicited responses relating to patient comfort, temperature and sleep quality while using the mattress (and cushion if appropriate). The Trezzo mattress was found to be comparable to the standard NHS mattress in these domains. A staff clinical evaluation (patient) questionnaire was completed by nursing staff on behalf of patients in their care at patient admission and discharge. This questionnaire elicited responses relating to patient skin condition, and incidences of pressure ulceration. The Trezzo mattress was found to be comparable to the standard NHS mattress with respect to changes in patient skin condition during hospital stay. A second staff clinical evaluation (mattress) questionnaire was completed by nursing staff, in which the Trezzo mattress was compared against standard mattresses in the domains of aesthetics, ease of use, ergonomics and temperature control; patient moving and handling and mattress stability; and cleaning and sodium hypochlorite use. The Trezzo mattress scored substantively higher than the standard mattress on all of these domains; with differences being statistically significant in all cases.

KEY WORDS

Comfort
Comparative evaluation
Pressure damage
Quality

Pressure damage, resulting in development of a pressure ulcer, can affect any individual, although it is more prevalent in older people. It can result in a reduction of mobility and activities of daily living, poor nutritional status, increased pain, and an increased financial cost to the care sector. This, in turn, can lead to an increased stay in hospital, increased community nurse visits and a reduction in health-related quality of life for those who have a pressure ulcer, compared to those without.

Pressure ulcers are areas of localised damage to the skin and underlying tissue, believed to be caused either by pressure, or by a combination of pressure and shear (National Pressure Ulcer Advisory Panel, European Pressure Ulcer Advisory Panel and Pan Pacific Pressure Injury Alliance, 2014). The costs of treating and managing pressure damage is dependent on severity of skin damage; the Department of Health (DH, 2010) stated the cost of treating a category 1 pressure ulcer (superficial damage) to be approximately £1,214 rising to £14,108 for a category 4 pressure ulcer (damage to the skin that extends to the bone).

A review of epidemiological studies reported by McInnes et al (2015) in a Cochrane review of support surfaces presented data from Europe, Canada and the USA. They reported pressure ulcer prevalence in European hospitals to range from 8.3% to 23% (Vanderwee, 2007); in the UK, pressure ulcer prevalence within care settings was estimated at 10.2%, with 59% of these being hospital-acquired (Phillips and Buttery, 2009). In American healthcare facilities, prevalence have been estimated at 12.3% (VanGilder et al, 2009), while in Canadian healthcare settings, prevalence has been reported to be 26% (Woodbury and Houghton, 2004). 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 (Bo et al, 2003). Based on the data available, between one-in-four and one-in-five patients within an acute hospital will have had a pressure ulcer (Posnett, 2009).

The National Safety Thermometer (Health and Social Care Information Centre, 2014) reported that in June 2016, 4.4% of reported patients had a pressure ulcer, compared with 4.3% in June 2015. It is, therefore, essential that service evaluation/evidence continues to be provided for clinicians regarding the use of new pressure redistributing mattresses to ensure they meet patient needs and prevent skin damage. An integral aspect of preventing skin damage is the use of pressure-redistributing mattresses. At present, there are a range of static mattresses available for healthcare practitioners to choose from. A Cochrane review (2011) reported high-specification foam alternatives to the standard hospital mattress significantly reduced the incidence of pressure ulcers in at-risk patients, when compared with the standard hospital foam (McInnes et al, 2011), and in 2015 a further Cochrane review identified that people at high risk of developing pressure ulcers should use higher-specification foam mattresses rather than standard hospital foam mattresses (McInnes et al, 2015).

Essential Healthcare have developed a range of products — the Trezzo range. This range of mattresses differs from those currently on the market, as they possess a 40 kg foam density, which is one of the highest, if not the highest foam density on the market; allowing great immersion, leading to improved support for the most vulnerable pressure points of the body. The Trezzo foam has an open cell structure allowing airflow, combined with infused micro gel beads to soak up heat creating a cooling effect. Additionally, the mattress is split into three zones for the head, heel and body to combat vulnerable areas, therefore minimising the need for supporting accessories, such as heel offloading aids. This is the first evaluation of this product, with the results being used to assist other healthcare providers with unbiased evidence as to the efficacy of the Trezzo product range. This paper presents analysis from a product evaluation of the Trezzo range of mattresses compared to standard foam mattresses in use on two clinical areas within Pennine Acute NHS Trust.

AIM

The evaluation primarily measured patient-related outcomes. This included both outcomes reported by the patients themselves (the authors assessed any differences in temperature, comfort

and sleep quality between patients using the different mattress types) and staff-reported outcomes (the authors assessed any changes in skin conditions such as pressure ulcers and skin damage between patients using the different mattress types; plus staff assessments of the use of the mattresses).

ETHICAL APPROVAL

Ethical approval was applied for and successfully received from Research Governance at Pennine Acute NHS Trust and the University of Huddersfield School of Human and Health Sciences Research and Ethics Panel. Additionally, ward staff and the Tissue Viability Nurse Consultant agreed to be involved in this evaluation.

METHODS

A 6-week prospective evaluation was employed with data collected via distribution of three questionnaires. A patient experience questionnaire was completed by patients after using their mattress. This questionnaire elicited responses relating to patient comfort, temperature and sleep quality while using the mattress (and cushion if appropriate). A staff clinical evaluation ('patient') questionnaire was completed by nursing staff on behalf of patients in their care at patient admission and discharge. This questionnaire elicited responses relating to patient skin condition, and incidences of pressure ulceration. A second staff clinical evaluation ('mattress') questionnaire relating to the mattress, rather than to specific patients, was also completed by nursing staff. This questionnaire elicited responses to staff opinions on mattress characteristics; for example, ease of use, moving and handling and cleaning. All questionnaire used both open and closed questions, with closed questions mainly taking the form of 5-point Likert-style items.

On admission to the clinical area, patients were asked, by the admitting nurse, if they wished to receive information about the mattresses evaluation. If they were happy to receive this, they were given written information about the study with time to read this and ask any questions. Normally, 24 hours was allowed for reading of the information sheet; however, if the patient was a day case or an overnight stay, they were allowed 2 hours to read the information sheet. If the patients were in agreement, they were screened using the inclusion and exclusion criteria by the admitting nurse to determine whether they met the inclusion criteria of the study. Nursing staff consented those patients who indicated they are happy to be involved. The main cohort of patients were randomly allocated to either the Trezzo Advance mattress or the standard mattress in use. Some patients who were allocated to the Trezzo Advance mattress also received a Trezzo cushion. These patients were augmented by 12 patients from an earlier data collection point, all of whom used the Trezzo Advance mattress.

A total of 92 sets of forms (staff and patient evaluations) were received. Of these, 63 staff evaluations and 54 patient evaluations were at least partially usable. However, not all usable forms provided a full set of data. It was not possible to definitively identify patient experience and clinical evaluation forms associated with the same patient in all cases. The questionnaires were held securely by nursing staff on completion and collected regularly from the ward by a researcher from the University of Huddersfield. After removal from the ward questionnaires were transferred to University premises and kept in a locked cabinet in a locked office. Access to the forms was limited to the researchers only. All data from the questionnaires were transferred to SPSS and stored on the university secure server.

Data from all questionnaires were summarised descriptively, comparing data from the Trezzo and standard mattresses. Where appropriate, statistical significance (using χ^2 testing) and the magnitude of differences in characteristics between mattress types was also assessed.

RESULTS

Data were obtained from two clinical areas, Wolstenhome Ward and the Clinical Assessment Unit at Rochdale Infirmary over a 6-week evaluation period between June 2016 and August 2016.

Patient evaluation forms

Completed or partially completed patient evaluation forms with mattress type specified were obtained from 53 patients. Thirty-two patients (60.4%) used the Trezzo mattress and 21 patients (39.6%) used the standard mattress. Patients were not asked for demographic information via this form.

The Trezzo mattress was compared against standard mattresses in use on the wards. There were a range of mattresses that had been audited in the previous 12 months and were deemed to be in a good condition; in the domains of patient comfort, temperature and sleep quality. For patient comfort and sleep quality, the proportions of patients using each mattress type reporting these quantities to be “very good” or “excellent” was compared. For temperature, acceptability was assumed to be represented by the options of “suitable” or “warm”; alternatives included “very cold”, “cold” and “very hot”.

No evidence was revealed to substantiate significant differences between the two mattress types in any of these domains. Outcomes are summarised in *Table 1*.

Sleep is essential for all humans, and poor sleep may result in a variety of physical and psychological health problems (Reid et al, 2006; Hamilton et al, 2007; Litinski et al, 2009). A lack of sleep can increase the pathological significance of a condition (Litinski et al, 2009), reduce energy levels, increase lethargy resulting in patients being reluctant to mobilise, and has obvious implications for patients to function physically and psychologically. As such, sleep quality was examined during this evaluation with results highlighting that patients nursed on the Trezzo reported their sleep quality as very good or excellent. Quality of sleep was strongly correlated with level of comfort ($r^s=0.614$, $p<0.001$) across the full patient cohort.

Fifteen patients using the Trezzo mattress also used a Trezzo cushion. Eighteen patients using a standard mattress also used a standard cushion. Some patients using both mattress types reported using no cushions. Hence the relationships between cushion type and comfort, temperature and sleep quality were broadly similar as for the relationships between mattress types and comfort, temperature and sleep quality, with no significant differences between cushion types observed with respect to any of these characteristics.

Staff clinical evaluation forms — mattress

Fifty-seven completed or partially completed staff evaluation (mattress) forms with mattress type specified were obtained. Forty-two forms (73.7%) related to staff experience of the Trezzo mattress; 15 forms (26.3%) related to staff experience of the standard mattress. The larger number of forms relating to the Trezzo mattress is accounted for by the inclusion of 29 forms from an earlier patient cohort; all of whom used a Trezzo mattress. Thirteen of the forms relating to the use of the Trezzo mattress also reported information on the use of the Trezzo cushion; however, in most cases this information was not reported. Twelve of the forms relating to the use of the standard mattress also reported information on the use of a standard cushion.

When choosing a support system it is essential the system allows for ease of use for staff and provides a comfortable and temperature controlled environment for the patient. The microclimate has been recognised as an important property of support systems in the prevention of pressure damage (Wounds International, 2010; Clark and Black, 2011). Indeed, the NPUAP et al (2014) state that any surface that is in contact with the skin will have the potential to affect the microclimate; the overall effect is dependent on the nature of the support surface and its type of cover. This is supported by Yusuf et al (2015) who report in their study the importance of maintaining the microclimate, that increasing skin temperature as a microclimate variable has a relationship with the development of pressure ulcers and superficial skin changes. Therefore, it is crucial that the support system does not significantly lead to a rise in temperature. Additionally, the level of mobility patients have while being nursed in bed and the perceived level of comfort the system provides for the patient have been identified as factors that require consideration when choosing the most appropriate support system (Wounds International, 2010).

The Trezzo mattress was compared against standard mattresses in the domains of aesthetics,

ease of use, ergonomics and temperature control. Differences in the proportions of respondents reporting Trezzo and standard mattresses to be very good, good or excellent in these domains were statistically significant, with the Trezzo mattress scoring substantively higher than the standard mattress on all four domains. Maintaining skin temperature is paramount for patients on support systems. A raised skin temperature has been reported (Clark and Black, 2011) as being related to pressure ulceration as higher temperatures increases metabolic demand, raising the tissue's susceptibility to ischaemic effects of pressure and shear; this rise in metabolic rate and body temperature can lead to tissue damage through a detrimental effect of epidermal weakening (Wounds International, 2010).

While the rise in metabolic activity results from increased body temperature, it has been suggested that elevations in skin temperature may also lead to skin and soft tissue damage, perhaps through weakening of the epidermis. In addition, raised body/skin temperature often induces sweating, which, as explained below, may further increase risk of pressure damage. The extent of significance is such that each individual outcome would still be regarded as significant when controlling for multiple testing; e.g. using the Bonferroni correction. Outcomes are summarised in *Table 2*.

The Trezzo mattress was also compared against standard mattresses in the domains of moving and handling. Again, the Trezzo mattress scored substantively higher than the standard mattress on these domains, although the substantive difference in ratings was generally slightly less than in aesthetics and related domains. As before, differences were statistically significant when considered on an outcome-by-outcome basis; however, allowing for multiple testing, the differences in proportions reporting patient moving and handling to be excellent or very good would not be considered to be statistically significant.

The ability of a mattress to allow ease of moving and handling procedures is critical. Some patients may require assistance with their moving regimens, whereas others will be able to move themselves unaided. Mattresses should not impede movement, the Trezzo was reported by both staff and patients as being very good or excellent in this category. The ability to move freely on the mattress will redistribute pressure and assist in reducing friction and shear forces that can distort tissues, occlude capillaries and reduce blood flow that will cause pressure damage. Outcomes are summarised in *Table 3*.

No fluid ingress was reported to have occurred on any of either of the assessed Trezzo or standard mattresses. This finding is important as there were no reports of fluid ingress and when correlated with the positive results of maintaining the microclimate, the authors can conclude that excessive skin moisture caused by perspiration is being prevented. Research and evidence highlights that excessive moisture on the skin surface can contribute to an increased risk of skin damage through maceration of the skin, an increased risk of damage to the skin caused by friction and possible pressure ulcer development (Wounds International, 2010). Gerhardt et al (2008) reported that moisture weakens the crosslinks between collagen in the dermis and softens the stratum corneum. Another important aspect of having no fluid ingress is that there is less risk of the foam being compromised due to ingress, thus there is less risk of cross infection and no requirement to destroy and replace mattresses due to fluid damage.

The Trezzo mattress was also compared against standard mattresses in the domains of cleaning. Again, the Trezzo mattress scored substantively higher than the standard mattress on these domains. As before, low frequencies precluded statistically significant differences. Being able to clean the mattress efficiently and easily with standard cleansing solutions can reduce staff time, provide less disruption for the patient and ensures that mattresses are cleaned in line with infection prevention policies requiring no additional specialist cleaning products. Outcomes are summarised in *Table 4*.

Staff clinical evaluation forms – patient

Sixty-one completed or partially completed staff evaluation (patient) forms with mattress type specified were obtained. Thirty-two forms (52.5%) related to patients using the Trezzo mattress (15

of which also reported using a Trezzo cushion); 29 forms (47.5%) related to patients using the standard mattress (19 of which also used a standard cushion).

The characteristics of patients using the Trezzo and standard mattresses on admission were compared. No substantive differences between either group on any characteristic were noted (Table 5). As such, it is evident that the Trezzo maintains comfort for the patient, an effective microclimate, is easy to clean with standard hospital cleansing solutions and is easy to use for the staff. Values are frequency and valid percentage unless where noted otherwise.

The conditions of patients using the Trezzo and standard mattresses on discharge were also compared. While some substantive differences were observed, these effects may be artefacts due to very low sample sizes. Reliable significance testing could not be undertaken on this data for the same reason.

Overall deterioration of patient skin condition was reported to have occurred in one patient using a Trezzo mattress and in one patient using the standard mattress. Overall improvement of patient skin condition was reported to have occurred in four patients using a Trezzo mattress and in five patients using the standard mattress. No change was reported in three patients using a Trezzo mattress and in three patients using a standard mattress.

These differences in outcomes between patients using the different mattress types are not substantively or statistically significant ($\chi^2_{(2)}=0.052$; $p=0.974$; $\phi=0.056$). However, changes in skin condition of the majority of patients, regardless of the type of mattress they were using, was not recorded during the measurement period, possibly because of a paucity of data relating to skin condition at discharge.

LIMITATIONS

This was a relatively small sample of patients and as such statistical significance is difficult to achieve in all areas. There was limited collection of patient data and, therefore, there can be no association made between the mattress used and the patient comorbidities.

SUMMARY OF FINDINGS IN THIS EVALUATION

There is no evidence that patient comfort or sleep quality is affected by the type of mattress used

There is no evidence that the type of mattress used is associated with changes of pressure damage/ulceration or reddening of the skin

The Trezzo mattress outperforms standard NHS mattresses in terms of aesthetics, ease of use, ergonomics, temperature control, patient moving and handling, and cleaning, with significant differences being observed between the Trezzo mattress and the standard NHS mattress in all these domains.

Overall, the results highlight that the Trezzo mattress outperformed the standard mattress with regards to ease of use, ergonomics and temperature control; patient moving and handling and mattress stability; cleaning and sodium hypochlorite use. The majority of patients found the Trezzo to be comfortable, with clinical staff also finding the mattress easy to use and clean. The lack of fluid ingress was positive with no risk of cross infection and a potential saving to healthcare environments as the foam does not become compromised and, therefore, does not require condemning.

Table 1. Comparison of Trezzo and standard mattresses on patient comfort, temperature and sleep quality

Characteristic	Mattress type		Significance	Effect size
	Trezzo	Standard		
Patient comfort:				
Very good or excellent	25/32 (78.1%)	16/20 (80.0%)	$\chi^2_{(1)}=0.026$; $p=0.872$	$\phi=0.022$; very small
Good, adequate or poor	7/32 (21.9%)	4/20 (20.0%)		
Mattress temperature:				
Suitable or warm	29/32 (90.6%)	16/19 (84.2%)	$\chi^2_{(1)}=0.473$; $p=0.492$	$\phi=0.096$; small
Very cold, hot, or very hot	3/32 (9.4%)	3/19 (15.8%)		
Sleep quality:				
Very good or excellent	18/31 (58.1%)	7/17 (41.2%)	$\chi^2_{(2)}=1.289$; $p=0.525$	$\phi=0.164$; small/ moderate
Adequate	10/31 (32.3%)	8/17 (47.1%)		
Good, adequate or poor	3/31 (9.7%)	2/17 (11.8%)		

Table 2. Comparison of Trezzo and standard mattresses on aesthetics and related domains

Characteristic	Mattress type		Significance	Effect size
	Trezzo	Standard		
Aesthetics:				
Very good or excellent	25/34 (73.5%)	2/12 (16.7%)	$\chi^2_{(1)}=11.8$; $p=0.001$	$\phi=0.507$; large
Good, adequate or poor	9/34 (26.5%)	10/9 (83.3%)		
Ease of use:				
Very good or excellent	29/40 (72.5%)	2/12 (16.7%)	$\chi^2_{(1)}=12.0$; $p=0.001$	$\phi=0.479$; large
Good, adequate or poor	11/40 (27.5%)	10/9 (83.3%)		
Ergonomics				
Very good or excellent	27/37 (73.0%)	2/11 (18.2%)	$\chi^2_{(1)}=10.6$; $p=0.001$	$\phi=0.471$; large
Good, adequate or poor	10/37 (27.0%)	9/11 (81.8%)		
Temperature control				
Very good or excellent	21/32 (65.6%)	1/12 (8.3%)	$\chi^2_{(1)}=11.5$; $p=0.001$	$\phi=0.510$; large
Good, adequate or poor	11/32 (34.4%)	11/12 (91.7%)		

Table 3. Comparison of Trezzo and standard mattresses on moving and handling domains

Characteristic	Mattress type		Significance	Effect size
	Trezzo	Standard		
Patient moving and handling				
Very good or excellent	26/41 (63.4%)	5/15 (33.3%)	$\chi^2_{(1)}=4.02$; $p=0.045$	$\phi=0.268$; moderate
Good, adequate or poor	15/41 (36.6%)	10/15 (67.6%)		
Mattress stability				
Very good or excellent	29/41 (70.7%)	4/13 (30.8%)	$\chi^2_{(1)}=6.63$; $p=0.010$	$\phi=0.350$; moderate
Good, adequate or poor	12/41 (29.3%)	9/13 (69.2%)		

Table 4. Comparison of Trezzo and standard mattresses on moving and handling domains

Characteristic	Mattress type		Significance	Effect size
	Trezzo	Standard		
Ease of cleaning				
Very good or excellent	30/39 (76.9%)	$\chi^2_{(1)}=6.49$;	$\chi^2_{(1)}=6.49$; $p=0.011$	$\phi=0.360$; moderate
Good, adequate or poor	9/39 (23.1%)	$p=0.011$		
Sodium hypochlorite use				
Very good or excellent	17/23 (73.9%)	3/9 (33.3%)	$\chi^2_{(1)}=4.55$; $p=0.033$	$\phi=0.377$; moderate
Good, adequate or poor	6/23 (26.1%)	6/6 (66.7%)		

Table 5. Patient characteristics of patients using Trezzo and standard mattresses on admission

Characteristic	Mattress type	
	Trezzo	Standard
Age in years (Mean (SD))	73.0 (18.5)	76.6 (10.1)
Gender		
Male	17/23 (73.9%)	16/28 (57.1%)
Female	6/23 (26.1%)	12/28 (42.9%)
Risk of pressure injury (Waterlow score)		
Low risk (<10)	0/16 (0.0%)	1/16 (6.3%)
At risk (10-14)	13/16 (81.3%)	15/16 (93.8%)
At high risk (15-19)	1/16 (6.3%)	0/16 (0.0%)
At very high risk (20+)	2/16 (12.5%)	0/16 (0.0%)
Pressure damage or ulceration		
Yes	4/24 (16.7%)	7/27 (25.9%)
No	20/24 (83.3%)	20/27 (74.1%)
Reddened areas on the body		
Yes	9/23 (39.1%)	14/28 (50.0%)
No	14/23 (60.9%)	14/28 (50.0%)
Skin temperature control		
Very good or excellent	8/18 (44.4%)	5/13 (38.5%)
Good, adequate or poor	10/18 (55.6%)	8/13 (61.5%)
Skin condition during use		
Very good or excellent	11/19 (57.9%)	5/9 (55.6%)
Good, adequate or poor	8/19 (42.1%)	4/9 (44.4%)

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