- *Basic Research*

Effect of an Innovated Turn Clock to Cue Patients' Two-Hourly Repositioning on Prevention of Hospital-acquired Pressure Ulcers among Orthopedic Bedridden Patients

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Abstract

Introduction: Pressure ulcers continue to be a significant health concern as the population ages and the complexity of care increases across all inpatient health care settings. Pressure ulcers are associated with pain, suffering, loss of functions, increased length of stay, increased morbidity and mortality, and significant financial burden. Repositioning patients approximately every two hours is a foundational element in the preventing pressure ulcers. **Aim:** Determine the effect of an innovated turn clock to cue patients' two-hourly repositioning on prevention of hospital-acquired pressure ulcers among orthopedic bedridden patients. **Methods:** A quasi-experimental research design was utilized among a convenience sample of 60 adult orthopedic bedridden patients admitted to the orthopedic wards at El Hadara hospital at Alexandria. **Research hypothesis:** Orthopedic bedridden patients who undergoing the use of a turn clock to cue for two-hourly repositioning will exhibit low incidence rate of hospital-acquired pressure ulcers than those who receiving routine nursing care. **Tools**: Three tools were used. Tool I: Orthopedic bedridden patients' socio-demographic characteristics and clinical data structured interview schedule. Tool II: Frequency of repositioning during shifts assessment tool. As well as tool III: Hospital-acquired pressure ulcers assessment tool. **Results:** Reveals that there was no statistically significant difference between the two groups in relation to the socio-demographic characteristics. There was a highly statistically significant difference between both groups in relation to the incidence of hospital acquired pressure ulcer .**Conclusion:** Most pressure ulcers can be prevented, orthopedic bedridden patients who undergoing the use of a turn clock to cue for two-hourly repositioning exhibited low incidence rate of hospital-acquired pressure ulcers than who receiving routine nursing care. **Recommendations**: Availability of turning clock in health care settings provide care for bedridden patients is crucial to prevent hospital acquired pressure ulcer.

Keywords: Turn clock, Two-hourly repositioning, Hospital-acquired pressure ulcers, Orthopedic, Bedridden patients.

Introduction

Hospital-acquired pressure ulcers (HAPUs) considered being reasonably preventable **(Lyder, 2020)**. Pressure ulcer is defined as "an area of localized damage to the skin and/or underlying tissue usually over a bony prominence as a result of pressure combined with shear. It has been recognized worldwide as a significant cause of morbidity, mortality, and health care burden (**Assefa, Mamo, Shiferaw, 2017)**. In orthopedic patients, hospital-acquired pressure ulcers are a common issue with high expectations of ward presence, it can be observed in any admitted patient having high liability for its development like old age, patients with malnutrition or anemia, and long stay in bed or complicated multiple surgeries. Orthopedic wards already contain a higher proportion of beds with pressure ulcers than those of any other specialty. Reports showed 11.9% - 19.2 % incidences in orthopedic wards against 8.8%-9.2% in all inpatients. Compared to patients without pressure ulcers, orthopedic patients with pressure ulcers experience greater morbidity and mortality. The most common reasons for orthopedic ward admission are hip fractures and hip replacements and are associated with the secondary development of pressure sores **(Parker & Johansen, 2016)**.

Repositioning as mentioned in the Quran; every human being has been created with the major basic functions in common including sleep" to sustain person's life on earth. The benefits and importance of sleep are copious, but the importance of body movement in sleep needs to be unmasked. The Quran is the word of Allah; who is the Creator of human beings and the universe. Body movement is one of the significant factors in human sleep. The major problems due to lack of movement in sleep impact the functions of blood circulation, which causes body pain, temporary numbness, and bedsores in lengthy stillness **(Bahammam, 2011)**.

Pressure is a vital factor for the development of pressure ulcers, Pressure for 2 hours or more over bony prominences is enough to cause an ischemic wound. Individuals who cannot independently reposition tend to be at the greatest risk for ulcer development. Application of high pressure for a shorter duration not only causes tissue necrosis due to blockage of capillaries but also produces pressure effect on the larger vessels causing thrombosis, more often venous thrombosis. Due to the effect of pressure, the ischemic degenerative changes occur at all the levels simultaneously affecting the skin, subcutaneous fat, muscle and fascia if any between the bony prominence and the pressure-causing surface. If subcutaneous necrosis occurs, ulceration will be clinically seen when the necrotic skin gives way **(Al-Shadedi, 2018 & Agrawal, Chauhan, 2019; Wound Ostomy and Continence Nurses Society, 2010)**.

Pressure, from lying or sitting on a particular part of the body results in oxygen deprivation to this area, this result in pain and discomfort, which stimulates the person to change

position. However, if the person is unable to reposition themselves, or has impaired sensation and therefore does not experience the discomfort, assistance will be required **(Gillespie, Chaboyer, McInnes, Kent, 2020)**. If a pressure ulcer occurred, it can cause decreased quality of life, infection, pain, and disfigurement, alteration to sleep, delayed healing, increased morbidity and mortality rates, an increased need for rigorous nursing and medical care, an increased workload for healthcare workers, and, as a consequence, increased healthcare costs. A patient with a pressure ulcer has a mortality risk that is 2 to 6 times greater than a patient with intact skin **(Dilie & Mengistu, 2017; Berlowitz, et al., 2011)**.

The pain and numbness might be caused due to a lack of blood flow to the body area. The numbness has occurred during the night the position of the body has caused pressure on the nerve or the artery to the part of the body to be and the blood supply cut off. Hence, poor blood circulation or lack of blood flow may lead to the malfunction of nerve cells. Because, numbness is due to some problem in the function of the sensory nerves **(Chayakulkeeree, Junsriwong, Keerasuntonpong, Tribuddharat, & Thamlikitkul, 2019)**.

Repositioning aims to redistribute pressure to the supporting soft tissues while facilitating offloading of bony prominences, such as the sacrum and heels. Repositioning reduces the duration of pressure experienced by the tissues and decreases tissue hypoxia and consequently the risk of pressure ulceration. **(Gillespie, Chaboyer, McInnes, Kent, 2020 & Woodhouse, Worsley, Voegeli, Schoonhoven, Bader**, **2019)**. The repetition of 2-hourly turns remains a common theme, although there is little evidence to support this frequency. For most patients, 2 hourly turns are too frequent, while others need to be repositioned at shorter intervals. The turning schedule should be individually prescribed for each patient based on his/her main risk factors and his/her ability and/or willingness to reposition. The patient becomes aware of why they are being repositioned may mean they move more frequently. Ensuring the patient's pain is well controlled can positively influence the frequency with which they reposition (**Fletcher, 2017; Hoogendoorn, Reenalda, Koopman & Rietman, 2017)**.

Orthopedic nurses should be familiar with measures required to prevent and reduce the occurrence hospital-acquired pressure. Even though nurses make the prevention part of hospital-acquired pressure ulcer including the application of repositioning protocol, there are some barriers to practice this repositioning protocol and care planning, these barriers including inadequate time, inconsistent documentation, lack of staff, lack of equipment, and lack of pressure ulcer related knowledge **(Afolayan, Afolayan, Gambari, 2015; Coleman, Gorecki, Nelson, 2013)**.

The turning clock is an interactive communication tool placed at the patient's bedside that outlines the individual positioning plan including; frequency of positioning, the type of the position, and time for the next position change. Upon initial assessment of the patient's repositioning needs, the turning clock is customized to reflect the care required. When care is provided at the bedside, the nurse can look at the Clock when and how the patient is to be positioned next **(Schut, Tarver, Pezzani, 2018 & Yap, Kennerly, Bergstrom, Theodore, Trumble, Hudak, Horn, 2017)**.

2. **Significance of the study:**

The training clock is significant to overcome nurses noncompliance to patient's repositioning as this clock serves as an effective reminder for staff to reposition patients at risk for pressure ulcers and which position to use for an effective rotation of sites using innovative methods of cueing to ensure timely and consistent turning/repositioning of residents, which in turn improve consistency in meeting standards of care and reduction in undesired variation in the occurrence and timing of care delivery.

3. Aim of study: Current study aims to evaluate the effect of an innovated turn clock to cue patients' two-hourly repositioning on the prevention of hospital-acquired pressure ulcers among orthopedic bedridden patients.

4. Research hypothesis:

Orthopedic bedridden patients who undergoing the use of a turn clock to cue for two-hourly repositioning will exhibit low incidence rate of hospital-acquired pressure ulcers than those who receiving routine nursing care.

5. Operational definition:

Innovated Repositioning Clock: It is a new method designed by the researchers for easy application and motivation to turn the patient every two hours to prevent pressure ulcer in different places of the body that for bedridden orthopedic patients.

6. Subjects and Methods

6.1. Research design: A quasi-experimental research design was utilized to fulfill the aim of the present study.

6.2. Setting: The study was carried out in orthopedic wards at El Hadara hospital at Alexandria .Selection of this setting based on the length of the stay of the patients to ensure exposure of study patients to PUs cases.

6.3. Subjects: The study subjects comprised a convenience sample of sixty (60) adult orthopedic bedridden patients, were selected based on **Epi info7 program** that was used to estimate the sample size using the following parameters:

Total population over one year ago at the above-mentioned hospital was 360 patients, 2019-2020.

Expected frequency = 50%

Acceptable error = 10%

Confidence coefficient = 95%

Estimated sample size is = 58 orthopedic bedridden patients.

The inclusion criteria:

Adult aged 18- 60 years old.

Bedridden patients with a long length of stay in the orthopedic ward.

These patients were treated for trauma to proximal femur, hip joint, pelvis and spinal trauma.

Free from current pressure ulcers.

Inclusion was done on the basis of Braden scale risk criteria for developing pressure sores: patient' score was 18 or less.

Adequate cognitive state i.e. able to understand and collaborate.

Exclusion criteria:

Hemodynamically unstable patients.

Patients will be divided randomly into two equal groups of 30 patients, each as follows**:**

Control group (GI): were exposed to the routine hospital care only.

Study group (GII): were exposed to the innovated turn clock to cue patients' repositioning in addition to routine hospital care.

6.4. Tools:

6.4.1. Tool I: Orthopedic bedridden Patients' Demographic characteristics and Clinical Structured Interview Schedule.

This tool was developed by the researchers based on reviewing the relevant recent literature **(Borgen, Bjørnerem, Solberg, Andreasen, Brunborg, Stenbro, & et al., 2019&Braden and Bergstrom, 1988)** to obtain baseline data. It consisted of three parts as follows:

Part I: Patient's socio-demographic characteristics; as age, gender, educational level, marital status, occupation, and residence area.

Part II: Patient's Clinical Data: It included fracture related items as fracture cause, site, and type. In addition to; type of surgery**.**

Part III: The hospital-acquired pressure ulcers development patient's risk factors assessment scale**:** hospital-acquired pressure ulcers risk was assessed using Braden Scale **(Braden and Bergstrom, 1988)**, it is a summated rating scale made up of six subscales scored from 1 -3 or 4, for each item .The total scores ranged from 6-22. A lower Braden Scale Score indicates a lower level of functioning and, therefore, a higher level of risk for pressure ulcer development. Patient's risk for pressure ulcers determined as the following:

Severe risk: Total score ≤9

High risk: Total score 10-12

Moderate risk: Total score 13-14

Mild risk: Total score 15-18

6.4.2. Tool II: Frequency of repositioning during shifts assessment tool: This tool was developed by the researchers. It includes numbers of repositioning during the morning, evening and night shifts.

6.4.3. Tool III: Hospital-acquired Pressure Ulcers Assessment Tool: This tool was developed by the researchers based on reviewing the relevant recent literature**(Amin, Haque, Saha, Zai, Hossain, Akter, 2018)**,it included the following: presence of pressure ulcer , Pressure ulcer's anatomical location , stage, associated manifestation, shape ,size, presence of necrotic tissue and exudates.

6.5. Method:

- An approval from the Ethical Research Committee, Faculty of Nursing, Alexandria University was obtained.

- An official letter from the Faculty of Nursing was submitted to the general director of El Hadra Hospital for obtaining permission to carry out the study after complete explanation of the study aim.

- All tools were developed by the researchers.

- Tools Validity: All tools were submitted to five experts in the field of orthopedic surgery, and Medical Surgical Nursing for content and validity and the necessary modifications were incorporated accordingly.

- **The reliability** of tools was tested by means of Cronbach's Alpha. Reliability coefficient for tool I was (0.692), tool II was (0.782), and tool III was (0.883) which denotes high reliability.

- A **pilot study** was initially carried out prior to the actual data collection phase on eight patients from the experimental study group to check clarity, feasibility and applicability of tools and identifying obstacles that may be encountered during the data collection process, and to determine the time needed to fill in the assessment tools, accordingly, the required modifications were done.

- Data collection started at the beginning of November 2019 and ended by May 2020.

-The study was carried out through four phases:

I. Assessment Phase:

An initial assessment was carried out individually for every patient in both the control and study groups after careful listening and documenting socio-demographic and clinical data and patient's risk to develop pressure ulcer using tool I.

II. Planning Phase:

Innovated repositioning clock was developed by one of the researchers and training was done for the other researchers and nurses reasonable for providing care for the study group patients through one-session on how correctly use the repositioning clock. This clock considered as an important tool for motivating and reminding nurses to turn the patient every two hours also used to evaluate the performance of the nurses

and detect any neglecting in patient turning in order to prevent bed sores indifferent places of the body that for bedridden patients.

III. Implementation Phase:

Innovated repositioning clock was used for the study group patients, for 3 weeks. The first 2 hours of the morning shift ensure that the patient was in lower fowler position, the second two hours reposition the patient in Left Semi's position, the third two hours reposition the patient in prone position, and the fourth two hours reposition the patient in right Semi's position as shown in **(figure 1).**

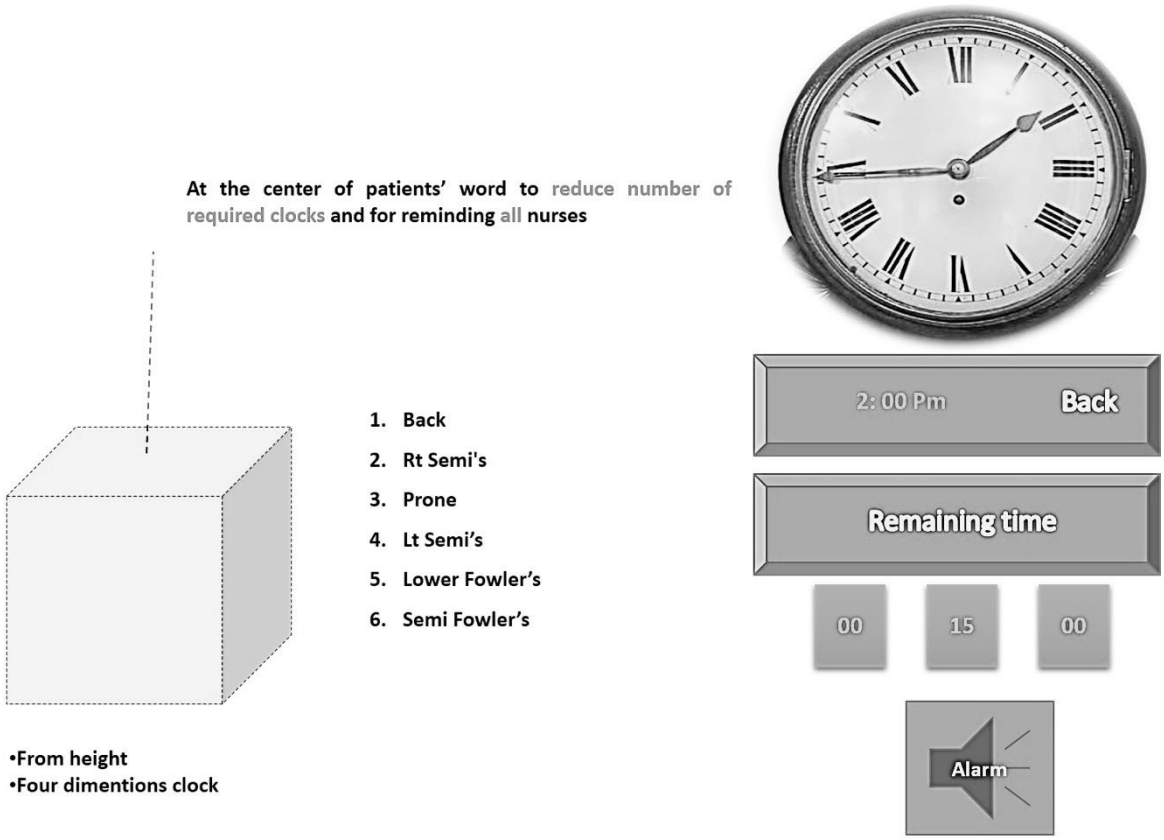

Fig (1): Patient repositioning clock (https://www.google.com.eg)

IV. Evaluation phase:

Every patient in the control and study group was re-evaluated after three weeks using tools III to assess whether the patient develop pressure ulcers or not.

-Comparisons between the findings of both groups were carried out using appropriate statistical analysis in order to determine the effect of using innovated turn clock to cue patients' repositioning on prevention of hospital-acquired pressure ulcers among orthopedic bedridden patients.

6.6. Ethical considerations:

A written informed consent from patients to participate in the study was obtained before data collection and after explanation of the aim of the study.

Privacy of the study participants was asserted.

Confidentiality of the collected data was assured.

Participants' voluntary participation and their right to withdraw from the study at any time were emphasized.

6.7. STATISTICAL ANALYSIS:

Data were processed and analyzed using PC with statistical package for social science (SPSS ver. 23). Cronbach's alpha reliability test was used to measure the reliability of all tools. Its maximum value is (α=1.0) and the minimum accepted value is (α= 0.7); below this level the tool would be unreliable. Numbers and percentages from total were used to describe and summarize the demographic data. Comparisons within and between both groups were carried out using **Chi-Square (χ^2)** and **Fisher's exact (FET)** tests for grade of dyspnea, and fatigue severity. The level of significance decided for this study was P equal to or less than 0.05**(John, 2016).**

7. Results

Table (1): Frequency Distribution of Orthopedic Bedridden Patients according to their Socio-demographic Characteristics.

Socio-demographic Characteristics	n=60				Significance test
	Control group n= 30		Study group n= 30		
	No.	%	No.	%	
Age in years:					
▪ 20 < 30	3	10.0	2	6.7	Mc= 0.661 P=0.241
▪ 30 <40	5	16.6	2	6.7	
▪ 40 < 50	10	33.3	14	46.6	
▪ 50 ≤ 60	12	40.0	12	40.0	
X ± SD	46 ± 9.349		44 ± 8.328		
Gender:					
▪ Male	20	66.7	17	56.7	FET= 0.425 P=0.298
▪ Female	10	33.3	13	43.3	
Area of Residence:					
▪ Urban	7	23.3	10	33.3	FET= 0.728 P=0.390
▪ Rural	23	76.7	20	66.7	
Level of education:					
▪ Illiterate &Read and Write	12	40.0	13	43.3	Mc= 0.332 P=0.141
▪ Primary& Preparatory	5	16.6	2	6.7	
▪ Secondary	10	33.3	5	16.6	
▪ Higher education	3	10.0	10	33.3	
Occupation:					
▪ Housewife	8	26.6	12	40.0	Mc= 0.889 P=0.8971
▪ Businesses	2	6.7	1	3.3	
▪ Manual work	18	60.0	15	50.0	
▪ Retired	2	6.7	2	6.7	
Marital status:					
▪ Single	0	0.0	2	6.6	Mc= 0.611 P=0.624
▪ Married	18	60.0	19	63.3	
▪ Divorced and Widowed	12	40.0	9	30.0	
Duration of hospital stays					
▪ 7 -10 days	20	66.7	14	46.6	FET= 2.433 P=0.118
▪ More than 10 days	10	33.3	16	53.4	

X ± SD = Mean and Standard Deviation Mc=Monte Carlo Test

FET = Fisher's Exact Test. *Significant Difference at P Level ≤ 0.05.

Table (1): Frequency and percentage distribution of orthopedic bedridden patients according to their demographic characteristics:This table revealed that more than one third (33.3%) of the control group patients were among age group of (50 ≤ 60) while around half (46.6%) of the study group patients were among age group of (40 < 50).As regard patient's gender, about two third (66.7) of the control group ,and more than half (56.7%) of the study group were males. More than two-thirds (76.7%) of the control patients and two-third (66.7%) of the study were coming from urban area. More than one third of both control and study group patients (40%, 40.3%) were illiterate &read and write. More than half (60%) of the control group and one half of the study group (50%) had manual work. More than half of both control and study patients (60%, 63.3%) respectively were married. It was observed that about two third (66.7%) of the control group patients their hospital stay was between 7-10 days, while, more than half (53.4%) of the study group patients their hospital stay was more than 10 days.

Table (2): Frequency Distribution of Orthopedic Bedridden Patients according to their Clinical Data

Clinical Data	n=60				Significance test
	Control group n= 30		Study group n= 30		
	No.	%	No.	%	
Causes of fracture					
▪ Car accidents	17	56.7	13	43.3	Mc= 0.046 P=0.070
▪ Falling from height	10	33.3	17	56.7	
▪ Pathological condition	3	10.0			
Site of fracture					
▪ Femur	17	56.7	12	40.0	χ^2 = 3.762 P =0.159
▪ Hip	6	20.0	12	40.0	
▪ Pelvic	5	16.7	3	10.0	
▪ Spin	2	6.7	3	10.0	
Type of fracture					
▪ Closed fracture	8	26.7	8	26.7	χ^2 = 0.655 P =0.721
▪ Compound fracture	16	53.3	13	43.3	
▪ Comminuted fracture	6	20.0	9	30.0	
Type of surgery					
▪ Open reduction and internal fixation (ORIF).	15	50.0	12	40.0	χ^2 = 2.341 P =0.504
▪ Decompression surgery with instrumentation and bone graft.	3	10.0	5	16.7	
▪ Posterior spinal fusion surgery with instrumentation.	2	6.7	5	16.7	
▪ Arthroplasty	10	33.3	8	26.7	

Mc=Monte Carlo Test $\chi 2$ = Chi-Square.

FET = Fisher's Exact Test. *Significant Difference at P level ≤ 0.05.

Table (2): Frequency and percentage distribution of orthopedic bedridden patients according to their clinical data**:** It was obvious that car accident was the most common cause of fracture encountered among the control group patients representing more than half (56.7%), while falling from height was the most common cause of fracture encountered among the study group patients representing more than half (56.7%).As regards to the site of fracture more than half (56.7%) of the control group had fracture in femur. While more than one third (40.0%) of the study group had femur, and hip fracture. Also, more than half and more than one third (53.3%- 43.3%) of control and study group respectively had compound fracture. More and more, half and more than one third (50.0%- 40.0%) of the control and the study group were undergoing open reduction and internal fixation (ORIF) respectively.

Table (3): Comparison between both Studied Groups Study and Control regarding their Risk Factors to Develop Hospital-acquired Pressure Ulcers.

Risk Factors	n=60				Significance test
	Control group n= 30		Study group n= 30		
	No.	%	No.	%	
Sensory perception					
▪ Completely limited	**15**	**50.0**	**14**	**46.6**	Mc= 20.088 P=<0.001*
▪ Very limited	6	20.0	11	36.7	
▪ Slightly limited	6	20.0	3	10.0	
▪ No impairment	3	10.0	2	6.7	
Moisture					
▪ Constantly moist	**10**	**33.3**	**20**	**66.7**	Mc= 13.248 P=0.003*
▪ Often moist	8	26.7	4	13.3	
▪ Occasionally moist	6	20.0	4	13.3	
▪ Rarely moist	6	20.0	2	6.4	
Activity					
▪ Bed fast	**10**	**33.3**	**15**	**50.0**	Mc= 0.545 P=0.557
▪ Chair fast	8	26.7	7	23.4	
▪ Walks occasionally	5	16.7	4	13.3	
▪ Walks frequently	7	23.3	4	13.3	
Mobility					
▪ Completely immobile	**20**	**66.7**	**15**	**50.0**	Mc= 0.738 P= 0.750
▪ Very limited ▪	4	13.3	4	13.3	
▪ Slightly limited	3	10.0	7	23.4	

▪					
▪ No limitation	3	10.0	4	13.3	
Nutrition					
▪ Very poor	**10**	**33.3**	**15**	**50.0**	$\chi 2 = 3.185$ P =0.367
▪ Probably inadequate	8	26.7	9	30.0	
▪ Adequate	5	16.7	3	10.0	
▪ Excellent	7	23.4	3	10.0	
Friction & shear					
▪ Problem	**13**	**43.3**	**13**	**43.3**	$\chi 2 = 0.119$ P =0.924
▪ Potential problem	10	33.3	9	30.0	
▪ No apparent problem	7	23.4	8	26.7	
Total risk assessment					
▪ Mild risk	2	6.7	3	10.0	$\chi 2 = 4.843$ P =0.184
▪ Moderate risk	8	26.7	2	6.7	
▪ High risk	6	20.0	10	33.3	
▪ Severe risk	**14**	**46.7**	**15**	**50.0**	
X ± SD	12.5 ± 5.083		13 ± 2.952		

X ± SD = Mean and standard deviation

Mc=Monte Carlo test χ^2 = Chi-Square

*Significant difference at P level ≤ 0.05.

Table (3): Comparison between both patients' groups' regarding their risk factors to develop hospital-acquired pressure ulcers. Reveals that half and around half (50.0% - 46.6%) of both control and the study group respectively had completely limited sensory perception. Also, one third and two third (33.3% - 66.7%) of both the control and the study group respectively were constantly moist. Concerning their activity and nutritional status of the control and the study group were (33.3%- 50.0%) had bed fast activity and very poor nutrition respectively. More and more, (66.7%- 50.5%) of the control and the study group were completely immobile. Also, more than one third (43.3%) of both control and the study group had friction and shear problem. Moreover, around half and half (46.7%- 50.0%) of the control and the study group had severe risk assessment respectively. Also, there was a statistically significant difference between the control group and the study group in relation to sensory perception and moisture where P (=<0.001*- =0.003*) respectively.

Table (4): Comparison between both groups regarding Mean and standard deviation of repositioning frequency during nursing shifts.

Position	N= 60						P1	P2	P3
	Control group N= 30			Study group N= 30					
	1st week	2nd week	3rd week	1st week	2nd week	3rd week			
	X ± SD	X ± SD	X ± SD	X ± SD	X ± SD	X ± SD			
lower Fowler's position	41.733 ± 0.961	41.866 ± 0.730	41.866 ± 0.730	42.000 ± 0.000	42.000 ± 0.000	42.000 ± 0.000	t=1.522 p=0.134	t=1.005 p=0.319	t=2.314 p=0.002*
Minimum ± Maximum	40±42	40±44	40±44	42±42	42±42	42±42			
Left Semi's position	13.933 ± 0.365	27.666 ± 0.922	26.333 ± 0.016	41.066 ± 5.112	41.466 ± 2.912	41.066 ± 5.112	t=29.633 p=0.000*	t=31.465 p=0.000*	t=15.786 p=0.000*
Minimum ± Maximum	12±14	24±28	12±18	14±42	26±42	14±42			
prone position	0.667 ± 0.365	0.667 ± 0.365	0.667 ± 0.365	16.066 ± 9.506	27.333 ± 13.869	27.466 ± 13.498	t=8.866 p=0.000*	t=10.507 p=0.000*	t=10.871 p=0.000*
Minimum ± Maximum	0±2	0±2	0±2	2±42	2±42	6±42			
Right Semi's position	14.000 ± 0.000	14.000 ± 0.00	28.00 ± 0.024	40.933 ± 5.138	40.933 ± 5.138	41.533 ± 2.566	t=28.711 p=0.0.00*	t=28.711 p=0.000*	t=28.855 p=0.000*
Minimum ± Maximum	14±14	14±14	28±32	14±42	14±42	28±42			

t: paired t test. *Significant difference at **P** level ≤ 0.05 SD: standard deviation

P1=p value comparing between both group patients after the first week from using the innovated turning clock.
P2=p value comparing between both group patients after the second week from using the innovated turning clock.
P3=p value comparing between both group patients after the third week from using the innovated turning clock.

Table (4): Comparison between both groups regarding Mean and standard deviation of repositioning frequency during nursing shifts. This table illustrated that there was a highly a statistically significant difference between the control and study groups in relation to repositioning frequency during nursing shifts as regards to lower fowler position in the third week where P= (0.002*). Also, there was a highly a statistically significant difference between both group in relation to left semi's position, prone position, and right semi's position in the first, second and third week where p (=0.000*).

Table (5): Comparison between Both Groups' Patients regarding the Incidence of Hospital-Acquired Pressure Ulcers Post 3 Weeks of using the Innovated Turn Clock.

Pressure ulcers related items	n=60				Significance test
	Control group n= 30		Study group n= 30		
	No	%	No	%	
Incidence of hospital-acquired pressure ulcers					
▪ No	9	30.0	20	66.7	FET= 8.057
▪ Yes	21	70.0	10	33.3	P=0.004*
Location	n= 21		n= 10		
▪ Scapula	1	4.8	1	10.0	
▪ Olecranon	4	19.0	1	10.0	
▪ Sacrum	10	47.6	6	60.0	Mc= 0.028
▪ Heal	5	23.8	2	20.0	P= 0.033*
▪ Greater trochanter	1	4.8			
Stage:					
▪ Stage one	5	23.8	6	60.0	
▪ Stage two	6	28.6	2	20.0	
▪ Stage three	8	38.1	2	20.0	Mc= 15.980
▪ Stage four	2	9.5			P=<0.001*
Associated manifestations					
▪ Pain	19	90.4	8	80.0	
▪ Broken skin	8	38.0	6	60.0	
▪ Bad odor	4	19.0	4	40.0	
▪ Black skin	3	14.3	1	10.0	Mc= 40.197 P=<0.001*
▪ Burning sensation	9	42.8	10	100.0	
▪ Open wounds	5	23.8	2	20.0	
▪ Itching	18	85.7	8	80.0	

▪ Pus filled blisters	2	9.5			
Shape:					
▪ Irregular	15	71.4	5	50.0	Mc= 4.692 P= 0.112
▪ Round /oval	3	14.3	2	20.0	
▪ Butterfly	2	9.5	2	20.0	
▪ Bowl /Boat	1	4.8	1	10.0	
Size:					
▪ Length x width <4 sq cm	10	47.6	5	50.0	Mc= 14.874 P= 0.004*
▪ Length x width 4-<16 sq cm	6	28.6	4	40.0	
▪ Length x width 16.1-<36 sq cm	1	4.8	1	10.0	
▪ Length x width 36.1-<80 sq cm	4	19.0			
▪ Length x width >80 sq cm					
Necrotic tissue:	n= 21		n= 10		FET= 12.381 P=<0.001*
▪ Absent	13	62.0	8	80.0	
▪ Present	8	38.0	2	20.0	
Exudates:					
▪ None	13	62.0	8	80.0	Mc= 14.202 P= 0.002*
▪ Bloody	2	9.5			
▪ Serosanguineous	1	4.8			
▪ Serous	5	23.7	2	20.0	

N.B: **More than one answers were allowed

Mc=Monte Carlo test

FET = Fisher's exact test. *Significant difference at P level ≤ 0.05.

Table (5): Comparison between both groups' patients regarding the incidence of the hospital-acquired pressure ulcers post 3 weeks of using the innovated turn clock. This table shows the incidence of hospital-acquired pressure ulcers post 3 weeks of using the innovated turn clock. It can be seen that there was a statistically significant difference between the study and control group where p= 0.004 represented in 66.7% of the study group didn't develop pressure ulcer and just only 33.3% had pressure ulcer. On the other hand, 70% of control group had pressure ulcer and only 30% didn't develop pressure ulcer. Also, there was a statistical significance difference between the study and control group in relation to pressure ulcer location, stages, associated magnification, and size where p=0.033, 0.001, 0.001, 0.004 respectively.

As regarding, pressure ulcer location 60% and 20% of the study group pressure ulcer in sacrum and heal compared with 47.6%, 23.8% in control group. Also, 60% of the study group had stage one pressure ulcer, however, 38.1%, 28.6% of control group had stage three and two pressure ulcers respectively. In relation to the pressure ulcer size, it is clear that 50%, 40% of the study group had pressure ulcer Length x width <4 sq cm, and Length x width 4-<16 sq cm respectively.

8. Discussion

Traditionally, turning protocols to prevent the incidence of pressure ulcers have taken a "one size fits all" approach that is not patient centered. Constant position monitoring technology may enable nursing staff to better individualize patient care in response to the national push towards a patient-centered healthcare model. Turn clock continually tracks patient movement, credit is given for any adequate patient self-turns; thus, it may prevent unnecessary work and patient disruptions and improve staff efficiency **(Schutt S, 2018).**

The present study demonstrated a considerable variability **in the incidence of hospital acquired pressure ulcer** between the study and control group patients as about two-third of the study group didn't develop pressure ulcer and only one third developed pressure ulcer (more than half of them their ulcers were at sacrum, stage one and half of them the pressure ulcers were irregular with size <4 sq cm , all patients had burning sensation at the site of ulcer further more; more than two third of them hadn't exudates or necrotic tissues). On the other hand, around one third of the control group patients didn't develop pressure ulcer and more than two third of them developed pressure ulcer (around half of them their ulcers were at sacrum, more than one third of them their ulcers were third stage, more than two third of them the pressure ulcers were irregular, around half of them their ulcer's size were <4 sq cm, more than two third of patients had pain at the site of ulcer. Furthermore, around two third of them hadn't exudates or necrotic tissues).

A potential explanation for this finding is that the study group follow the innovated turn clock to cue patients' two-hourly repositioning as it ensures timely and consistently turning/repositioning of patients. Repositioning reduces the duration of pressure on bony prominences, which is the most critical element in the pressure ulcer formation process as pressure from lying or sitting on a particular part of the body can result in sustained deformation of soft tissues and a reduction in blood flow to the specific area. Turn clock, relieving or redistributing the pressure and reducing the risk of pressure ulcers.

Cueing supports storage of the regularly scheduled task of repositioning in staff memory that is required by the protocol and reinforces timely recall and performance of this task, even in the presence of distracting intrusive events. The result is improved consistency in meeting standards of care and reduction in undesired variation in the occurrence and timing

of care delivery therefore; the present study show highly a statistically significant difference between the study and control group in relation to repositioning frequency during nursing shifts as regards to lower fowler position in the third week. Also, there was a highly a statistically significant difference between both group in relation to left semi's position, prone position and right semi's position in the first, second and third week, which reflecting cyclical changes that occur in turn adherence over 24 hr.

These results were in congruent with, **(Wiens, 2010)** who indicated that staff cued with a turn clock were significantly more likely to reposition their patients approximately every two hours than staff who were not cued with a turn clock. **(Still, Dunlap&Buchman,2013)** found that cuing patients every 2 hours dramatically decreased the incidence of pressure ulcers and the majority of stage I and stage II ulcers appear to be preventable. Furthermore**; (Vanderwee, et al., 2007)** illustrated that in the experimental group, 16.4% patients developed a pressure ulcer lesion (grade 2-4), the incidence was not statistically significantly different between the two groups (P = 0.40). The severity (P = 0.65) and location (P = 0.19) of pressure ulcer lesions, and the time to developing them (P = 0.29) were also similar in both groups.

Regarding patients' risk factors to develop hospital-acquired pressure ulcers. The present study reveals that half and around half of both control and the study group respectively had completely limited sensory perception. Also, one third and two third of both the control and the study group respectively were constantly moist. Concerning their activity and nutritional status of the control and the study group were one third and half of both the control and the study group respectively had bed fast activity and very poor nutrition respectively. More and more, two third, half of the control and the study group were completely immobile. Also, more than one third of both the control and the study group had friction and shear problem. Moreover, around half and half of the control and the study group had severe risk assessment respectively. Also, there was a statistically significant difference between the control group and the study group in relation to sensory perception and moisture. Furthermore, regarding categorization of patient according to Braden scale that around half of both groups were falling in severe risk group.

These findings may be explained by that essential nutrient are necessary for maximum tissue health, healing potential and immunity to infection. **Impaired nutritional status** such as poor food intake, weight loss, low triceps, skin fold, low serum albumin, low hemoglobin and low total lymphocyte count can significantly predispose patient to pressure sores. Patient who has low protein levels are in negative nitrogen balance which in turn make them experience tissue wasting which inhibits tissue repaired. **Moisture** could be from perspiration, wound drainage, urine or stool. These act as irritants and place the patient at risk of skin breakdown (**Afolayan1&Gambar, 2015)** .**Immobility** make the patients unable

to move independently as more than half of the control group patients had fracture in femur, and more than one third of the study group patients had fracture in femur and hip which in turn make them subjected to sustained static friction & shear which are the most serious element in the pressure ulcer development. This was supported by a study of **(Al-Shadedi,2018)** and (**Alderden et, al. 2017)** who found that categorization of patient according to Braden scale revealed that most of patients were falling in the severe risk and moderate risk groups and the least were in low risk.

Even though numerous different factors were found in this study and have an impact in pressure ulcer development, more than one third of the control group patients were among age group of ($50 \leq 60$) while around half of the study group patients were among age group of ($40 < 50$). as **ageing** is a physiological process which brings about several changes in the organs and systems of the body. One of these changes is that which takes place in the skin and its supporting structures, making the sick persons more prone to impaired skin integrity. This result was in congruent with the results of **(Afolayan1& Gambar, 2015) and (Tubaishat, Anthony &Saleh2011)** who found that more than one third of orthopedic patient who developed pressure ulcer were among age group of 55-64.

The study sample were bed ridden patients and adding other factor as **long hospital stay** make the patient at a great risk to develop pressure ulcer, about two third of the control group patients their hospital stay was between 7-10 days, while, more than half of the study group patients their hospital stay was more than 10 days. This result was in harmony with **(Moon M, 2017)** who found a relation between increase in the number of inpatient days and PUs developments.

Finally, while the risk factors to develop pressure ulcers are considered to be the same among both groups, the difference among both groups in relation to the incidence of hospital acquired pressure ulcer can be attributed to non-compliance of nurses or caregiver to turning schedule in the control group. Innovative technologies as turning o'clock imperative in improving health care delivery and clinical outcomes for patients and ensure effective of turning with equal time intervals.

9. Conclusion

Based on the findings of the present study, it can be concluded that most pressure ulcers can be prevented. At the end, the two groups had statistically significant differences in terms of pressure ulcer occurrence. So, it can be said that of a turn clock to cue patients' two-hourly repositioning on the prevention of hospital-acquired pressure ulcers among orthopedic bedridden patients. Turn clock to cue patients' two-hourly repositioning is much more effective and less costly in the prevention of the pressure ulcers.

10. Recommendation

Based on the findings of the present study, it can be recommended that:

More attention should be taken from departments head nurse about nurse's application of pressure ulcer preventive strategies.

Continuous in-service training and educational program must be designed for nurses to enhance their knowledge and practice regarding pressure ulcer preventive strategy.

Availability of turning clock in health care settings provide care for bedridden patients.

Continuous in-service training must be provided for nurses about importance and how to use turning clock to cue patient positioning.

11.References

Afolayan, J. A., Afolayan, A. M., & Gambari, A. R. Y. (2015). Prevention of Pressure Sore Development in Orthopedic Wards of Selected Nigeria Teaching/Specialist Hospitals. *Journal of Health,* Medicine and Nursing, 14(1), P. 28-35.

Agrawal, K., & Chauhan, N. (2019). Pressure Ulcers: Back to the Basics. *Indian Journal of Plastic Surgery*: Official Publication of the Association of Plastic Surgeons of India, 45(2), P. 244.

Alderden J., Rondinelli J., Pepper, G., Cummins, M., Whitney, J. (2017). Risk Factors for Pressure Injuries among Critical Care Patients: A Systematic Review. *Int J NursStud*, P. 71: 97-114.

Al-Shadedi, A. M. (2018). Prevalence of Pressure Ulcers in Orthopedic Patients. *Iraq. American Journal of Nursing,* 107(4), P. 44-53.

Amin, M. R., Haque, M. M., Saha, P. K., Zai, S. Z. E., Hossain, S. M., &Akter, S. (2018). Pattern and Risk Assessment of Bedsore in Hospitalized Patients. *ChattagramMaa-O-Shishu Hospital Medical College Journal*, 13(2), P. 12-16.

Assefa, T., Mamo, F., & Shiferaw, D. (2017). Prevalence of Bed Sore and its Associated Factors among Patients Admitted at Jimma University Medical Center, Jimma Zone, Southwestern Ethiopia, Cross-sectional study. *Orthopedics and Rheumatology Open Access Journals*, 8(4), P. 74-81.

Bahammam, A. (2011). Sleep from an Islamic Perspective. *Ann Thorac Med*, 6(4): P. 187–192.

Bergstrom, N. (1988). The Braden Scale for Predicting Pressure Sore Risk. Omaha, NE: University of Nebraska Medical Center. Available at:www.bradenscale.com.

Berlowitz, D., Lukas, C., Parker, V., Niederhauser, A., Silver, J., Logan, C., & Ayello, E. (2011). Preventing Pressure Ulcers in hospitals. Available at:

http://www.ahrq.gov/professionals/systems/longtermcare/resources/pressureulcers/pressureulcertoolkit/index.html.
Borgen, T., Bjørnerem, Å. Solberg, L. B., Andreasen C., Brunborg, C., Stenbro, M. B., & Eriksen, E. F. (2019). High Prevalence of Vertebral Fractures and Low Trabecular Bone Score in Patients with Fragility Fractures: A Cross-sectional Sub-study of No FRACT. Bone, 122, 14-21.
Chayakulkeeree, M., Junsriwong, P., Keerasuntonpong, A., Tribuddharat, C., & Thamlikitkul, V. (2019). Epidemiology of Extended-spectrum Beta-lactamase Producing Gram-negative Bacilli at Siriraj Hospital, Thailand. *Southeast Asian Journal of Tropical Medicine and Public Health*, 36(6), 1503.
Coleman, S., Gorecki, C,. Nelson, EA. (2013) Patient Risk Factors for Pressure Ulcer Development: Systematic Review. *Int J Nurs Stud*; 50(7): P. 974-1003.
Dilie, A., & Mengistu, D. (2017). Assessment of Nurses' Knowledge, Attitude, and Perceived Barriers to Expressed Pressure Ulcer Prevention Practice in Addis Ababa Government Hospitals, Addis Ababa, *Ethiopia. Advances in Nursing*, 2017, P. 1-14.
Fletcher J. (2017). Reposition Patients Effectively to Prevent Pressure Ulcers. Wounds International; 8 (1), P. 7-11.
Gillespie, B. M., Walker, R. M., Latimer, S. L., Thalib, L., Whitty, J. A., McInnes, E., &Chaboyer, W. P. (2020). Repositioning for Pressure Injury Prevention in Adults. Cochrane Database of Systematic Reviews, 2(6), P. 108.
Hoogendoorn, I., Reenalda, J., Koopman, BFJM, Rietman, JS.(2017) The Effect of Pressure and Shear on Tissue Viability of Human Skin in relation to the Development of Pressure Ulcers: A Systematic Review. *J Tissue Viability*. 26(3): P. 157-71.
Lyder, C. H. (2020). Pressure Ulcer Prevention and Management. *Jama*, *289*(2), P. 223-226.
Moon, M., Lee, SK. (2017). Applying of Decision Tree Analysis to Risk Factors Associated with Pressure Ulcers in Long-term Care Facilities. Health Inform Res, 23(1): P. 43-52.
Parker, M., & Johansen, A. (2016). Hip fracture. *BMJ*, *333*(7557), P. 27-30.
Schutt S. (2018). Pilot Study: Assessing the Effect of Continual Position Monitoring Technology on Compliance with Patient Turning Protocols. *Nursing open*, 5(1): P. 21-28.
Still, M., Dunlap, M., Buchman, T. (2013). The Turn Team: A Novel Strategy for Reducing Pressure Ulcers in the Surgical Intensive Care Unit. The American College of Surgeons, 216(3): P. 373-379.
Tubaishat, A., Anthony, D., Saleh, M. (2011). Pressure Ulcers in Jordan: A Point Prevalence Study. *J Tissue Viability*, 20(1): P. 14-9.
Vanderwee K1, Clark M, Dealey C, Gunningberg L, Tom Defloor. (2007). Pressure Ulcer Prevalence in Europe: A Pilot Study. *Journal of Evaluation in Clinical Practice*, 13(2): P. 227-235.

Wiens J. (2010). The Effect of Using A Turn Clock to Cue Patient Repositioning for Pressure Ulcer Prevention in an Acute Care Setting. Published Master's Theses. Fort Hays State University.Availableat:https://scholars.fhsu.edu/cgi/viewcontent.cgi?article=1189&contexttheses.

Woodhouse, M., Worsley, P. R., Voegeli, D., Schoonhoven, L., & Bader, D. L. (2019). How Consistent and Effective are Current Repositioning Strategies for Pressure Ulcer Prevention? Applied Nursing Research, P. 48, 58-62.

Wound Ostomy and Continence Nurses Society. (2010). Guideline for Prevention and Management of Pressure Ulcers: 2 WOCN Clinical Practice Guidelines Series. Mount Laurel, NJ: Wound Ostomy and Continence Nurses Society.

Yap, T. L., Kennerly, S. M., Bergstrom, N., Hudak, S. L., & Horn, S. D. (2017). An Evidence-based Cue-selection Guide and Logic Model to Improve Pressure Ulcer

الملخص العربي

تأثير الساعة ساعة مبتكرة لتحفيز تغير وضع المريض كل ساعتين على الوقاية من قرح الفراش المكتسبة من المستشفى بين مرضى العظام طريحي الفراش

المقدمة: لا تزال قرح الفراش تشكل مصدر قلق صحي كبير مع تقدم العمر وطول فترة الرعاية في بعض أماكن الرعاية الصحية. يمكن أن تقترن قرح الفراش بالألم ، المعاناة ، فقدان بعض الوظائف ، إطالة مدة الإقامة ، زيادة معدلات الإصابة بالأمراض والوفيات ، بالإضافة الي العبء المالي الكبير. و لذلك تعد إعادة وضع المرضى كل ساعتين عنصرًا أساسيًا في منع حدوث قرح الفراش.

الهدف من الدراسة: معرفة تأثيرإستخدام ساعة مبتكرة لتحفيز تغير وضع المريض كل ساعتين على الوقاية من قرح الفراش المكتسبة من المستشفى بين مرضى العظام طريحي الفراش.

إفتراضات البحث: مرضى جراحة العظام طريحي الفراش الخاضعين لإستخدام ساعة تحفيز تغيير وضع المريض كل ساعتين معدل حدوث قرح الفراش المكتسبة من المستشفي سيكون أقل مقارنة بالمرضي الخاضعين للرعاية التمريضية الروتينية.

منهجية البحث: تم إستخدام تصميم بحثي شبه تجريبي لعينة ملائمة مكونة من 60 مريضًا من مرضى العظام طريحي الفراش الموجودين بأقسام جراحة العظام بمستشفى الحضرة الجامعي – جامعة الإسكندرية.

تم إستخدام ثلاث أدوات لتجميع البيانات من المرضي:

الأداة الأولي: إستبيان مقابلة لجمع بيانات عن الخصائص الاجتماعية والديموغرافية والبيانات الإكلينكية لمرضى العظام طريحي الفراش.

الأداة الثانية: أداة تقييم معدل إعادة وضع المرضي أثناء نوبتجيات الرعاية الصحية .

الأداة الثالثة: أداة تقييم قرح الفراش المكتسبة من المستشفي.

النتائج: لقد أسفرت نتائج البحث عن الأتي لم يكن هناك فرق ذو دلالة إحصائية بين المجموعتين فيما يتعلق بالخصائص الاجتماعية والديموغرافية. بينما هناك فرق ذو دلالة إحصائية عالية بين المجموعتين فيما يتعلق بحدوث قرح الفراش.

التوصيات : توفر ساعة تحفيز تغيير وضع المريض في أماكن الرعاية الصحية للمرضى طريحي الفراش أمر بالغ الأهمية لمنع حدوث قرح الفراش المكتسبة من المستشفى.