LINET

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

BACKGROUND

Pressure injury prevention is generally one of the main focuses within the HealthCare Industry. Almost 6,000 studies dedicated to pressure injuries have been developed so far and 33% of those in the past 5 years*. The large increase in studies in recent years confirms that pressure injuries are still a highly discussed topic with a lot of uncertainties. Hospital Acquired Pressure Injuries (HAPI) are in the spotlight of a high number of studies, because the number and severity of HAPI are an indicator of the quality provided by a health care institution. For this reason, a lot of studies were created for the evaluation of whether prevention is more effective than treatment of HAPI. Effectiveness is related to hospital budget, patient improvement, and the care provided by caregivers. For example, the Padula study 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, we integrated features into the Sprint 200 for better pressure distribution to overcome the challenges faced by Health Care Professionals in Emergency Departments. The first feature is 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 of mattress support platform adjustment 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 and one-day care.

The diversity of mattresses available allows health care professionals (HCP) to select the best mattress according to individual patient needs. From a pressure distribution point of view, the Advanced and Reactive mattresses can be recommended for patients with complex pressure injury (PI) needs, while the Advanced mattress has great pressure distribution and is most suitable for mobile patients. The Reactive mattress is built of air foam cells under the back and buttock area which react to load. The air foam cells help to maintain equal pressure distribution and minimize pressure peaks in the pelvic area. In conclusion, it can be recommended for partly mobile patients.

Regarding the Ergoframe innovative technology, we can conclude that it has a clear impact on reducing pressure in the pelvic area and migration of the patient on the stretcher, independent of the patient's position.

From the results of Ergoframe testing, average pressure is reduced by 16% in the sitting area. The results of testing patient migration in different positions showed reduced migration of up to 50%. The reduction in patient migration consequently reduces the friction forces applied to the body contact points by the mattress, which can be at a high risk of PI.

Finally, the Sprint 200 and the features designed within this segment were developed as support tools for improving the care already provided by nurses and other HCPs on a daily basis. Considering this, it is relevant that hospital staff continue to follow local guidelines for the prevention of PIs and EPUAP/NPIAP best practice 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 Prevelence of Pressure Injuries in Emergency

Of all the HAPI studies, only a few are dedicated to Emergency Care and the prevalence of HAPI data is very limited. This lack of data is exacerbated by hospital adverse event reporting systems, which often do not report specific HAPI rates for Emergency Departments (ED) (Santamaria N, 2019), although interest around HAPI in Emergency Care has shown international growth over the last few years. Patients can develop pressure ulcers within a few hours of entering an Emergency Department (ED). However, despite the critical role of EDs in reducing incidences of pressure ulcers, few have protocols in place for their prevention (Stanberry B, 2021). The truth is that 26,5% of patients spend more than 4 hours on a stretcher because of long waiting times or patient observation, etc (Al Nhdi, 2021). Long stays on a stretcher can be dangerous for patients who are at high-risk of PI because they can develop pressure injuries 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)

Sprint 200 Mattress Recommendations According to Patient Complexity and Mobility

According to the EPUAP/NPIAP Clinical guide, support surfaces are an important part of pressure injury (PI) prevention and treatment, although by itself 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 to offload and reposition as much as possible when spending long periods on any support surface (EPUAP/NPIAP, 2019).

The Sprint 200 support surfaces include 4 types of mattresses, which are intended for use in emergency departments, during transportation, and in one-day-care departments. Regarding transportation, EPUAP/NPIAP recommends using a pressure redistributing support surface for patients at risk of developing PIs during transportation (EPUAP/NPIAP, 2019).

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

Support Surface Selection

The support surface should be selected according to the patient's needs based on the following factors (EPUAP/NPIAP, 2019):

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 pressure injuries.

Pressure Redistribution in Sprint 200 Mattresses

Support surfaces are defined by EPUAP/NPIAP 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). Thanks to this knowledge, we decided to test the pressure redistribution of mattresses. We chose to test them for subject in the supine position and in positions with high pressure on the buttocks.

We tested all 4 mattresses and measured pressure under the body area. For the evaluation of each mattress, we used an an average pressure and a pressure peaks as information about pressure redistribution.

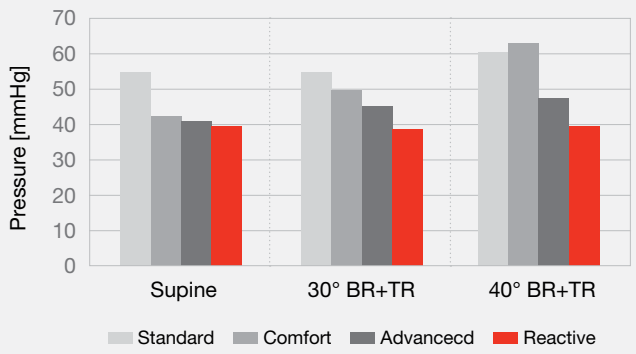
Testing Conditions

Subjects:	Healthy 82.5 kg (181.5 lbs) adult
Positions:	• Supine • 30° backrest + elevated thighrest • 40° backrest + elevated thighrest
Stretcher:	Sprint 200
Mattress:	Standard, Comfort, Advanced, Reactive
Measuring time:	20 minutes in supine, 10 minutes in other positions

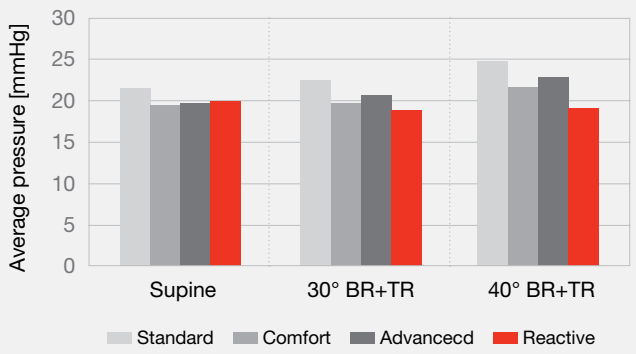
Results

The results for the mattresses are described in the following graphs and in the summary of this chapter. The evaluated pressure distribution is translated into the recommendation according to patient mobility and complex PI needs, which follows factors for the support surface selection.

GRAPH 1 | Comparison of peak pressures for each mattress



GRAPH 2 | Comparison of average pressures for each mattress



Standard Mattress

The mattress average pressure (Graph 1) and pressure peak are the highest of all the mattrasses (Graph 2). The pressure results lead us to recommend the Standard mattress for use during short stay, e.g. approximately 2 hours, or during the transport of patients with no complex PI needs. Patients need to be mobile and able to reposition themselves to offload high pressure contact points.

Level of immobility and inactivity	Mobile Active
Complex PI needs	No
Mattress material	Standard PU foam
Number of layers	1

Comfort Mattress

The Comfort mattress has increased pressure redistribution because of the top layer of viscoelastic foam (Graph 1 and Graph 2). This top layer increases patient comfort. It is recommended for mobile patients with no complex PI needs for longer periods.

Level of immobility and inactivity	Mobile Active
Complex PI needs	No
Mattress material	Standard PU foam Viscoelastic foam
Number of layers	2

Advanced Mattress

The Advanced mattress efficiently redistributes pressure because of the different layers of foam inside and the viscoelastic foam on the top of mattress. We can see a lower average pressure (Graph 2) and a reduction of pressure peaks in different patient positions (Graph 1) in comparison with the Standard and Comfort mattress.

For that reason, we recommend the Advanced mattress for mobile patients with complex PI needs. This recommendation is supported by EPUAP/NIPIAP, which declares that a high specific foam mattress can be used for patients at risk of developing PIs (EPUAP/NPIAP, 2019)

Level of immobility and inactivity	Mobile Less active
Complex PI needs	Yes
Mattress material	3 types of PU foam Viscoelastic
Number of layers	4

Reactive Mattress

From the results we can see the ability of the Reactive mattress to keep peaks at a low-pressure level (Graph 1). These low-pressure peaks have an impact on average pressure (Graph 2) which is lower than for the rest of the mattresses when positioning the patient. We came to the conclusion that this mattress can redistribute pressure equally along the patient's body, independently of their position.

The Reactive mattress is designed as a reactive air foam mattress which is able to react to the load. Air cells under back and seat area help reduce pressure, mainly during patient positioning on a stretcher. Because of these results, we recommend this mattress even for partly mobile patient with complex PI needs, because the mattress will react to any movement and reduce pressure peaks underneath risk contact points. According EPUAP/NPIAP, it is possible to use a reactive air mattress for patients at risk of developing PIs (EPUAP/NPIAP, 2019).

Level of immobility and inactivity	Partly mobile Less active
Complex PI needs	Yes
Mattress material	Standard PU foam 2 types of viscoelastic foam Foam air cells
Number of layers	3

Reactive mattress can be recommended **for patient at risk of developing PI.**

(Testing by LINET Lab)

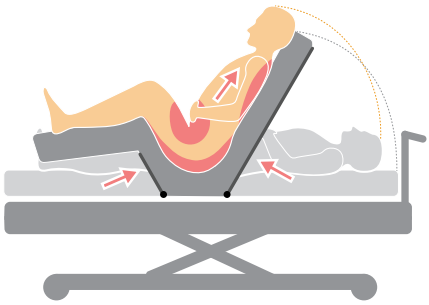
Summary

In summary, the Standard mattress has high pressure peaks in comparison with the Reactive mattress. The Standard and Comfort mattress can be recommended for mobile patients with no complex PI needs because of the occurrence of high-pressure peaks. The Advanced mattress can be recommended for mobile patients with complex PI needs because of the good pressure distribution. The Reactive mattress can be recommended for partly mobile patients with complex PI needs because of the pressure redistribution along the body, independent of position.

Even though these mattresses are dedicated for use in emergency and one-day care, we do not recommend any of these mattresses for completely immobile patients because of insufficient scientific evidence. We are aware that only the caregiver can evaluate a patient's condition and their needs. With pressure testing, we can provide information about pressure redistribution and support the evidence of the EPUAP/NPIAP guidelines. This whitepaper chapter can help you choose a mattress according to the needs of your patient and support your hospital HAPI prevention standards during long stays of patients in the Emergency Department.

The Impact of the Ergoframe on Patient Care

Elevating the backrest from 30° to 45° (Semi-Fowler position) is not a new practice in nursing and is used worldwide, with the main therapeutical purpose of promoting 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. Firstly, the friction and shear forces increase on the patient's upper body when elevating the backrest; secondly, pressure is increased on the pelvic area; and thirdly, larger patients can feel squeezed across the abdomen.

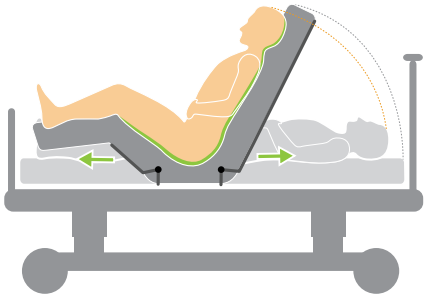


Patients who cannot mobilize themselves (because of pain, sensory perception, or reduced mobility) are at high risk of developing a PI. The more time a patient is immobile, the bigger the risk of developing a PI (Gefen A, 2022). The most frequently affected areas are the scapula and sacrum when the backrest is elevated from 30° to 45°. These sites tend to develop pressure injuries 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 relieve 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. The Ergoframe is a proven innovation from LINET acute and ICU beds, which was newly added to the Sprint 200 stretcher.



Evaluation of Pressure Distribution of the Ergoframe

To prove the effects of the Ergoframe on a patient, we performed pressure measurements on the Sprint 200 in comparison to a stretcher with a standard mattress platform.

Testing Conditions

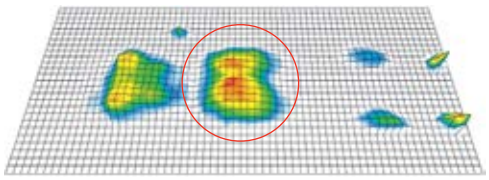
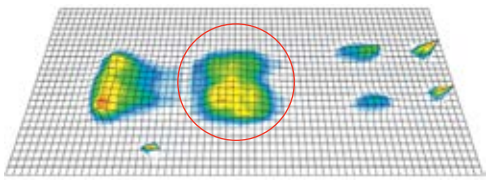
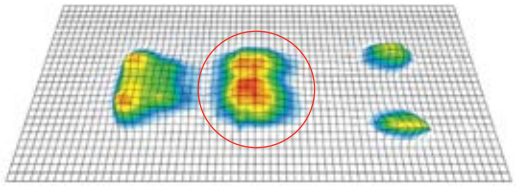
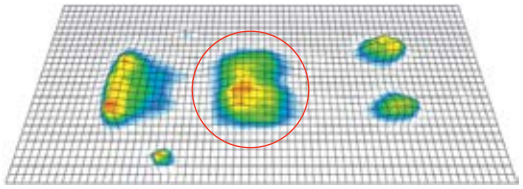
Subjects:	2 healthy adults 82.5 kg (181.5 lbs) and 122 kg (268.4 lbs)
Positions:	Elevated backrest (BR) to 30° with and without thighrest (TH) to 20°
Stretchers:	Stretcher with standard mattress platform (SSMP) and Sprint 200 with Ergoframe (S200)
Mattress:	Standard mattress
Measuring time:	5 minutes

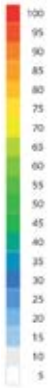
Results

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

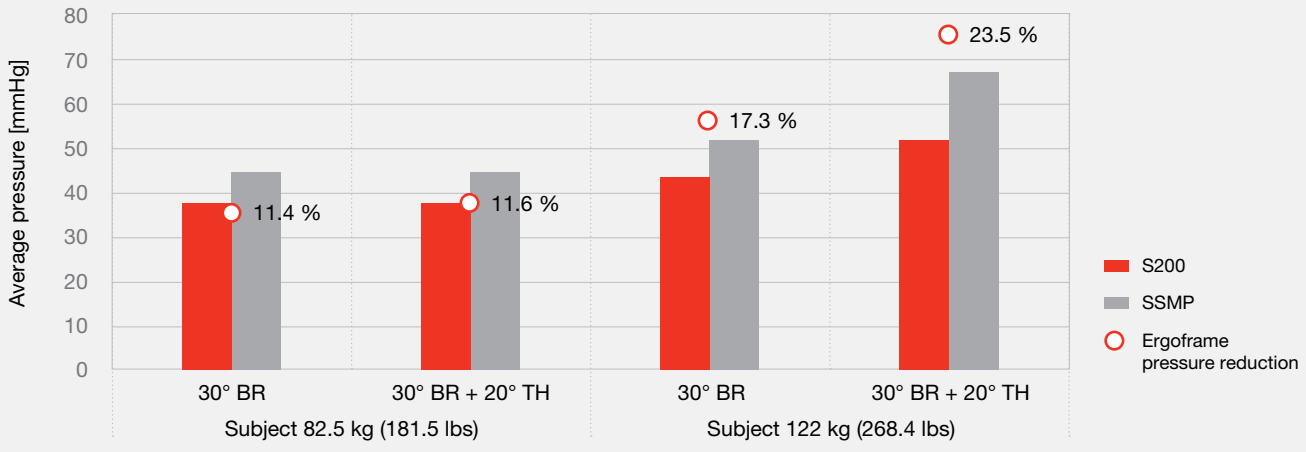
To evaluate the Ergoframe effect, we calculated the average pressure from the seating area for both stretchers (Graph 3) and visualized the pressure onto pressure maps (Table 1). The pressure maps show a clear difference between SSMP and S200 in the seating area. A stretcher with a standard mattress platform has higher pressure peaks compared to the Sprint 200 with the Ergoframe. In conclusion, the Ergoframe reduced the average pressure on the seating area by 16 % against a stretcher with a standard mattress platform for both subjects.

TABLE 1 | Pressure maps for 82.5 kg (181.5 lbs) adult in different positions

	Stretcher with standard mattress platform (SSMP)	Sprint 200 with Ergoframe (S200)
BR 30°		
BR 30° + TH 20°		



GRAPH 3 | Comparison of average pressure for SSMP a S200



Reduction in Patient Migration During Positioning on the Sprint 200

Another impact of the Ergoframe during patient positioning is on the 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 are at the risk of developing a PI (Hermans MH, 2015). The opposite situation occurs with stretchers which, by lowering the seat platform, cause the patient to move upwards during positioning, and the patient's head can reach the end of the backrest. Patients who migrate during manipulation with a backrest are affected by friction forces, and caregivers need to reposition the patient back as part of PI prevention. Repositioning a patient back is considered a task with a high risk of musculoskeletal injury (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

We measured the distances between markers on the subject and markers on the mattress from supine to 30°/60° backrest. 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 can migrate by up to 14 cm (5.5 in). Mainly the shorter subject migrated on average 5 cm (2 in) further than the taller subject. The parts of the body most affected by migration were the upper body and the heels. The Sprint 200 with the Ergoframe can reduce patient migration by up to 50% in comparison with the other stretchers (Table 2).

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

(Testing by LINET Lab)

TABLE 2 | 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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Members of LINET Group

LINET spol. s r.o.
Želevčice 5 | 274 01 Slaný | Czech Republic
tel.: +420 312 576 400 | fax: +420 312 522 668 | e-mail: info@linet.com | www.linet.com

www.linet.com

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