



WOUNDCAREMATTRESS
Prevent & Treat Pressure Sores 

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Pro-care Turn

Bilateral Turning Air Mattress

Clinical Practice Guideline

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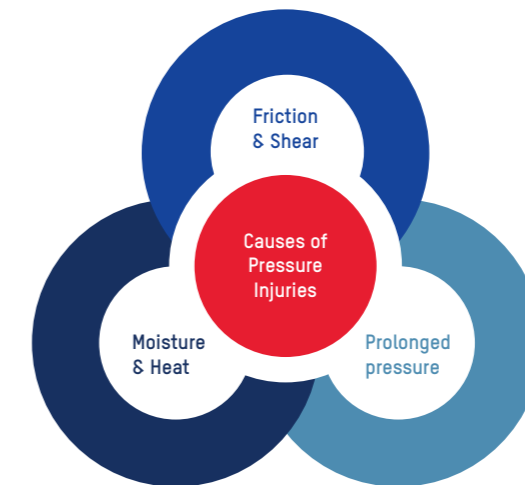
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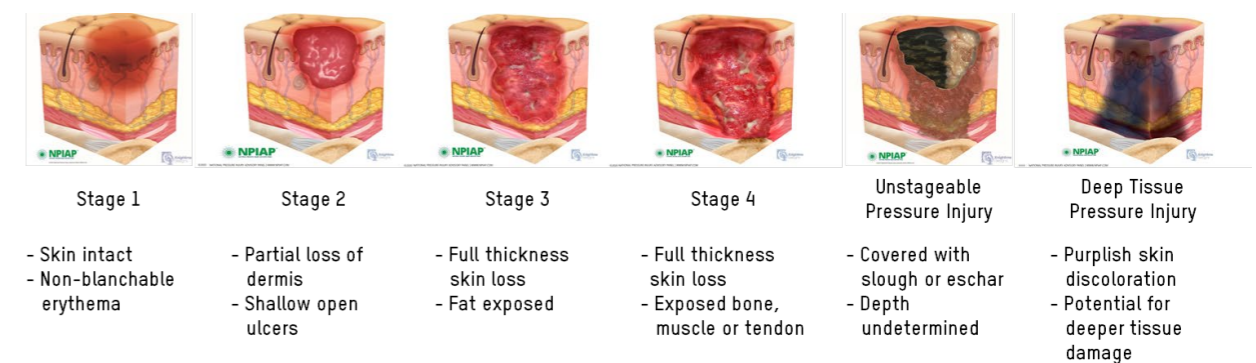
Risk Factors and Development of Pressure Injuries

Pressure Injuries commonly occur as a result of tissue being exposed to prolonged pressure or pressure associated with friction & shear, or the weaker tissue caused by moisture.¹



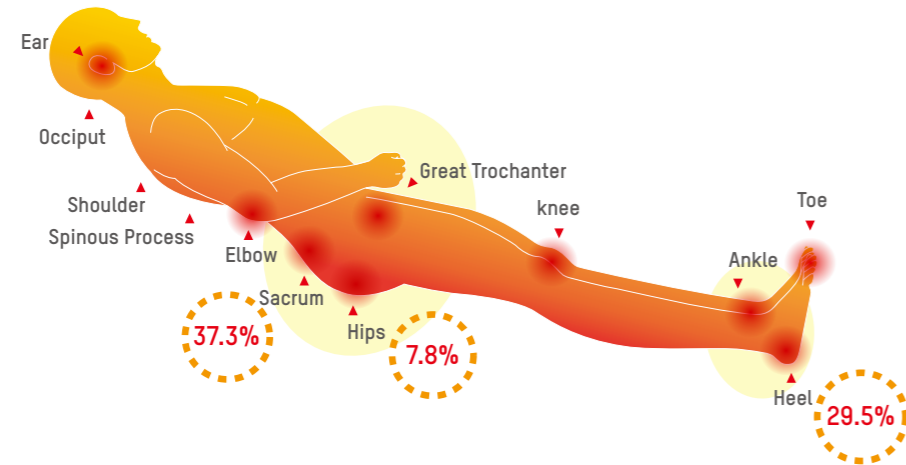
Common Risk Factors of Pressure Injuries

Pressure injuries are categorized into 6 stages²: Stage I with a non-blanchable erythema of intact skin; Stage II with a partial-thickness skin loss with exposed dermis; Stage III with a full-thickness skin loss; Stage IV with a full-thickness skin and tissue loss; Unstageable pressure injury is defined as obscured full-thickness skin and tissue loss; And last, Deep tissue pressure injury is the persistent non-blanchable deep red, maroon or purple discoloration of the skin.



Images used with permission from <https://npiap.com/page/PressureInjuryStages>

They may be superficial injuries affecting the epidermis and dermis or they can extend into the subcutaneous tissues and involve muscle, tendon and bone. Pressure injuries typically occur over bony prominences with the lower trunk (sacrum, coccyx, trochanter and ischial tuberosity) and heels being the two most common anatomical locations.^{3,4}



Locations in Risk of Pressure Injuries

Localized areas of tissues that have prolonged pressure cause the occlusion of blood flow, preventing the supply of nutrients and oxygen to the tissue, resulting in ischaemia and re-perfusion injury, leading to cell obliteration and eventually tissue death.⁵

From the information of the mechanism of pressure injuries above, additional risk factors that have been correlated with are age of 70 years and older, current smoking history, dry skin, low body mass index, impaired mobility, altered mental status (i.e., confusion), diabetes mellitus, peripheral vascular disease, urinary and fecal incontinence, malnutrition, physical restraints, malignancy, history of pressure injuries, and human race.

Pressure injuries can develop within 2 to 6 hours. Therefore, the key to preventing pressure injuries is to accurately identify at-risk individuals quickly, so that preventive measures may be implemented.⁶ A major method of redistributing pressure is the use of support surfaces. Many researches had been conducted on the effectiveness of the use of support surfaces in reducing the incidence of pressure injuries. The concept of pressure redistribution has been embraced by the NPIAP.

“ Support surfaces are: “Specialized devices for pressure redistribution”⁷ “



“Support surfaces are specialized devices for pressure redistribution designed for management of tissue loads, microclimate, and/or other therapeutic functions (i.e., any mattress, integrated bed system, mattress replacement, overlay, or seat cushion, or seat cushion overlay)”.⁷ In this context, pressure refers to the distribution of force on the individual’s body surface that is in contact with the device.

“ Reposition all individuals with or at risk of pressure injuries on an individualized schedule, unless contraindicated.”⁸ “

Despite support surfaces are utilized for the prevention and treatment of pressure injuries, repositioning of individuals with or at risk of pressure injuries on a routine basis can further eliminate prolonged pressure on some localized areas temporarily.

Bilateral turning up to specific degrees can be beneficial in terms of reducing pressure exerted on localized areas such as greater trochanters as bilateral turning can significantly reduce interface pressure on patients’ body whilst increase capillary circulation.⁹



Support Surface Solution



Pro-care Turn offers

Prolonged Pressure



Continuous Low Pressure (CLP)



Alternating Mode



Maximum 30-degree Bilateral Turning



Seat Inflation



QubiCell™ Design



Heel Relief Function

Friction & Shear



4-way Stretch Top Cover with Low Friction & High MVTR

Moisture & Heat



Micro Low Air Loss

Pressure Mapping

By investigating the pressure mapping of Pro-care Turn, we can use the software to analyze the Pressure Redistribution Index (PRI) of different modes to see the performance of product, when threshold of interface pressure gets stricter, you can find out that Pro-care Turn can still offer good performance for prevention of pressure injuries.

Equipment Used: The XSENSOR X3 Display Medical Mattress System

Software Used : Xsensor X3 medical V6

Method: Each test is conducted over a 60-minute period during which the average, peak and minimum pressures are recorded.



Pressure Area Index (PAI): Pressure Area Index (PAI) is a method used to measure the interface pressure of the surface. The PAI is calculated as the proportion of sensors that register interface pressure values.¹⁰

Pressure Redistribution Index (PRI): Pressure Redistribution Index (PRI) is a method to assesses the ability of a dynamic support surface to sustain interface pressures below a chosen set of thresholds. The PRI is calculated as the ratio of the time during which the dynamic support surface interface pressure trace spends below the threshold and the total time of one inflation/deflation cycle.¹¹

Product Therapy Modes and Performance

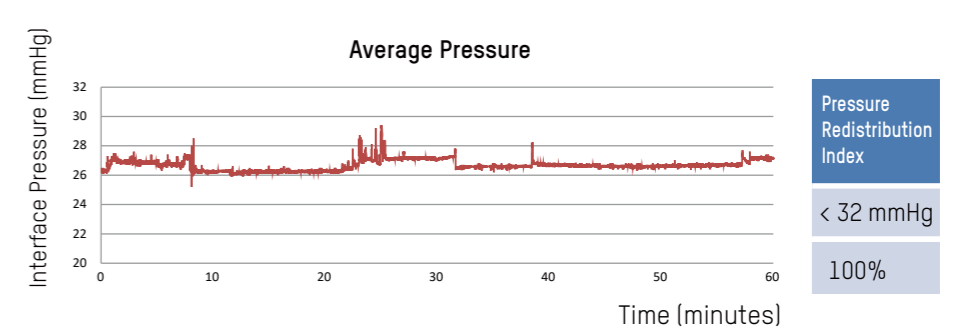
Continuous Low Pressure

“ Consider using a reactive air mattress or overlay for individuals at risk for developing pressure injuries¹² ”

Reactive air mattresses redistribute pressure by deforming in response to an individual’s weight on the surface¹³. Pro-care Turn offers a Continuous Low Pressure mode for caregivers to choose, caregivers can use this mode if patients don’t like vibrations or alternating sensations, this mode provides a stable surface with pressure lower than the corresponding level when in alternating mode.



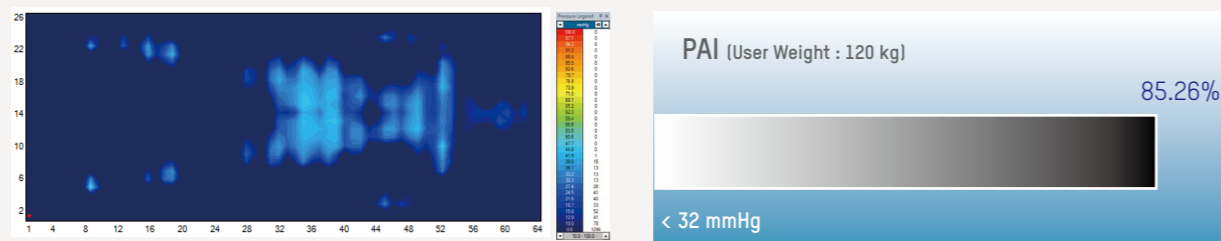
The Pro-care Turn (when used in Continuous Low Pressure mode) reaches a maximum of 29.4 mmHg and a minimum of 25.2 mmHg, and the 100% of interface pressures during its 60-minute cycle are all below 32 mmHg.



Alternating Mode

“ Assess the relative benefits of using an alternating pressure air mattress or overlay for individuals at risk of pressure injuries ¹⁴ ”

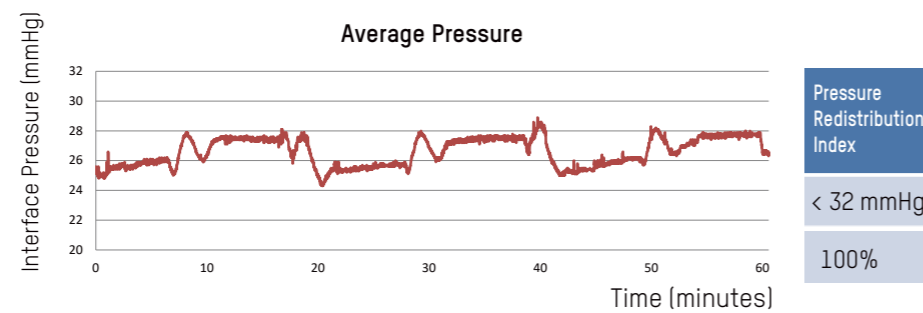
Pro-care Turn offers an alternating mode, it can give patients continuously and sequentially inflate and deflate air cells (1-in-2 alternating) to avoid long term pressurization of tissue, and also provides four kinds of operating cycle time (10, 15, 20, 25 minute) for caregivers to choose.



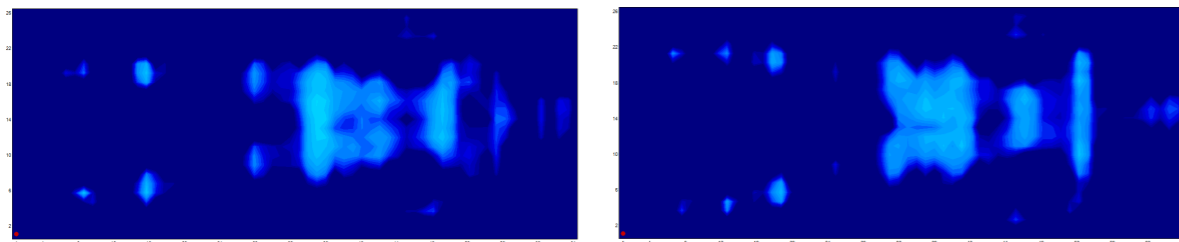
Pressure mapping test of Pro-care Turn in supine position for 60 minutes

User Height : 175 cm
 User Weight : 120 Kg
 BMI : 39.1

The Pro-care Turn (when used in alternating mode) reaches a maximum of 28.9 mmHg and a minimum of 24.3 mmHg, and the 100% of interface pressures during its 60-minute cycle are all below 32 mmHg.



By the pressure mapping we can easily observe the alternating situation of supine position



Turning Mode

“ Reposition the individual to relieve or redistribute pressure using manual handling techniques and equipment that reduce friction and shear ¹⁵ ”

Pro-care Turn offers two kinds of turning mode: Continuous and One-time turning.

Continuous turning can help caregivers to easily achieve repositioning and reduce the risk of lower back and arm injuries during repositioning. One time turning mode is provided when nursing interventions are required. As for the setting of Dwell time, to simulate postural drainage for mobilizing secretions (3-4 times per day, each time 5-15 minutes)¹⁶.

Therefore a 10-minute dwell time is provided to meet the goal, caregivers can also choose 20, 30 or 60 minute since the general medical care protocol and NPIAP international guideline recommend that the patient should be turned once every two hour to further relieve the pressure from patient's scapulae and great trochanters.



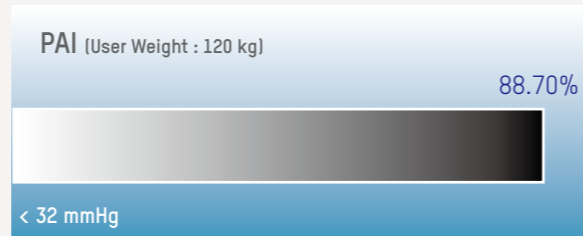
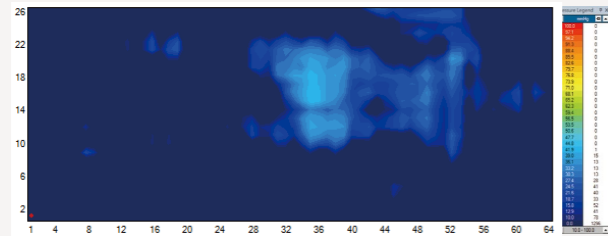
*Dwell time : The time that Pro-care Turn holds at the set angle

“ Use the 30° side lying position in preference to the 90° side lying position when positioning¹⁷ “

As for the turning angle, 30 degrees of turning not only complies with clinical guidelines but also provides optimal comfort.¹⁸ Pro-care Turn offers a maximum 30-degree turning angle and an alternating function during dwelling time. A cover rubber pad is provided for the comfort and stability of the patient during the turning therapy.

Progress of turning mode (e.g.: 60 minutes):

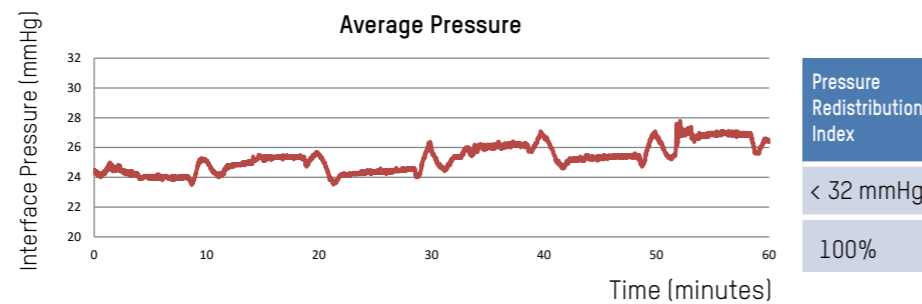
60-minute turn over one side → Lies flat for another 60-minute → Turn over to the other side for the next 60 minutes.



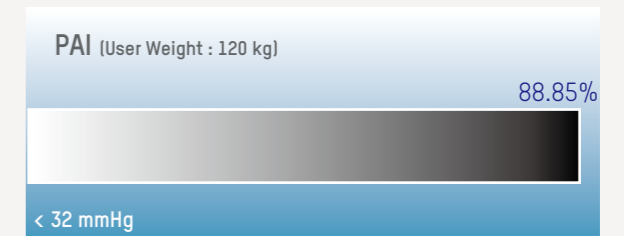
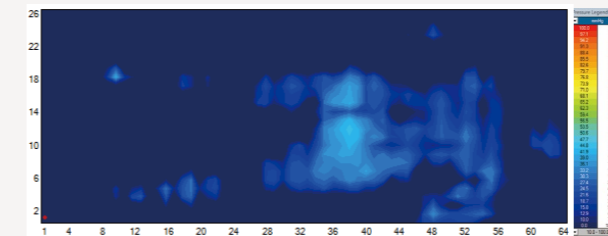
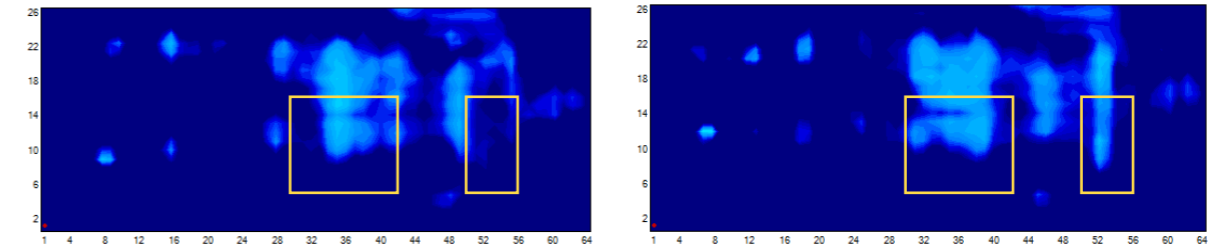
Pressure mapping test of Pro-care Turn in Left-Turn position for 60 minutes

User Height : 175 cm
User Weight : 120 Kg
BMI : 39.1

The Pro-care Turn (when used in left turning mode) reaches a maximum of 27.8 mmHg and a minimum of 23.5 mmHg, and the 100% of interface pressures during its 60-minute cycle are all below 32 mmHg.



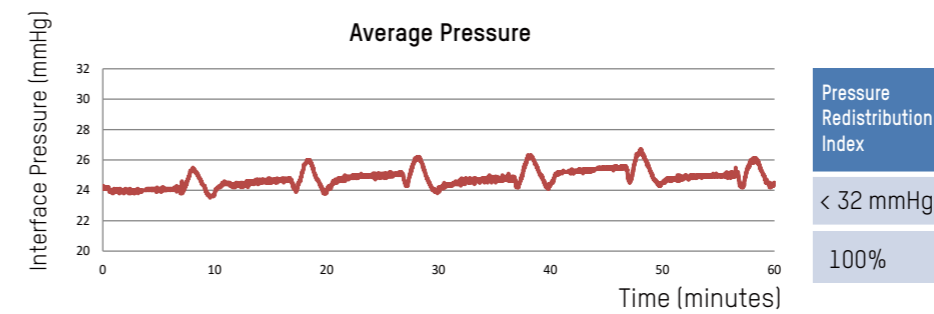
By the pressure mapping we can easily observe the alternating performance when patient in Left-Turn position:



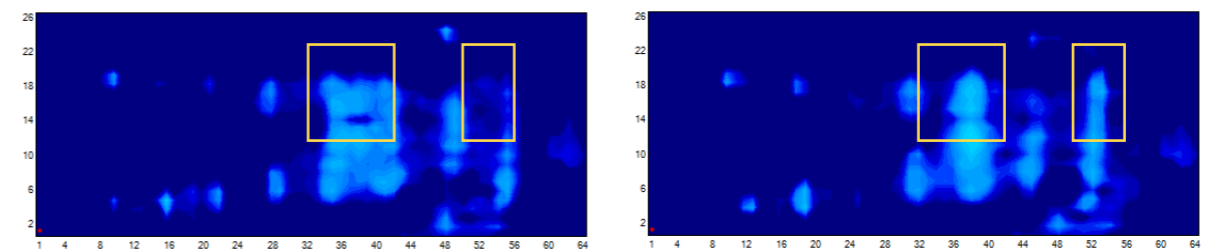
Pressure mapping test of Pro-care Turn in Right-Turn position for 60 minutes

User Height : 175 cm
User Weight : 120 Kg
BMI : 39.1

The Pro-care Turn (when used in right turning mode) reaches a maximum of 26.7 mmHg and a minimum of 23.5 mmHg, and the 100% of interface pressures during its 60-minute cycle are all below 32 mmHg.



By the pressure mapping we can easily observe the alternating performance when patient in Right-Turn position:



Seat Inflation

“ For individuals with a pressure injury, consider changing to a specialty support surface when the individual: ‘Bottoms out’ on the current support surface ¹⁹ “

To avoid the situation of bottoming out, Pro-care Turn offers an extra support in sacral area during sitting position. It will increase pressure of whole mattress, when patient in a fowler's position for steady support.



Design of Mattress

Heel Relief Function

“ The heel is one of the two most common anatomical sites for pressure injury development. In a European survey on pressure injury prevalence, almost 80% of all Category/Stage IV pressure injuries were found at the sacrum and heels²⁰ “



APEX Heel Relief Function is a simple and easy way to prevent and assist in treating heel pressure injuries by eliminating interface pressure from heels as if they are suspended in air. The heel is typically reported as the second most common sites for pressure injury development.²⁰ With the Heel-Relief quick connectors on the last five cells from the foot end, regardless of patients' height, caregivers can always deflate the cell directly underneath the heel to achieve zero pressure.

Information of Top Cover

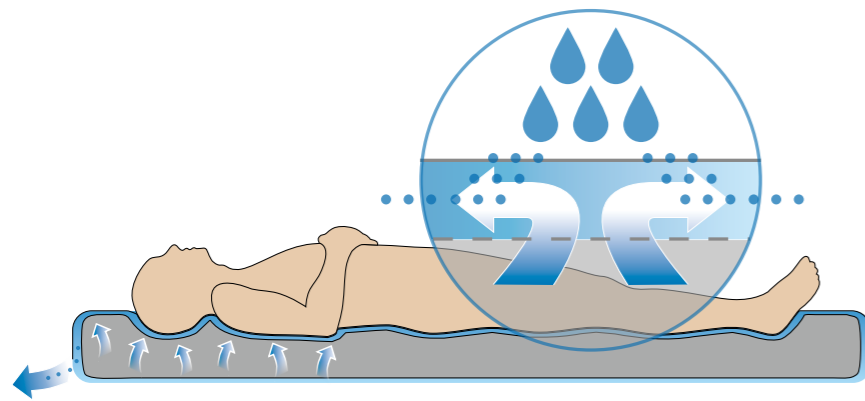
“ Consider using textiles with low friction coefficients for individuals with or at risk of pressure injuries ²¹ “



Pro-care Turn dynamic air mattress system is provided with a standard cover (sanitary cover sheet) with high-performance technical material which covers them completely and is biocompatible, with low friction & shear forces, water resistant and highly vapor permeable. The Moisture vapor transmission rate (MVTR) is 2315 g/24hrs/m² according to ASTM E96 Procedure BW.

Microclimate Management

“An increasing body of evidence suggests that the microclimate between skin and the supporting surface plays a role in the development of pressure injuries ²²”



As for the microclimate control, Pro-care Turn offers micro low air loss function, it provides good ventilation and reduces the accumulation of heat and moisture.

Use of Nano Positioning Pillows

With Nano positioning pillows:

They can decrease the risk of patients wedged between side bolsters and the contracture of joint. They can also let the patient be repositioned easily with the help from caregivers. Caregivers should check the position of Nano positioning pillows during the process of one single turning mode (to do nursing interventions or make sure the safety of patients) and the setting of turning dwell time can be set at 10 minute. (One single turning in a higher degree)

Without Nano positioning pillows:

The setting of turning dwell time should be set at 20, 30, 60 minute. (Continuous turning in a lower degree)

Tips of using Nano positioning pillows:

Arm

Reposition the patient’s arm and place a Nano positioning pillow on his/her elbow.

Legs

Let the posterior leg being straight and the anterior one curved, place a Nano positioning pillow between two knees to prevent pressure injury and contracture from happening.



Arm position with a Nano positioning pillow



Leg position with a Nano positioning pillow



FAQ

(1) What are the advantages of using Pro-care Turn?

1. Saves caregiver's time.
2. Relieves the pressure of hips, sacrum, greater trochanters and heels.
3. Provides a more comfortable and stable mattress and reduces the feeling of wave during alternating cycles.
4. Reduces the risk of musculoskeletal disease and lower absentee rate in the facility: No need to relocate the patient into another mattress. Hence, reduce the risk of musculoskeletal disease to caregivers.
5. Helps reposition patients and increase their mobility.
6. Provides multiple functions for different care plans to patients.
7. Keeps air inside the mattress during power outage or transport of patient and prevents the patient from bottoming out.

(2) Would patient feel uncomfortable when being turned over one side on Pro-care Turn mattress?

Pro-care Turn mattress will start alternating when the turning angle is reached to further relieve pressure exerted to patient's body during turning position, plus the heel relief function that helps streamline the patient's body and make the patient more comfortable. (Pro-care Turn will operate without alternating feature when the dwell time is set at 10 minute)

(3) What kind of patient should use Pro-care Turn?

1. Unconscious
2. Bedbound and immobilized
3. Medium to high risk of pressure injuries, especially on the scapulae and great trochanters

(4) Where can Pro-care Turn be used?

ICU, GICU, NICU, Neurosurgery and Neurology.

(5) Why starts at CLP mode instead of alternating mode?

After initial inflation, each single air cell will be sufficiently inflated. At this point, if the caregiver chooses turning function, the mattress can be quickly switched for this operation. If there is no action to the pump, it will automatically enter alternating mode after 10 minute.

(6) How much time is needed to change from right or left to plane degree?

The mattress takes approximately 3-5 minutes to change from right or left to plane degree, while the actual time is depending on patient's BMI and body contour (more time if patient gets a higher BMI). The dwell time starting to count immediately after the selected turning degree is reached.

(7) Can the alternating feature be turned off during turning mode?

No, Pro-care Turn is designed as a dynamic mattress with turning function. With the combination of these two functions: To alleviate pressure points at the contact surface in the turning position as well as reduce the incidence of pressure injuries.

References

1. Karen Hertz. 2018. Fragility Fracture Nursing. USA: Springer
2. NPIAP Pressure Injury Stages (https://cdn.ymaws.com/npiap.com/resource/resmgr/online_store/npiap_pressure_injury_stages.pdf)
3. Zhaoyu Li, Frances Lin, Lukman Thalib, Wendy Chaboyer. 2020. Global prevalence and incidence of pressure injuries in hospitalized adult patients: a systematic review and meta-analysis. *Journal of Nursing Studies*.
4. Gawlitta D, Li W, Oomens CW, Baaijens FP, Bader DL, Bouten CV. 2007 The relative contributions of compression and hypoxia to development of muscle tissue damage: an in vitro study. *Annals of Biomedical Engineering*. 35(2), 273-84.
The references listed below by page number, refer to direct statements appearing in the full version of the European Pressure Ulcer Advisory Panel, National Pressure Injury Advisory Panel and Pan Pacific Pressure Injury Alliance. Prevention and Treatment of Pressure Ulcers/Injuries: Clinical Practice Guideline. The International Guideline, Emily Haesler (Ed.).EPUAP/NPIAP/PPIA:2019.
5. Section 5 Skin and Tissue Assessment. **Page 74**
6. International review. Pressure ulcer prevention: pressure, shear, friction and microclimate in context. A consensus document. London: Wounds International,2010.
7. Section 10: Support Surfaces. **Page 155**
8. Section 8: Repositioning and Mobilization: Recommendation 5.1. **Page 115**
9. Peterson MJ et al., Patient repositioning and pressure ulcer risk—Monitoring interface pressures of at-risk patients, *JRRD* 2013Section 2: Etiology. **Page 22**
10. Kenney L , Rithalia SVS. 1999. Mattress & bed resource file: assessment of support surfaces . *J Wound Care (Suppl)* ;Part 2: 1-8 .
11. Twiste M, Rithalia S. 2008. Measurement system for the evaluation of alternating pressure redistribution mattresses using pressure relief index and tissue perfusion– a preliminary study. *Wound Practice and Research*. Volume 16
12. Section 10: Support Surfaces: Recommendation 7.5. **Page 163**
13. Malbrain M, Hendriks B, Wijnands P, Denie D, Jans A, Vanpelicom J, De Keulenaer B. 2010. A pilot randomised controlled trial comparing reactive air and active alternating pressure mattresses in the prevention and treatment of pressure ulcers among medical ICU patients. *J Tissue Viability*. 19(1), 7-15.
14. Section 10: Support Surfaces: Recommendation 7.7. **Page 165**
15. Section 8: Repositioning and Mobilization: Recommendation 5.6. **Page 121**
16. Robert Kacmarek, James Stoller, Al Heuer. 2016. *Egan’s Fundamentals of Respiratory Care - 11th Edition*. USA : Elsevier Science Health Science div.
17. Section 8: Repositioning and Mobilization: Recommendation 5.8. **Page 123**
18. Moore Z et al., 2011. A randomized controlled clinical trial of repositioning, using the 30 tilt, for the prevention of pressure ulcers. *Journal of Clinical Nursing*
19. Section 10: Support Surfaces: Good Practice Statement 7.9. **Page 169**
20. Section 9: Heel Pressure Injuries. **Page 145**
21. Section 6: Preventive Skin Care: Recommendation 3.4. **Page 88**
22. Section 2: Etiology. **Page 22**

