HEALTHCARE INNOVATIONS AUSTRALIA

NEST® Cushions and Mattresses: Evaluations

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NEST® Evaluations

Please note that some documents within this evaluation pack reference **Meditec Medical** as the evaluations took place when they were the manufacturer of the NEST®. **NUA Medical** is the current manufacturer and is in partnership with **HIA** as a distributor for Australia. The information and evaluations remain accurate.

Get in touch with HIA at sales@hiaus.net.au for more available evaluations and reports.

Clinical Evaluation of The Nest Cushion® in the prevention of Pressure Ulcers in a Residential Setting – Lisheen Nursing Home

Risk Factors for Pressure ulcer development

Lisheen Nursing home is a residential unit comprising of 114 beds and provides care and support for residents who require assistance with the daily activities of living. At the Nursing Home our aim is to provided person-centred care and to support all residents whilst promoting their health and wellbeing. On admission to the Nursing Home all residents have a comprehensive nursing assessment carried out to identify strengths/limitations and weaknesses in relation to the daily activities of living. Many of the residents have reduced mobility and require assistance with moving and repositioning. Sitting for prolonged periods of time increases interface pressures, which may increase the risk of pressure damage[3]. The weight of a seated individual against their chair or sofa compresses soft tissue, which obstructs blood flow. When this compression is combined with limited movement, poor sensation, malnutrition and increased age, it may lead to pressure damage to the individual's ischial tuberosities, buttocks and sacrum.

Advancing age has been identified as a predictor of pressure-related injuries due to the gradual decline of general nutritional and mental status, decreased mobility, sensory perception deficits, incontinence and the changing characteristics of the skin such as decreased elasticity

Nursing Assessment of all our residents includes a Waterlow Pressure Ulcer Risk Assessment to assist with identifying existing factors that put the residents at risk of developing a pressure ulcer. By highlighting these factors, the nurses can plan effective interventions to remove or reduce the risks. The grading of pressure ulcers is another important aspect of caring for residents. In line with HIQA regulations, the Office of the Chief Inspector must be notified at the end of the quarter of all pressure ulcers sustained by residents where the pressure ulcer was Category II or higher. The pressure ulcer classification system referred to is the International NPUAP/EPUAP Pressure Ulcer Classification System 2009

The Nest® Cushion

Meditec Medical a supplier of our pressure redistribution mattresses asked us to trial a new pressure relieving cushion. At this time a variety of pressure relieving cushions including foam and gel were in use in the Nursing Home. Some were provided by the HSE Community Occupational department for wheelchair users, others were brought into the Nursing Home on admission by the residents themselves or their families and the remainder were purchased by the Nursing Home. The latter are classed as communal pressure relieving cushions in the Nursing Home and used by different residents when required and cleaned in line with our infection and prevention control policies.

The Nest® Cushions is a new generation of cushion technology providing pressure relief through unique pressure distribution. We were supplied with extensive research material by Meditec, identifying good proven outcomes in relation to the pressure distribution properties of the Nest®, blood flow circulation and positive microclimate properties. Pressure distribution is the key to pressure ulcer prevention in bed and chairfast residents. The pressure relieving properties of The Nest® occur by dispersing the load away from the patient through the interlocking loops of the unique material. This reduces the external pressure (skin interface pressure) and more importantly the internal pressures (deep tissue stresses) that cause the majority of pressure injuries.

Three scientific studies have concluded that The Nest® allows better blood flow circulation in the

sacral area as well as the gastrocnemius muscle during seating compared to polyurethane foam.

Temperature and humidity affect the structure and function of the skin increasing or lowering possible damage thresholds for the skin and underlying soft tissues. From a pressure ulcer prevention research perspective, the effects of humidity and temperature next to the skin surface are inextricably linked to concurrent soft tissue deformation. The Nest® breathability is 10 times higher than polyurethane foam promoting a positive microclimate, which means humidity and temperature remain constant, preventing heat jam in the cushion.

All equipment used in the Nursing Home must be thoroughly cleaned in line with our Infection Prevention and Control Policies. The Nest Cushion® meets all SEK standards, inhibits bacteria and has superior anti-microbial and deodorant properties. A unique feature of the Nest® is the ability for us to effectively clean the cushion inside and outside, unlike our existing polyurethane foam and gel cushions. The Nest® material is made up of a polyester based thermoplastic elastomer. It can be safely and effectively cleaned in a domestic washing machine and easily tumbled or air dried. The nest material can be disinfected and it can withstand temperatures above 120°C. The Nest® is 100% recyclable and reusable.

Evaluation of The Nest Cushion®

Our evaluation is based on our experience of the nine residents who used the Nest® as part of their overall plan of care in the prevention of pressure ulcers. The selected residents all had reduced mobility together with identified existing risk factors associated with pressure ulcer development. They all had Waterlow Scores greater than 15 placing them in the very high-risk category for pressure ulcer development. Skin assessment and monitoring was carried out daily and no evidence of skin damage was recorded in relation to patients on the Nest®.

The Nest® Cushion was light to handle, remained in place on the chair and did not slide. There were no requirements to inflate or deflate the cushion to maximise pressure redistribution. Residents found The Nest® very comfortable and from a housekeeping perspective no problems were encountered with cleaning and disinfecting the cushion cover. When the cover was soiled with bodily fluids both the cover and the nest itself was machined washed at 80°C and tumbled dried. The nest material did not lose its shape or durability and was easily reinserted back into the cushion cover.

Conclusion

National and International guidelines on pressure ulcer prevention and management all highlight the importance of carefully selecting seating support surfaces. Consideration must be given to selecting a cushion that effectively redistributes the patients weight over as large a surface as possible. The cover must be stretchable/breathable and permit air exchange to minimise temperature and moisture build up.

Our evaluation found The Nest® Cushion very effective in the redistribution of the residents' weight when sitting in the chair and provided excellent pressure relief to both the sacral areas and ischial tuberosities while maintaining a positive microclimate throughout the evaluation period. Within the Nursing Home and indeed all healthcare institutions curtailment and management of cross infection is of paramount importance and very challenging in the current climate of COVID 19, CRE, MRSA etc. The safety net that The Nest® brought to the nursing home was fantastic, knowing that the cushion could be thoroughly cleaned (inside and outside) and vital in relation to infection prevention and control.

Valerie Joy

DON Lisheen Nursing Home

Evaluation of Wheelchair Seat Cushions – Duncan Bain 2019

How to use this Report
The performance of a wheelchair cushion is a combination of many different parameters, and no single one stands out as being the most important. Different users will have different prime purposes for their respective cushions, and this means that different criteria will apply.

The purpose of these reports is to provide authoritative and accurate information as to the performance of cushions against a variety of objectively measurable criteria. The user, carer, or prescriber can then use this information to make informed choices based on those criteria deemed to be most important for a specific user.

It must be acknowledged that the information contained in these reports is not exhaustive, and must be used alongside clinical judgment and common sense.

When choosing and using a wheelchair cushion, do not rely solely on the contents of these reports, but play close attention to the correct set-up of system comprising both wheelchair and cushion.

Development of Test Criteria

The test criteria presented here are the result of many years development and discussion. Much of this process has been undertaken under the auspices of the International Standards Organisation (ISO) Working Group 11 (ISO TC 173/SC 1/WG 11), charged with the development of international standards for wheelchair seating.

This process has engaged with physiotherapists, occupational therapists, physicians, engineers, nurses, carers, and users internationally. Points have been initially debated by internet forum, and later proposed and voted at a succession of international meetings. This has ensured a very broad base of consensus for the evaluation criteria, and the test methods employed.

The methods employed in these reports do not currently constitute an International Standard. Draft standards for discussion have been circulated[1], and it is anticipated that further adjustments may be made in due course before final decisions are reached. These methods are, however, the current state of the art in the standards development process.

Validation of these test methods has been undertaken by inter-laboratory comparison in 3 different countries to ensure robustly reproducible results.

Rationale and Method

All the test criteria and methods employed are described below.

1 Horizontal Stability

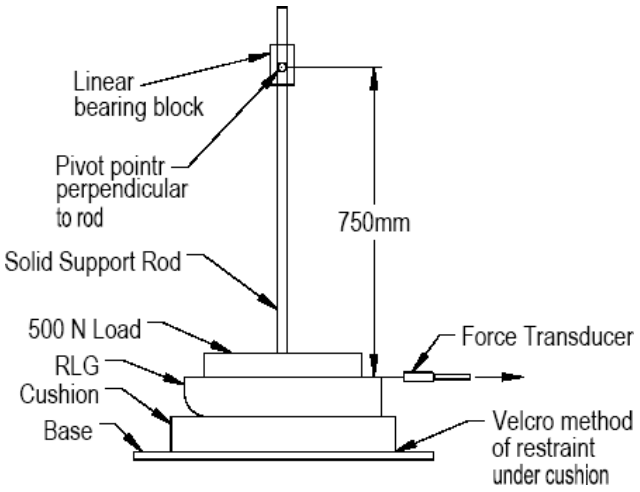


Figure 1: Apparatus for measuring horizontal stability parameters

The apparatus shown in figure 1 comprises a rigid base, nominally shaped to represent a person's bottom, attached to a linear guide, which is pivoted at the top. This allows a weight of 50kg to be loaded onto the base, representing the seated weight on the cushion. This assembly can then be pulled forward by means of a cable attached to a force gauge. 2 features of the cushion's performance can be measured in this way:

Horizontal Stiffness

Forces tangential to the surface of the skin ("shear forces") are known to contribute to skin damage. These forces may arise as a result of small body movements, with relative movement between adjacent areas of skin. Deformability of the cushion surface in a direction tangential to the skin can accommodate these small movements, and so reduce the associated forces.

Horizontal stiffness is measured by recording the force at which the loading apparatus moves forward by 5mm, without slipping on the surface of the cushion. This procedure is repeated to a total of 3 times, and the mean value is presented together with the standard deviation.

Report output:

Horizontal Stiffness (N)
average of 3 (+/- standard deviation)

Lower Horizontal Stiffness => Lower shear forces

Sliding Resistance

For many users, an important consideration is the tendency to slide forwards out of the wheelchair. Safety and stability demand that adequate resistance to sliding is provided by the cushion, appropriate to the user. This parameter combines the effects of the geometry of the cushion (inclines, wedges, and pommels all tend to prevent forward sliding) with envelopment effects (sinking further into the cushion will tend to stabilize), and frictional properties of the cover.

Sliding resistance is measured by recording the force at which the loading apparatus starts to slip relative to the surface of the cushion. This procedure is repeated to a total of 3 times, and the mean value is presented together with the standard deviation.

Report output:

Sliding Resistance (N)
average of 3 (+/- standard deviation)

Higher Sliding Resistance => Improved Stability

2 Pressure Distribution

For users at risk of pressure ulcers, pressure distribution is an important consideration. The ideal pressure distribution, from a tissue integrity standpoint, spreads the pressures as evenly as possible over the largest possible surface area, to reduce the highest pressure values.

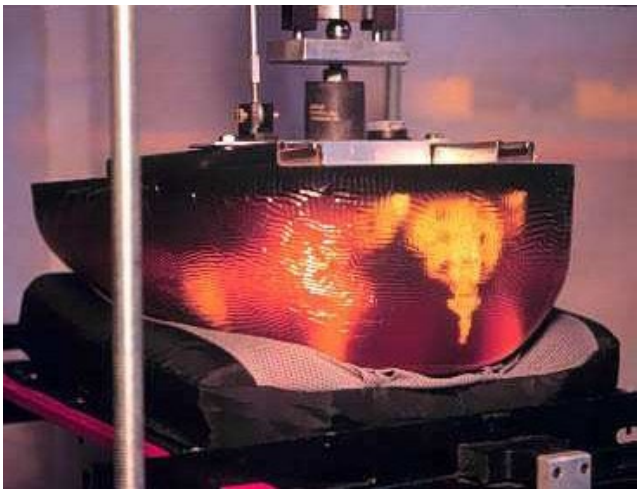


Figure 2a: Pressure distribution apparatus

The apparatus shown in figure 2a consists of a rigid pelvis embedded in a polymer gel material. The total pelvis is loaded to 50k on a standard horizontal rigid wheelchair seat. A pressure-mapping array (XSensor) is placed on the cushion, and the apparatus is loaded onto the cushion. The pressure mapping array flexible, which allows for mapping on deep-contoured cushions without being subject to excessive errors caused by tension in the substrate.

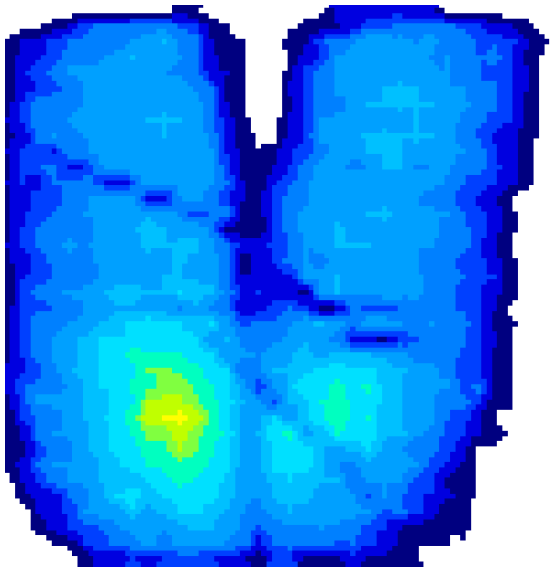


Figure 2b: Sample pressure map

For each pressure map (see figure 2b), 2 criteria are identified:

Peak Pressure

This represents the highest value of pressure encountered by any 2x2 square of pressure sensors within the map. High pressures have been positively associated with pressure ulcers.

Report output:

Peak Pressure (mmHg)
Average of 3 (+/- standard deviation)

Lower Peak Pressure => Improved Tissue Integrity

3 Skin Microclimate

The temperature and humidity of the microclimate immediately above a cushion are considered to have an important effect on tissue integrity of the sitter and are strongly influenced by the thermodynamic and moisture dissipating characteristics of the cushion. This method outlines the principles addressed in the simultaneous measurement of the heat and water vapour dissipating properties of wheelchair cushions under test conditions that simulate body loading on support surfaces with flat and contoured profiles.

The apparatus shown in figure 3 has the capacity to supply, measure and control an environment at a temperature and humidity comparable to that generated by the human body sitting on a seat cushion.

It comprises a perforated outer shell formed from 4mm +/- 1 mm polycarbonate sheet formed to a shape nominally representing a human bottom, as specified in DIS ISO 16840-Part 2. An inner reservoir tank is filled with spherical glass flow dispersers (marbles). A microporous water vapour permeable membrane (5l/24hour/m2) lines the inside of the outer shell. A capillary mat, shaped to conform, distributes moisture within the shell

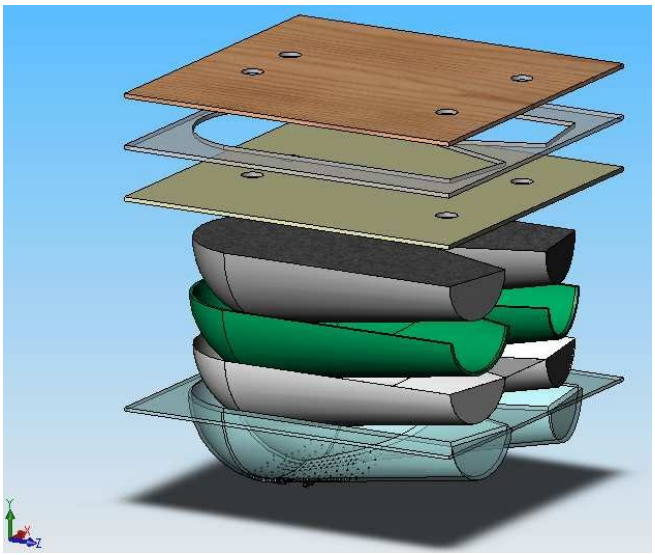


Figure 3a. Thermodynamic rigid cushion loading indentor (TRCLI). Component parts

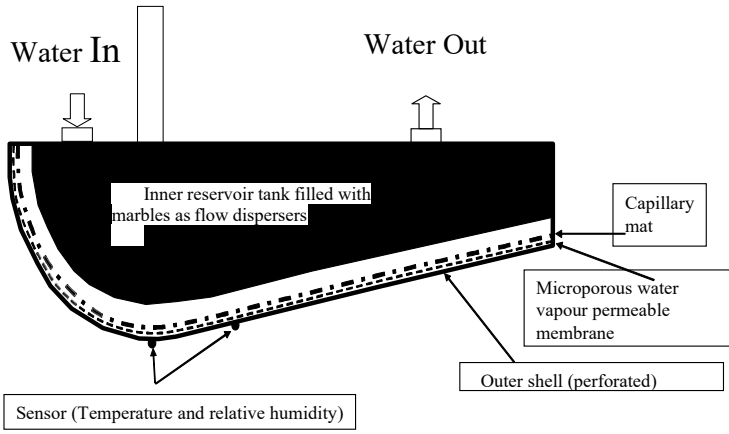


Figure 3b. Thermodynamic rigid cushion loading indentor (TRCLI). Assembled

Sensors to measure temperature and humidity at the interface are placed at the locations of the two ischial tuberosities and 2 proximal thighs (Figure 3).

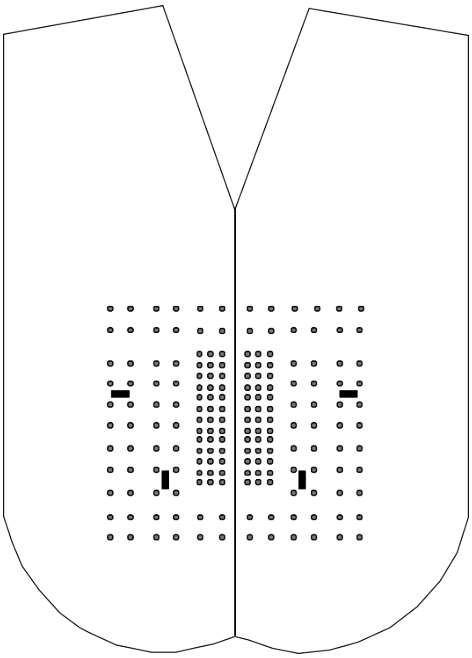


Figure 3. Location of sensors and perforations in outer shell

The apparatus is loaded onto the cushion, and interface parameters (temperature and humidity) are measured over time. Both values generally start low, as the cushion has been stored at room temperature and humidity, and then rise over time. It takes many hours to reach a stable condition. Average values for temperature and humidity after 1 hour at the 4 locations shown are calculated.

Report output:

Temperature after 1 hour (°C)

Lower Temperature => Improved Tissue Integrity

Report output:

Relative Humidity after 1 hour (%)

Lower Humidity => Improved Tissue Integrity

4 Loaded Contour

For many users, it is important for a cushion to envelop the bony shapes of the pelvis, without causing "bottoming" (total penetration through the cushion to the base beneath). It is important for the user to maintain a margin of safety in cushioning effect before an overload condition is experienced. Certain functional movements such as leaning and reaching effectively overload an

The apparatus shown in figure 4 consists of a pair of cylinders nominally representing ischial tuberosities, and a wider-set pair of smaller cylinders nominally representing greater trochanters. Tissue covering over these prominences is nominally represented by a strip of webbing material laid over the cylinders.

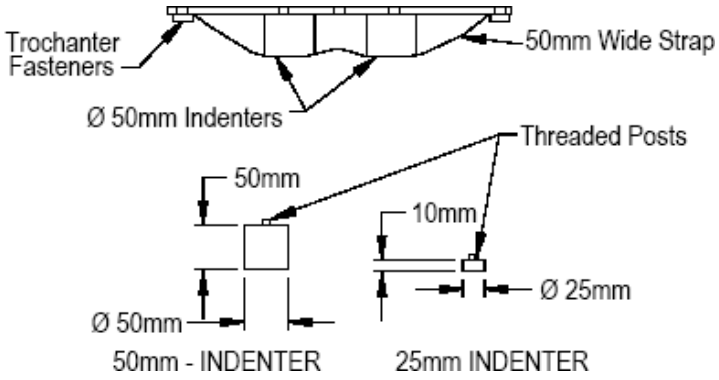


Figure 4 Loaded Contour apparatus

2 parameters are measured:

Contour Depth

The apparatus shown is applied to the cushion, and loaded to 135N. The depth of penetration into the cushion beyond the initial thickness of the cushion is measured. This takes into account the initial contour of the cushion to accommodate the pelvis, as well as the additional contouring due to loading.

Report output:

Contour Depth (mm)

Higher Contour Depth => Better Pelvis Envelopment

Overload Depth

The apparatus is further loaded to 180N, and the additional penetration into the cushion is recorded. This shows the cushion's ability to withstand over-load conditions. If a cushion has already overloaded at

135N, little additional penetration will be seen at 180N.

It should be noted that the indentor shape specified is a 2-dimensional cross-section of a pelvis, and therefore does not model the behaviour of a cushion when the whole surface is loaded. This means that the results of this test must be viewed with caution when considering air-filled or gel-filled cushions.

Report output:

Overload Depth (mm)

Higher Overload Depth => Better Overload Capacity

5 Weight

Many users remove the cushion from their wheelchairs during transport. This may be to allow folding of the wheelchair, for example. It is therefore more convenient for some to have a lightweight cushion.

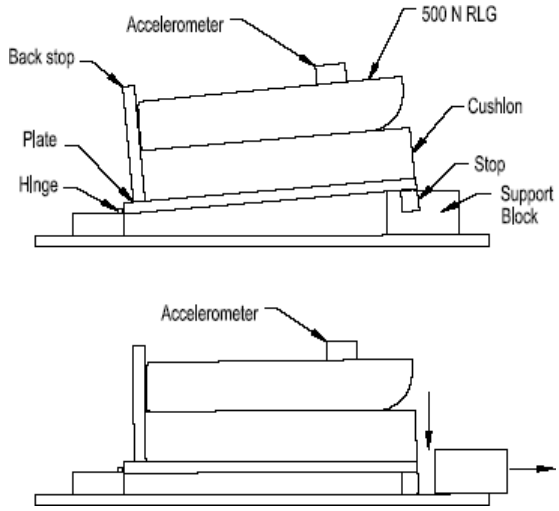
Report output:

Weight (kg)

Lighter Weight => Easier Lifting and Handling

6 Impact damping

Wheelchairs are used dynamically, and the cushion properties have a large influence on the smoothness of ride over rough terrain or going over kerbs. The apparatus shown in figure 6 consists of a rigid indenter, nominally representing a human bottom, and weighing 50 kg. The indenter is hinged at the back, and initially elevated 5°, to a height nominally representing a kerb. An accelerometer is attached to the top of the indenter, to record acceleration. A cushion is placed underneath the indenter. At a designated moment, the support block holding up the indenter is retracted, allowing the indenter to fall onto the cushion.



The accelerometer records the g-forces during free fall, and subsequent impact with the cushion. 3 parameters are reported:

Number of rebounds

A trace of acceleration against time is examined to determine how many times the indenter bounced on the surface of the cushion before coming to rest. A rebound must exceed 10% of the initial rebound to qualify.

Report output:

Number of Rebounds

Lower Number => More Energy Absorption

Maximum impact

The trace is examined to determine the maximum impact when the indentor hit the cushion

Report output:

Maximum Impact

Lower Impact => Smoother Ride

Rebound Percentage

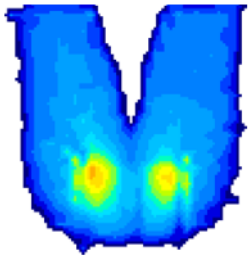
The trace is examined to determine the ratio of the second rebound to the first rebound, expressed as a percentage.

Report output:

Rebound %

Lower % => More Energy Absorption

NEST Cushion - 1



Description

NEST is Polyester based Thermoplastic Elastomer

Horizontal Stability

Horizontal Stiffness *(N)*	**101 +/-9**
Sliding Resistance *(N)*	**455+/-11**

Supplier

Meditec Ltd

Pressure Distribution

Peak Pressure (mmHg)	**102** +/-5
Contact Area (cm^2)	**1266**+/-8

Skin Microclimate

Temperature (1 hr) *°C*	**26**
Humidity (1 hr) *%RH*	**32**

Loaded Contour

Contour Depth (mm)	**45**
Overload Depth (mm)	**10**

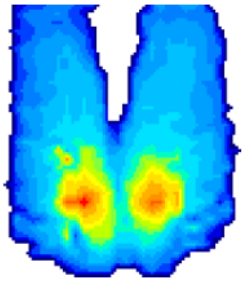
Weight

Weight (kg)	**0.8**

Impact Damping

Number of Rebounds	**1**
Peak rebound *(g)*	**1.1** +/- 0.1
Rebound %	**15** +/-2

HR70 Standard Foam Reference - 2



Description

Reference standard block of foam as specified by SADMERC protocols for wheelchair cushion evaluation. 100mm thick high resilience foam, 75 kgm^{-3} density.

Horizontal Stability

Horizontal Stiffness *(N)*	**139 +/- 12**
Sliding Resistance *(N)*	**189 +/-14**

Supplier

REFERENCE STANDARD

Pressure Distribution

Peak Pressure (mmHg)	**220** +/-8
Contact Area (cm^2)	**1240**+/-14

Skin Microclimate

Temperature (1 hr) *°C*	**35**
Humidity (1 hr) *%RH*	**54**

Loaded Contour

Contour Depth (mm)	**40**
Overload Depth (mm)	**8**

Weight

Weight (kg)	**1**

Impact Damping

Number of Rebounds	**4**
Peak rebound *(g)*	**1.7** +/- 0.3
Rebound %	**58** +/- 2

Evaluation of NEST® Mattress in the Regional Hospital, Mullingar

The Regional Hospital, Mullingar, is part of the Ireland East Hospital Group which is in academic partnership with University College Dublin (UCD).

Introduction

Pressure ulcers are a recognized indicator of the quality of health care and are preventable in most instances[1]. They are known to cause pain, wound chronicity, infection and even death. Pressure ulcer incidence in Ireland ranges from 8% to 14.4% depending on the patient group. It costs approx. €119,000 to successfully treat one patient with a grade 4 pressure ulcer. From this figure it is extrapolated that it would cost €250 million per annum to manage pressure ulcers across all care settings in Ireland[2]. Shockingly the development of pressure ulcers has been associated with a 4.5-times greater risk of death than that for persons with the same risk factors but without pressure ulcers[3]. The 2015 HSE special report on Serious Reportable Events stated that 19% of the reported care management events related to pressure ulcers acquired after admission to a healthcare facility and in three cases it was confirmed that a person had died.

The Nest® Mattress

The NEST® mattress is not a foam mattress. It is made from a polyester based thermoplastic elastomer. Due to its random 3D spring structure, it has excellent load dispersion characteristics delivering exceptional internal and external pressure distribution. This provides proven pressure relief for external pressure at skin level (interface pressures) and, more importantly, at the inner muscle level.

The Nest® Mattress inhibits the growth of harmful bacteria and its innovative structure creates a low temperature and low humidity environment.

The Nest® Mattress can be thermally disinfected and is 100% recyclable. This is important as it is now recognised that there is an environmental impact of the disposal of soiled medical foam mattresses and cushions because most of these products are dumped in landfill. Polyurethane foam that ends up in landfill only starts to decompose after 15 years and takes over 100 years to fully decompose. It is estimated that approx. 6,000 mattresses are sent to landfill each year. The solution is a mattress/cushion that can be easily cleaned and effectively decontaminated for re-use and, at the end of its suitability for use, can be fully recycled with no need for sending to landfill. The polyester elastomer composition of Nest® can be completely shredded (Wellman International, Co. Cavan) and used in the manufacture of other products.

Evaluation Background

The objective of the evaluation was to assess the positive impact on patient outcomes and potential cost savings. Evaluation of Nest® Mattress commenced on November 1st, 2020 and continued for 8 months. 8 Nest mattresses were evaluated on the chosen ward which is a busy medical ward.

Areas of evaluation included ease of patient mobility, micro-climate, maintenance of skin integrity and ease of use for nurses.

42 patients in a busy Medical ward were included in the evaluation with an average age of 72 years with ten patients over 80 years. The average length of stay was nine days.

At commencement of evaluation, two patients were assessed to be dependent on assistance; eleven patients required minimal assistance and eight patients were totally independent.

Evaluation Results

Patient Self Repositioning – sixteen patients were able to self-reposition while on Nest® mattress. Three patients who previously required assistance to reposition were able to self-reposition. In cases where assistance was required, staff commented that it was 'easy to reposition patient' with 'no dipping in the mattress'.

Skin Micro-Climate – all patients commented that the Nest® mattress was cool to lie on and very comfortable. Comments included "no over-heating", "no night sweating", "very cool to sleep in". Four patients with previous experience of hospital foam mattresses, commented that the Nest® mattress was cooler and more comfortable than previous mattresses.

Skin Integrity – skin integrity, as assessed at commencement of evaluation, was maintained in all patients.

Mattress Ease of Use – all nurses involved in the removal of the Nest® mattress from bed frames rated it 'easy to move'.

Cost Savings

Over the course of the evaluation, the Nest mattress decreased the wards requirement to rent dynamic air mattresses by 18%

In addition, reduction in logistics, storage, moving and handling infection transmission and nursing time are declined through this climate smart innovative static mattress.

Conclusion

All patients evaluated the Nest® mattress as cool and comfortable and allowed them to move easily or more easily than on previous mattresses.

All nurses evaluated that the Nest® mattress was light to move and allowed easy handling.

Patient skin integrity was maintained in all patients.

1. Gallant C, Morin D, St-Germain D, Dallaire D. Prevention and treatment of pressure ulcers in a university hospital centre: a correlational study examining nurses' knowledge and best practice. Int J Nurs Pract. 2010;16(2):183-187.

2. G Gethin, J Jordan-O'Brien, Z Moore Estimating costs of pressure area management based on a survey of ulcer care in one Irish hospital J Wound Care 2005 Apr;14(4):162-5.

3. Staas, Pressure sores--a multifaceted approach to prevention and treatment. Staas et al. West J Med 1991

An Evaluation of The Nest® Mattress: A New Generation of Mattress Technology at Tallaght University Hospital

Introduction

Pressure ulcers represent a major burden to patients, carers, and the healthcare system. They impact greatly on an individual's functional status and health-related quality of life. The mainstay of pressure ulcer prevention practice is the provision of pressure redistribution support surfaces, patient repositioning and managing patients identified as having coexisting risk factors. All hospital beds are fitted with standard foam mattresses and following clinical assessment by nursing staff, mattresses are upgraded to alternating air mattresses via the current rental contract in place in Tallaght University Hospital (TUH).

The Nest® Mattress

Prior to the trial, as staff were not familiar with the Nest® mattress, Meditec Medical provided education in relation to the science behind the technology of the mattress including the pressure redistribution properties, the improvement in blood flow circulation, the anti-microbial properties and the unique structure of the mattress, which inhibits the growth of harmful bacteria, reducing the risk of healthcare-associated infections.

Their presentation included the following key points:

- The Nest® mattress is a new generation of mattress technology providing pressure relief through pressure distribution.
- The Nest® material is made of a polyester based thermoplastic elastomer compared to standard polyurethane foam.
- The Nest® mattress disperses the load away from the patient in all different directions through the interlocking 3D Spring Structure of the material. This reduces the external pressure (skin interface) and more importantly the internal pressure (deep tissue stresses) that cause the majority of pressure injuries.
- The Nest® mattress has anti-microbial properties and unique structures which inhibit the growth of harmful bacteria, reducing the risk of healthcare associated infections.
- Both the cover and the material can withstand extremely high temperatures, which makes it suitable for various disinfecting processes such as submersion, industrial machine-washing, pressure washing and vapour disinfection.

Crampton Ward was selected by the TUH Senior Management Team to trial and evaluate the Nest® mattress. Areas of evaluation included the pressure relieving properties of the mattress, the microclimate, and the compatibility of the mattress with infection prevention and control measures in reducing the risk of healthcare-associated infections.

Crampton is a very busy general adult medical ward with patients presenting with acute medical conditions and many coexisting morbidities. During the trial period, between early March 2020 to mid-May 2020, Meditec Medical replaced twelve of our standard foam mattresses with twelve Nest® mattresses.

Findings

Our evaluation is based on our experience of thirty-four patients who were nursed on the Nest® mattress. The patients age group ranged between 30 and 90 years of age, presenting with acute medical conditions, which placed this

cohort of patients in the higher risk categories for pressure ulcer development.

Pressure Relief and improved blood circulation

The mattress provided excellent pressure relief at skin level. We observed patients did not sink into the mattress and the spring like properties of the Nest® material facilitated ease of movement for the patient when turning themselves and when getting in and out of bed. This ease of movement for the patients confirmed what the literature suggested-that the rebound properties of the Nest® material would enable the patient to turn more easily which would improve better blood flow circulation in the capillaries allowing greater blood profusion .This meant that some patients did not need to be repositioned as frequently by the nursing staff/healthcare assistants, thus reducing the need for turning patients during the busy COVID 19 period.

Regular skin assessment confirmed that no patients showed any evidence of redness or tissue damage whilst on the Nest® mattress

As we became more confident in the technology behind the Nest® mattress and the positive clinical evidence of the mattress redistributing the patients' weight, good skin integrity being maintained and the patients moving more freely, we tried the Nest® mattress for some patients in the higher risk category. Additional and careful monitoring of the patients' skin showed no deterioration in skin integrity. One patient who was noted to have persistent redness of intact skin on the foam mattress showed continuous improvement when placed on the Nest® mattress throughout the trial period. This proved very reassuring for the nurses and they gained greater trust in the Nest® as a mattress support surface for redistributing patients' weight and assisting with the overall plan of care in pressure ulcer prevention and management.

Positive Microclimate

Patients often complain that their foam mattress becomes uncomfortably warm, with evidence showing a build-up of moisture on the mattress cover. The Nest® mattress is 90% air, which creates excellent breathability throughout the material and the patients found the mattress cool and comfortable with no evidence of any build-up of moisture on the mattress cover. From an infection prevention and control perspective, greater breathability in both the mattress cover and the nest material itself will inhibit bacterial growth and prevent the formation of mould inside the mattress as is often seen during foam mattress audits. The fact that the Nest® material will not harbour bacteria was a very important feature
for us, especially when strikethrough on a mattress cover is observed during audits.

Infection Prevention and Control

The manufacturer's instructions for cleaning the Nest® mattress cover was compatible with TUH Infection Prevention and Control guidelines. In the event of a foam mattress being contaminated our protocol is that the mattress must be decommissioned, disposed of and replaced at a high cost to the hospital. The material in the Nest® mattress allows for complete cleaning and disinfection by industrial machine washing, pressure washing, and vapour disinfectant thereby eliminating the need to decommission, dispose of and replace contaminated mattresses.

Auditing of Mattresses

Worn or damaged covers can allow bodily fluids inside a mattress, posing a risk of infection to patients who may come into contact with a contaminated mattress. Routine auditing of mattresses is carried out in TUH in the prevention of healthcare-associated infections.

The lightweight feature of the Nest® mattress facilitated easy inspection (inside and outside) of

both the cover and the Nest® material. Unlike during the inspection of foam mattresses, auditors and nurses could easily and confidently examine the entire mattress inside and outside for evidence of contamination. Normally two persons were needed to remove a mattress for auditing purposes but the lightweight material of the Nest®, which is 25% lighter than foam, enabled one person to remove the mattress. Each mattress is checked every Sunday on Crampton Ward.

Cost savings

During the trial period we would have normally ordered some additional rental alternating air mattresses for patients in the higher risk group. Instead, during this trial, we made clinical decisions following skin and patient assessments to nurse some of these patients on the Nest® mattress. The patients' skin was monitored closely, and positive patient clinical outcomes were recorded, with no skin deterioration. This resulted in significant savings in the reduction of the cost of rental mattresses for higher risk patients.

Secondly, the material in the Nest® mattress allows for complete decontamination of the mattress in the event of contamination with bodily fluids of patients with viral, bacterial, and fungal pathogens. Meditec Medical can arrange for complete decontamination of the entire Nest® mattress and have them returned to the hospital. The cost of decontamination of a mattress versus the cost of replacing the mattress (inclusive of incinerating costs or land fill costs) has substantial cost savings for TUH.

Conclusion

Patients' skin condition was excellent throughout the evaluation period and no evidence of any tissue damage or deterioration in the thirty-four-patients nursed on the Nest® mattress was observed.

The mattress was compatible with CPR protocol and the delivery of nursing care at the bedside. The lightweight material of the mattress was a positive feature from bed making and from a manual handing perspective. Patients were moving more frequently and independently themselves with greater ease getting in and out of bed. The mattress remained cool and comfortable for the patients with no evidence of pooling of moisture. Cleaning of the mattress was compatible with infection prevention control guidelines and the added feature of the Nest® material, which is capable of being fully disinfected and decontaminated if needed, was a major bonus in reducing the risk of healthcare associated infections caused by viral, bacterial, and fungal pathogens. The Nest® mattress has potential cost savings for the hospital by reducing the cost of the rental of air alternating mattresses and eliminating the need to replace and dispose of contaminated foam mattresses. The Nest® mattress is eco-friendly and 100% recyclable in line with EU directives. Excellent education and training were given to all staff prior to this trial. Meditec`s team was very supportive throughout the trial.

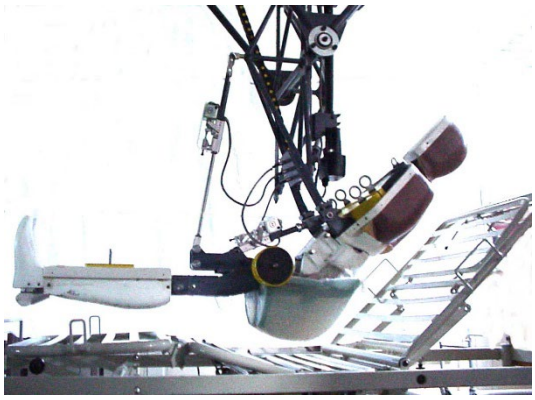
Kathy Doyle A/CNM2
Crampton Ward - Tallaght University Hospital
Date: June 2020

Evaluation of NEST covered mattress – Duncan Bain 2019

Introduction

The purpose of this report is to examine the effects on mattress performance when a layer of NEST material is bonded to the top surface of the mattress. Performance for the purpose of this report is defined and measured as follows:

1) **Pressure distributive properties**



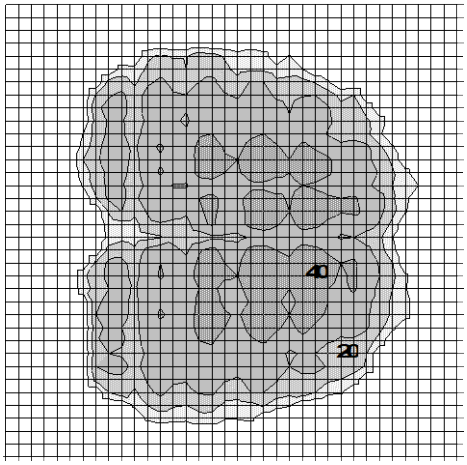
UCL Phantom

These are assessed using the UCL Phantom (developed by the RAFT Institute), a full technical description of which is published in the scientific literature. This is a life-sized articulated dummy with soft tissues, and bony prominences within. The Phantom has an automated positioning system, which places it in exactly the same way on every mattress. Pressure measurements are made using a highly flexible pressure-mapping array, to locate the peak pressures (which occur in different anatomical regions on different mattresses).

The surface of the Phantom is warmed to 35 °C using special heated and temperature-controlled skin.

Tests are performed with the mattress on a 4-section profiling bed in standard position according to EPUAP draft guidelines, with the backrest inclined to 45°, the gatch section elevated to 20°, and made up with a loose sheet. The phantom is lowered onto the mattress in standard 45° rigid attitude, and then the hip and knee joints are released.

The phantom is left to dwell for 10 minutes on the mattress, to allow for initial stabilisation of the mattress.



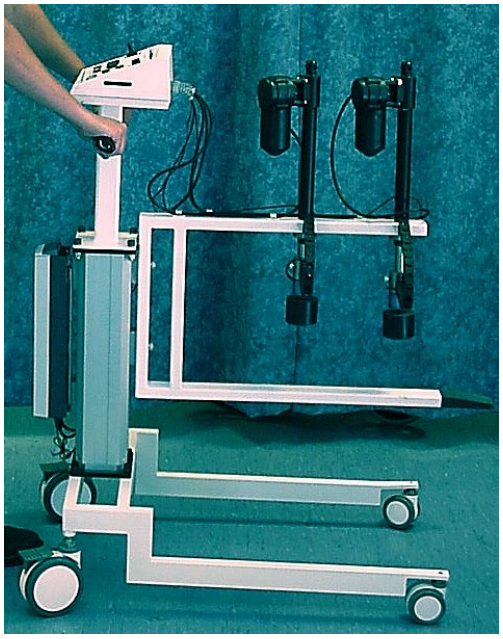
Multiple measurements are made, to obtain confidence intervals for the peak pressures in the pelvic and heel regions. Low peak interface pressure is deemed to be the most valid measure of pressure reducing properties according to current evidence at the time of publication

Report Outputs:

- **Peak Interface pressure Pelvic area (95% confidence limits) (mmHg)**
- **Peak Interface pressure Heels (95% confidence limits) (mmHg)**
- **Pressure map (10mmHg Isobars)**

2) Fatigue Longevity

Mattresses are known to have a finite life-span. Their pressure-distributive properties degrade substantially over a period of years. Significant changes in these properties, if left undetected, may lead to increased risk of pressure ulcers.



Quince 2

Examination of the actual fatigue life of mattresses in service is impractical for the purposes of this protocol.

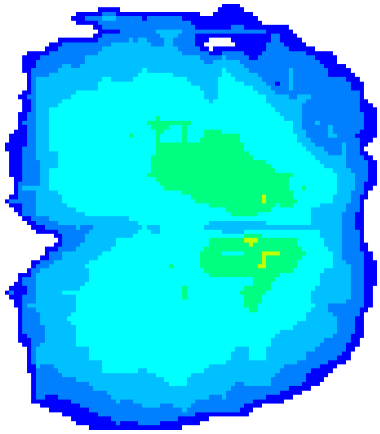
A representative sample of mattresses would have to be monitored in service for several years, by which time the sample would no longer be representative of the mattresses on the market. In the interests of currency, the preferred approach is to subject mattresses to an accelerated, artificial fatigue cycle.

Products undergo 100,000 repetitive indentations using a cylindrical indentor of 80mm diameter. Force-indentation tests using a Quince 2 mattress audit device (having a matching 80mm cylindrical indentor) quantify changes in mattress properties relative to the starting point. A high percentage indicates a large change in indentation properties after fatigue.

This measure cannot be directly extrapolated to give an estimate of the service life of the mattress, since the fatigue conditions are artificial, and not accurately representative of the fatigue of a mattress in use. It does however allow indicative comparisons to be made between mattresses.

Report Outputs:

- **%Change in Quince2 bottoming force after 100,000 indentations**



Pressure Map (10mmHg Isobars)

Technical Data

Peak Interface Pressure (pelvis)	**64**	+/-5	mmHg
Peak Interface pressure (heels)	**70**	+/-8	mmHg
Longevity (% reduction Quince after 10^5 cycles)	**7**	%	

*Information provided by manufacturer

Other Comments

Zip access on 3 sides, with welded seams. Turning schedule and cleaning instructions printed on cover.

Evaluation

This report adheres to a standard protocol for evaluation of static mattresses, as described in the attached document “Protocol for the Evaluation of Static Mattresses”.

[1] Bain DS, Nicholson N, Scales JT. A Phantom for the Assessment of Patient Support Systems. Journal of Medical Engineering and Physics. 21 (1999).293-301

[1] Bain D, Ferguson-Pell M, McLeod A. Evaluation of mattresses using interface pressure mapping. Journal of Wound Care Vol 12, No. 6, June (2003) 231-235.

[1] Bain DS Ferguson-Pell MW Davies PJ In-service mattress testing of hospital mattresses using the Quince mattress tester. J. Tissue Viability 11,4 October, 161-165,

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