LINET

ENHANCED FEATURES OF THE SPRINT 200 STRETCHER THAT SUPPORT THE PREVENTION OF PRESSURE INJURIES

BACKGROUND

Pressure injury (PI) prevention is a topic of concern within the health care industry. Almost 6,000 studies have been conducted so far and 33% of those were published in the past 5 years*. The increased number of studies in recent years confirms that Pressure Injuries (PI's) are still a burden to society with mixed outcomes. Hospital Acquired Pressure Injuries (HAPI's) continue to be a focus for health care because of the number and severity. HAPI's may be seen as an indicator of the quality of care provided by a health care institution. For this reason, the focus of research has shifted to prevention efforts over treatment. Prevention of PI's is dependent on available resources, including facility budget and the number of available caregivers. For example, Padula demonstrated how much more physically demanding and time consuming it is for caregivers to care for patients with HAPI (Padula WV, 2019).

Considering this knowledge, LINET integrated features into the Sprint 200 for better pressure distribution to overcome the challenges faced by healthcare professionals (HCP) in Emergency Departments. The first feature is several or multiple support surface options according to patient complexity and mobility. Support surfaces help with pressure distribution and reduce peak pressure on the patient's body. The second innovative solution is called the Ergoframe. The Ergoframe is a kinematic system for mattress support platform adjustments which decreases the pressure on the patient's abdomen and pelvic area, as well as frictional forces on the patient's body.

CONCLUSION

The Sprint 200 stretcher brings the Ergoframe and different mattress options to critical care and one-day care, like the ED. The diversity of mattresses available allows HCPs to select the best mattress according to individual patient needs. From a pressure redistribution point of view, the Advanced and Reactive mattresses are recommended for patients with complex PI needs, while the Advanced mattress has great pressure redistribution and is most suitable for mobile patients. The Reactive mattress is built from air and foam cells under the back and buttock area which react to changing load. The air and foam cells help to maintain equal pressure redistribution and minimize peak pressures in the pelvic area. In conclusion, the Reactive mattress can be recommended for partly mobile patients.

We can conclude that the innovative technology of the Ergoframe has a clear impact on reducing pressure in the pelvic area and it also reduces migration of the patient independent of the patient's position.

From the results of Ergoframe testing, the average pressure is reduced by 16% in the seating area. The results of testing patient migration in various positions showed a reduced migration of up to 50%. The reduction in patient migration reduces the friction and shear forces applied to the most at-risk body contact points.

Finally, the Sprint 200 was developed as a support tool for improving the care provided by nurses and other HCPs daily. All things considered, hospital staff should continue to follow local guidelines for the prevention of PIs, including the EPUAP/NPIAP Guidelines.

* Studies researched at PubMed library until 05/2022 with the keywords: pressure injury(ies), pressure ulcer(s), decubitus ulcer(s) and bedsore(s).

The Prevalence of Pressure Injuries in Emergency

Of all the HAPI studies, only a few studies are dedicated to PI in the Emergency Department (ED) and the prevalence and incidence of HAPI data is limited. This lack of data is exacerbated by inconsistent hospital adverse event reporting systems, which often do not report specific HAPI rates for the ED (Santamaria N, 2019). Despite these inconsistencies, interest regarding HAPI in the ED has grown over the last few years. Patients can develop a PI within a few hours of entering an ED. However, despite the critical role of ED's in reducing the incidence of PI, few ED's have protocols in place to prevent PI's (Stanberry B, 2021). The fact is that 26.5% of patients spend more than 4 hours on a stretcher because of longer wait times (Al Nhdi N, 2021). Long stays on a stretcher can be a fundamental problem for patients who are at high-risk of PI because they can develop PI within tens of minutes of immobility (Gefen A, 2022).

26.5% of patients stay
in emergency departments longer than 4 hours
(Al Nhdi N, 2021)

Support Surfaces for Emergency department

According to the EPUAP/NPIAP Clinical Practice Guideline, support surfaces are an important part of PI prevention and treatment, but by themselves they are not able to eliminate the risk completely. Patients should be repositioned regardless of the type of pressure redistribution support surface being used. Part of PI prevention is the education of patients and families to off-load and reposition as much as possible when spending lengthy periods of time being immobile on any support surface (EPUAP/NPIAP, 2019).

There are four support options available for the Sprint 200 stretcher. These options are intended for use in the ED, during transport and in the short-stay environment. The EPUAP/NPIAP recommends using a pressure redistribution support surface for patients at risk of developing PIs during transport (EPUAP/NPIAP, 2019).

Patient at risk of PI
should be transported on a pressure redistributing support surface.
(EPUAP/NPIAP, 2019)

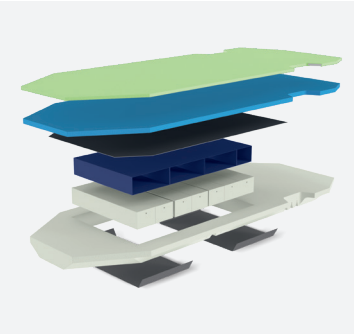
Support Surface Selection

According the latest EPUAP/NPIAP/PPPIA Clinical Guidelines from 2019, the support surface should be selected according to the patient's needs based on the following factors:

1. Level of immobility and inactivity
2. Need to influence microclimate and shear reduction
3. Size and weight of the patient
4. Number, severity, and location of existing PIs
5. Risk of developing new PI's

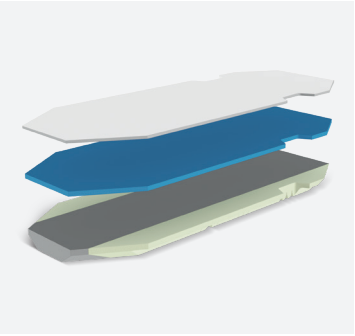
Mattresses options for hospital stretcher Sprint 200

Reactive



— Reactive mattress redistributes pressure equally under the back and pelvic area in every position.
— For patients at risk of pressure injuries.
— Viscoelastic foam layer.
— 13 cm mattress with air cells in the back and seat area.

Advanced



— Advanced mattress provides comfort and pressure redistribution.
— For patients at risk of pressure injuries.
— Viscoelastic foam layer.
— 13 cm 4-layer mattress.

Comfort

— Comfort mattress.
— For patients with low risk of pressure injuries.
— Viscoelastic foam layer.
— 13 cm 2-layer mattress.

Standard

— Basic mattress.
— 10 and 13 cm 1-layer mattress.

Pressure Redistribution in Sprint 200 Mattresses

Support surfaces are defined by EPUAP/NPIAP/PPPIA as: “specialized devices for pressure redistribution designed for management of tissue loads, microclimate, and/or other therapeutic function (i.e., any mattress, integrated bed system, mattress replacement, overlay, or seat cushion, or seat cushion overlay)” (EPUAP/NPIAP, 2019). LINET tested the pressure redistribution properties of the support surfaces with pressure mapping. Subjects were tested in the supine position and with the head of the bed (HOB) elevated in two positions.

All four options of the support surface were pressure mapped. For each mattress, the average pressure was calculated as well as the peak pressure was reported.

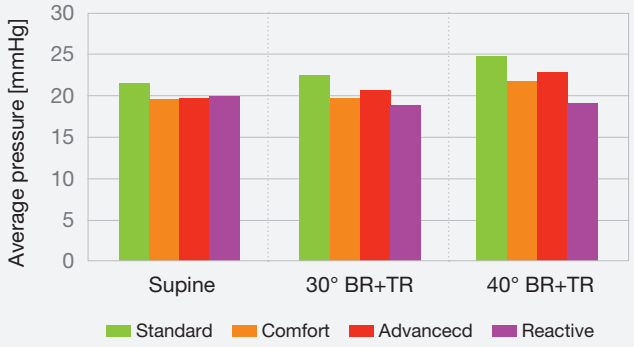
Testing Conditions

Subjects:	Healthy 82.5 kg adult
Positions:	Supine
	30° backrest (BR) + elevated thigh rest (TR)
	40° backrest (BR)+ elevated thigh rest (TR)
Stretcher:	Sprint 200
Mattress:	Standard, Comfort, Advanced, Reactive
Measuring time:	20 minutes in supine, 10 minutes in semi-sitting positions

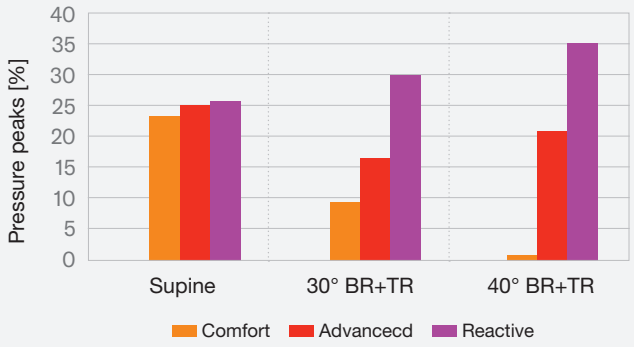
Results

The average pressure of all mattresses are visualized in Graph 1. The Reactive mattress has the highest redistribution, performing equally in the the supine and semi-sitting positions. The Reactive mattress also has the lowest peak pressures compared to the Standard mattress. The results of the Comfort and Advanced mattresses are similar to each other (Graph 1) while the Advanced mattress has a greater reduction of peak pressures compared to a Standard mattress (Graph 2).

GRAPH 1 | Comparison of average pressures for each mattress



GRAPH 2 | % Reduction of peak pressure in comparison with Standard mattress



Summary

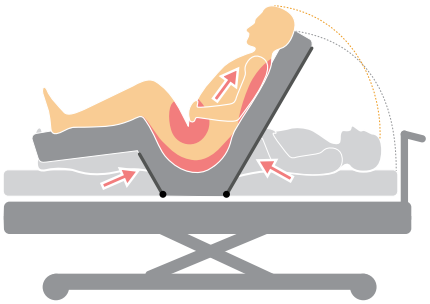
In summary, all Sprint 200 mattresses can be used for pressure redistribution of tissue loads, as they all achieved an average pressure below 25 mm Hg. The main difference between the mattresses are the peak pressures and these are dependent on the patient's position. The Comfort, Advanced, and Reactive mattresses have better results than the Standard mattress. The Advanced and Reactive mattresses achieved good redistribution features for patients in a semi-sitting position. Of these four mattresses, the Reactive mattress achieved the lowest average pressure and peak pressure.

Based on the results, LINET created recommendations for each mattress based on the risk of developing PI and the mobility of the patient. However, these recommendations do not replace the best clinical practice and nursing care, which is necessary for PI prevention.

The pressure map testing conducted by LINET provides information about pressure redistribution and supports the evidence of the EPUAP/NPIAP/PPPIA Guidelines. This whitepaper can help you select a mattress according to the needs of your patient and support your hospital's HAPI prevention protocols during long stays of patients in the ED.

The Impact of the Ergoframe on Patient Care

Elevating the backrest from 30° to 45° (Fowler's position) is not a new practice in nursing and is used worldwide, the purpose of which is to of promote lung expansion and to provide greater comfort to the patient, especially when eating (Perry AG, 2006). However, even though this position is the most clinically recommended or tolerated by the patient, there are still negative effects that can occur from it. In this position, the friction and shear forces are increased on the upper body with the back rest elevated. The diagram illustrates the increased pressures on the pelvic area, buttocks and abdomen. Larger patients in particular can feel "squeezed" in the abdominal area with the back rest elevated.

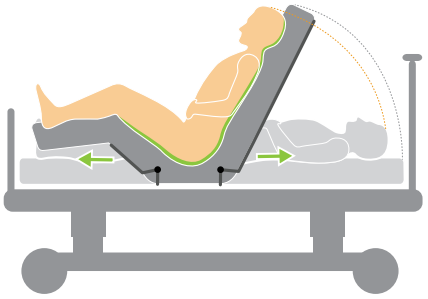


Patients who cannot mobilize themselves (because of pain, sensory perception, or reduced mobility) are at high risk of developing a PI. The longer a patient is immobile, the bigger the risk of developing a PI (Gefen A, 2022). The most frequently affected areas are the scapula and sacrum when the backrest is elevated from 30° to 45°. These sites tend to develop PI's more quickly, as these areas are composed of less fat and muscle (Kim SY, 2021).

The scapula and sacrum
are the most affected areas in the Fowler position
(Kim SY, 2021)

The Ergoframe Design

The Ergoframe was designed to redistribute pressure on the buttocks by creating a wider area for the pelvis and, at the same time, creating more space for the abdomen during patient positioning. LINET's Ergoframe technology has been tested in the ICU and acute care setting with good outcomes.



Evaluation of Pressure Distribution of the Ergoframe

To support the effects of the Ergoframe on a patient, LINET performed pressure mapping measurements on the Sprint 200 in comparison to a stretcher with the standard mattress.

Testing Conditions

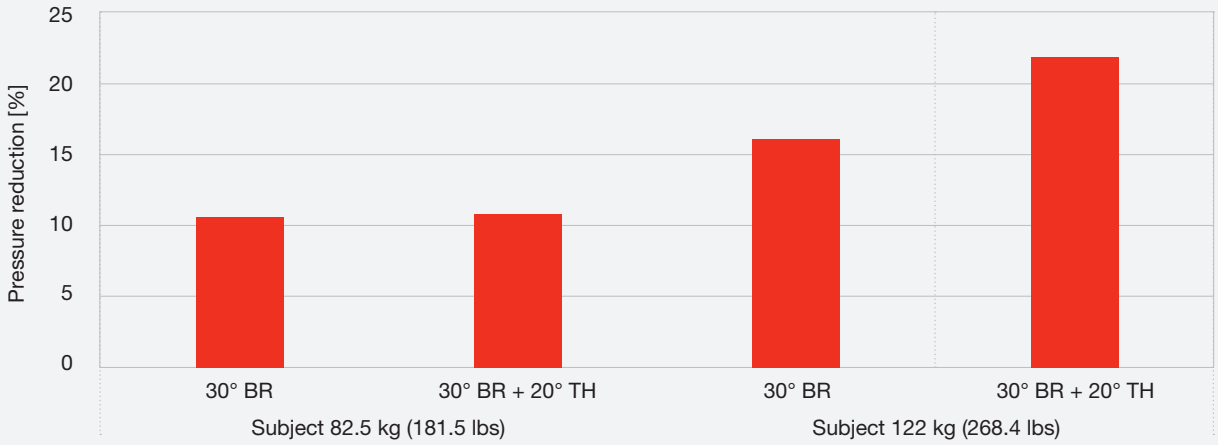
Subjects:	2 healthy adults 82.5 kg (181.5 lbs) and 122 kg (268.4 lbs)
Positions:	Elevated backrest (BR) to 30° with and without thighrest (TH) to 20°
Stretchers:	Stretcher with standard mattress platform (SSMP) and Sprint 200 with Ergoframe (S200)
Mattress:	Standard mattress
Measuring time:	5 minutes

Results

16 % lower average pressure
on the pelvic area with the Ergoframe
(Testing by LINET Lab)

To evaluate the effect of the Ergoframe, the average pressure was calculated from the seating area for both stretchers (Graph 4). Table 3 shows a snapshot of the pressure mapping. The pressure mapping images demonstrate a clear difference between the stretcher with standard mattress platform (SSMP) and the Sprint 200 in the seating area. The SSMP has higher pressure peaks compared to the Sprint 200 with the Ergoframe. In conclusion, the Sprint 200 with Ergoframe reduced the average pressure on the seating area by 16 % compared to the SSMP for both subjects.

GRAPH 3 | % pressure reduction for Ergoframe of S200 in comparison with SSMP



Reduction in Patient Migration During Positioning on the Sprint 200

Another benefit of the Ergoframe during patient repositioning is a decrease of migration of the patient on the stretcher. During positioning, the patient can slide down the stretcher and their feet may hang over the edges of the mattress/stretcher. In that moment, the heels can touch the metal parts of the stretcher and increase the risk of developing a PI (Hermans MH, 2015). The opposite situation occurs with specialized stretchers which, by lowering the seat platform, cause the patient to move upwards during positioning. In this case, the patient's head can reach the end of the backrest if the patient is tall. Patients who migrate during manipulation with a backrest are affected by friction and shear forces. Caregivers are affected by the need to reposition the patient multiple times as part of PI prevention. Repositioning a patient is considered a task with a high risk of musculoskeletal injury to the caregiver (Bartnik LM, 2013).

Testing Conditions

Subjects:	2 healthy people with heights of 164 cm (5 ft 4.6 in) and 184 cm (6 ft 0.5 in)
Positions:	Supine to 30° and 60° backrest (BR) and back
Stretchers:	• Stretcher with standard mattress platform • Sprint 200 with Ergoframe • Stretcher with lowering seat platform
Mattress:	Standard mattress
Measured body points:	Ear, shoulder, hip, knee, heels

The distances were measured between body points/markers on the subject and markers on the mattress from supine to 30°/60° of the backrest. From 30°/60° to supine, the distances between the markers were insignificant, and for that reason they were excluded from the results. We tested the most commonly used stretchers in hospitals for comparison with the Sprint 200 with the Ergoframe.

Results

During testing we found that patient body points/markers can migrate up to 14 cm. The shorter subject migrated on average 5 cm further than the taller subject. The parts of the body most affected by migration were the upper body and the heels. The contact points at risk of PI, i.e., occiput, scapula, sacrum, and heels (Perry AG, 2006), are most affected by friction forces when elevating the backrest. The Sprint 200 with the Ergoframe can reduce patient migration by up to 50% in comparison with the other stretchers (Table 2).

The Ergoframe feature reduces patient migration by up to 50% during positioning on the Sprint 200

(Testing by LINET Lab)

TABLE 3 | Comparison of maximum distances of markers during positioning of subjects

Height of the subject	Backrest position	**Sprint 200 with Ergoframe**	**Stretcher with standard mattress platform**	**Stretcher with lowering seat platform**
184 cm (6 ft 0.5 in)	30°	0.4 cm (0.15 in)	3.5 cm (1.38 in)	0.5 cm (0.2 in)
	60°	1.0 cm (0.39 in)	5.5 cm (2.17 in)	3.0 cm (1.18 in)
164 cm (5 ft 4.6 in)	30°	3.5 cm (1.38 in)	3.5 cm (1.38 in)	7.0 cm (2.76 in)
	60°	7.0 cm (2.76 in)	8.0 cm (3.15 in)	14.0 cm (5.51 in)

(Minimal distance is highlighted in green)

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