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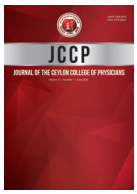

Research

Effectiveness of using turning clocks for the prevention of pressure ulcers in a neurology and stroke rehabilitation unit

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ABSTRACT

Background: Pressure ulcers remain a significant healthcare challenge, particularly in patients with limited mobility. Frequent repositioning is a cornerstone prevention strategy, yet adherence to repositioning schedules remains suboptimal in clinical practice. Visual cues have shown promise in improving compliance with repositioning protocols, but evidence from resource-limited settings is scarce. This study aimed to assess the effectiveness of introducing a turning clock with customised repositioning schedules to prevent pressure ulcer incidence and to promote adherence to a two-hourly repositioning practice in a neurology and stroke rehabilitation unit.

Methods: A pre- and post-intervention study was conducted in a 22-bedded neurology and stroke rehabilitation unit at Teaching Hospital Rathnapura. Patients unable to reposition independently were included. Baseline data on pressure ulcer incidence and repositioning adherence were collected over ten months (March–December 2022). Following the implementation of turning clocks in January 2023, similar assessments were conducted for a further 10 months (January–October 2023). Both groups received comparable pressure-redistributing surfaces.

Results: The pre-intervention period included 40 patients, with 662 patient-days and 10 pressure ulcer incidents. Post-intervention assessment included 38 patients, with 680 patient-days and 3 pressure ulcer incidents ($p < 0.001$). Adherence to the two-hourly repositioning schedule improved significantly with the turning clock intervention.

Conclusion: The implementation of turning clocks significantly reduced the incidence of pressure ulcers and improved the consistency of repositioning practice. This simple, low-cost visual cue intervention shows promising impact on prevention of pressure ulcers in resource-limited settings.

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Introduction

Pressure ulcers, also known as pressure injuries or bedsores, pose a significant burden on healthcare systems worldwide, affecting patients' quality of life and imposing substantial economic costs on healthcare institutions.[1,2] These wounds develop when prolonged pressure on the skin reduces blood flow to vulnerable areas, causing tissue damage that can range from superficial skin changes to deep tissue injury involving muscle and bone.[1] Patients with neurological conditions, particularly those recovering from stroke, face an elevated risk due to impaired mobility, sensory deficits, and prolonged bed rest.

Preventing pressure ulcers is more effective and cost-efficient than treating them, making prevention strategies a priority in clinical care.[3,8] Among various preventive measures, regular patient repositioning stands out as a fundamental intervention supported by extensive clinical evidence.[3,4,5] Current guidelines recommend repositioning immobile patients at least every two hours to relieve pressure on bony prominences and promote tissue perfusion.[1] However, despite these clear recommendations, adherence to repositioning protocols in clinical practice remains inconsistent, with studies reporting compliance rates of 30% to 70% across various healthcare settings.

Multiple factors contribute to suboptimal adherence to repositioning, including a high nursing workload, competing care priorities, inadequate staffing, and a lack of systematic monitoring.[6,8] Visual reminder systems have emerged as a potential solution to improve compliance, with turning clocks being one such innovation.[6] A turning clock is a simple bedside tool that displays the patient's current position and the time of the next required turn, serving as a visual cue for healthcare staff.

While international literature provides some evidence supporting the use of visual cues to improve adherence,[6,15] research from Sri Lankan healthcare settings remains limited. The unique challenges of resource-constrained environments, including nurse-to-patient ratios and availability of pressure-relieving equipment, necessitate locally relevant evidence. Furthermore, the specific context of neurology and stroke rehabilitation units, where patients often experience prolonged immobility and multiple comorbidities, requires targeted investigation.

This study aimed to address this knowledge gap by evaluating the effectiveness of introducing turning clocks in a neurology and stroke rehabilitation unit at Teaching Hospital Rathnapura. We hypothesised that introducing turning clocks would improve adherence to two-hourly repositioning schedules and, consequently, reduce the incidence of pressure ulcers among immobile patients.[9,10] This quality improvement initiative marks the first documented implementation of a visual reminder system in a Sri Lankan rehabilitation setting.

Methods

Study Design and Setting

This prospective pre- and post-intervention study was conducted in the 22-bedded neurology and stroke rehabilitation unit at Teaching Hospital, Rathnapura, Sri Lanka. The unit provides specialised care for patients with various neurological conditions, including stroke, spinal cord injuries, traumatic brain injury, and neurodegenerative disorders. The study was approved by the hospital's scientific review committee as a quality improvement initiative.

Study Population

Patients were eligible for inclusion if they met the following criteria: (1) admitted to the neurology and stroke rehabilitation unit during the study period, (2) unable to reposition independently due to neurological deficits or physical disabilities, and (3) expected length of stay exceeding seven days. Exclusion criteria included patients with pressure ulcers on admission, those transferred from other units with incomplete documentation, and those who were ambulatory or able to reposition independently.

Study Periods

Pre-intervention period (March to December 2022): During this ten-month baseline period, standard care practices were maintained. Nursing staff were expected to reposition patients every two hours, as documented in patient charts and in accordance with existing unit protocols. No visual reminder systems were in use during this period.

Post-intervention period (January to October 2023): Following a brief implementation phase in January 2023, data collection continued for ten months. Turning clocks were placed at the bedside of all eligible patients, and nursing staff were trained in their use and documentation requirements.

Intervention: The turning clock

The turning clock was a customised visual tool designed specifically for this study. It consisted of a circular clock face and an inner rotatable circular diagram divided into sections representing different patient positions (supine, right lateral, left lateral, and semi-Fowler's, where appropriate). The device featured a movable indicator showing the current patient position, time markers for the next scheduled turn, clear visual representations of recommended positions, a rotatable diagram for selecting the initial position according to the patient's preference, and a laminated surface for easy cleaning and reuse.

Each turning clock was mounted on a visible surface at the patient's bedside. Nursing staff were instructed to update the clock after each repositioning manoeuvre, rotating the

Figure 1. The turning clock device used in this study (adjustable time-indicating arm and rotatable inner face).

indicator to reflect the new position and the next scheduled time. The two-hourly repositioning schedule remained consistent with pre-intervention practice, while the visual cue served as a structured reminder.

Prior to implementation, all nursing staff received training sessions covering: the rationale for pressure ulcer prevention; the proper use of the turning clock; correct positioning techniques; documentation requirements; and the importance of adhering to the repositioning schedule.

Outcome Measures

Primary outcome: Incidence of hospital-acquired pressure ulcers, defined as any new pressure ulcer (Stage I or higher according to the National Pressure Injury Advisory Panel classification)[1] developing during the hospital stay among patients without pressure ulcers at admission.

Secondary outcome: Adherence to two-hourly repositioning schedules was assessed through random point surveillance (random, uninformed, investigator-initiated checks). During each 10-month period, 20 random checks were done. Adherence was calculated as the percentage of scheduled position changes completed within 30 minutes of the designated time.

Data Collection

Data were collected prospectively throughout both study periods. For each eligible patient, the following information was recorded: demographic data (age, gender), primary diagnosis, mobility status, length of stay, use of pressure-redistributing surfaces, daily skin assessments, and the development and stage of any pressure ulcers. Pressure ulcer risk was assessed using the Braden Scale.[17] Daily skin assessments were performed by nursing staff during routine care, with any skin changes documented and reviewed by the ward medical team. Pressure ulcer staging followed the National Pressure Injury Advisory Panel classification system.

Standard Care Measures

Throughout both study periods, all patients received standard pressure ulcer prevention measures, including pressure-redistributing mattresses (air mattresses based on risk assessment), nutritional assessment and support, skin moisturisation protocols, incontinence management, proper positioning techniques with pillows and cushions, and regular skin assessments.[1,8] These measures remained consistent between the pre- and post-intervention periods to isolate the effect of the turning clock intervention.

Statistical Analysis

Pressure ulcer incidence rates were calculated as the number of new pressure ulcers per 100 patient-days for each study period. The chi-square test was used to compare the incidence rates between pre- and post-intervention periods. A p-value of less than 0.05 was considered statistically significant. Descriptive statistics were used to summarise patient characteristics and repositioning adherence rates. Data analysis was performed using appropriate statistical software.

Results

During the pre-intervention period (March to December 2022), 40 patients who met the inclusion criteria were enrolled, accounting for 662 patient-days of observation. The post-intervention period (January to October 2023) included 38 eligible patients with 680 patient-days. Patient characteristics were similar between the two groups (Table 1), with the majority of patients admitted for stroke rehabilitation or management of other chronic neurological conditions.

Pressure ulcer incidence

During the pre-intervention period, 10 incidents of pressure ulcers were documented among the 40 patients (25% of patients), resulting in an incidence rate of 1.51 pressure ulcers per 100 patient-days. The anatomical locations included the sacrum (n = 6), heels (n = 3), and one case involving the left trochanter.[9,10] All pressure ulcers were identified as Stage I or Stage II injuries.

Following the implementation of turning clocks, 3 pressure ulcer incidents were reported among 38 patients in the post-intervention period (7.8% of patients), representing an incidence rate of 0.44 pressure ulcers per 100 patient days. All three incidents were Stage I pressure injuries.

The reduction in pressure ulcer incidence from 1.51 to 0.44 per 100 patient days represented a 71% relative

Table 1
Patient Characteristics.

Characteristic	Pre-intervention (n = 40)	Post-intervention (n = 38)
Mean age (years)	64.2 ± 12.5	62.8 ± 14.1
Male gender (%)	58.8	61.9
Primary diagnosis – Stroke (%)	76.5	71.4
Mean Braden Score*	13.4 ± 2.1	13.1 ± 2.3
Mean length of stay (days)	11.7 ± 5.8	8.8 ± 4.2
Total patient-days	662	680

Values presented as mean ± standard deviation or percentage where appropriate. *Braden Scale: higher scores indicate lower pressure ulcer risk (range 6–23; score ≤ 18 indicates risk).

Table 2
Pressure ulcer outcomes.

Outcome	Pre-intervention	Post-intervention
Number of patients	40	38
Total patient-days	662	680
Number of pressure ulcers	10	3
Incidence per 100 patient-days	1.51	0.44
Percentage of affected patients	25%	7.8%
p-value†	**< 0.001**	

†Chi-square test used for statistical comparison.

risk reduction. This difference was statistically significant ($p < 0.001$), demonstrating a substantial impact of the turning clock intervention on pressure ulcer prevention (Table 2).

Adherence to repositioning schedule

Adherence to the two-hourly repositioning schedule showed marked improvement following the introduction of turning clocks. During the pre-intervention period, random point surveillance revealed that repositioning occurred as scheduled (within 30 minutes of the designated time) in approximately 58% of expected repositioning episodes.

In the post-intervention period, adherence improved to approximately 89% of scheduled repositioning episodes, with more consistent documentation patterns. The turning clock served as both a reminder for nursing staff and a visible accountability mechanism.

Discussion

This pre- and post-quality improvement study demonstrated that introducing a simple bedside turning clock as a visual cue in a neurology and stroke rehabilitation unit was associated with a 71% relative reduction in hospital-acquired pressure ulcer incidence (from 1.51 to 0.44 per 100 patient-days, $p < 0.001$) and a substantial improvement in adherence to two-hourly repositioning (from 58% to 89%). These findings support the premise that a low-cost visual cueing tool can meaningfully bridge the gap between guideline recommendations and bedside practice in a resource-limited setting.

Our study population, predominantly stroke patients with a mean Braden Score of approximately 13,[17] represents a group particularly susceptible to pressure ulcer development. The incidence of pressure ulcers in patients with stroke-related paralysis has been reported to be as high as 20–70%, with prolonged bed rest and local tissue compression being the principal contributing mechanisms.[11] The predominance of sacral and heel injuries in our cohort, which accounted for the majority of the ten pre-intervention cases, is consistent with patterns documented in neurorehabilitation settings, where supine positioning is predominant among immobile patients. A seven-year retrospective study of a neurorehabilitation unit similarly identified the heel and sacrum as the most common pressure ulcer sites, with stroke and spinal cord injury among the most common primary diagnoses.[12] The restriction of all post-intervention injuries to Stage I, compared with pre-intervention injuries across both Stage I and Stage II, suggests that increased repositioning frequency may also have facilitated earlier detection of skin changes during routine turning, an important secondary benefit of adherence to structured repositioning schedules.

The pre-intervention adherence rate of 58% recorded in this study reflects a well-documented global challenge. Turning and repositioning protocols are generally subject to low staff adherence, often below 60%, with the mean time between documented turns averaging 6.6 hours in some settings.[13] Competing clinical demands, communication gaps between nursing staff on successive shifts, and the absence of a visible prompt at the point of care all contribute to this deficit. The turning clock directly addressed each of these barriers. Its bedside format made the current position and the next scheduled turn immediately visible to any staff member passing the patient, eliminating reliance on separate chart review. Many international guidelines acknowledge that auditory or visual reminders can be used to increase adherence to repositioning schedules.[1]

The 89% post-intervention adherence achieved with this low-technology tool is comparable to findings from studies using far more sophisticated systems. A pre-test and post-test study employing wearable triaxial accelerometer sensors to cue nurses in a medical intensive care unit reported that repositioning compliance improved from 55% to 89%, and concluded that visual cueing about patients' mobility needs is associated with increased compliance with the facility repositioning protocol.[13] The fact that an equivalent adherence level was achieved in our study without electronic infrastructure is particularly significant for resource-limited hospitals across South Asia and other low- and middle-income settings, where wearable cueing technology remains unaffordable.

The pre-intervention pressure ulcer incidence rate of 1.51 per 100 patient days (25% of patients affected) is broadly consistent with published rates in comparable neurological inpatient populations. A meta-analysis of pressure ulcer prevalence in stroke patients reported a pooled prevalence of 9.53% among those without structured medical services, highlighting how the care environment and adherence to preventive protocols significantly influence outcomes.[14] Following the intervention, the incidence fell to 0.44 per 100 patient-days (7.8% of patients), with all three remaining cases being Stage I injuries, suggesting near-complete prevention of clinically significant tissue breakdown. A systematic review of pressure ulcer prevention interventions found that bedside visual reminders integrated into the

patient care environment may be useful in prompting healthcare professionals about the need for repositioning and mobilisation,[15] and our results provide prospective clinical evidence in support of this recommendation.

The multicomponent nature of care in this unit, with pressure-redistributing mattresses, nutritional support, and incontinence management remaining consistent across both study periods, means that the turning clock was introduced into an environment where standard preventive measures were already in place. The observed improvement in outcomes can therefore be most plausibly attributed to the specific enhancement of repositioning adherence facilitated by the visual reminder, rather than to changes in other aspects of care.

The structured training delivered to nursing staff prior to the implementation of the turning clock, covering the rationale for pressure ulcer prevention, correct positioning techniques, and proper use of the turning clock, likely amplified the tool's effect. Evidence indicates that challenges such as inadequate staff education and limited capacity to adhere to pressure injury guidelines can hinder the effectiveness of prevention interventions, even when the evidence base is strong.[16]

Limitations

This study has several important limitations. The pre- and post-design without a concurrent control group precludes definitive causal attribution of the observed reduction to the turning clock alone. Hawthorne effects, secular trends, and increased staff awareness may have contributed. The study was conducted in a single unit at a single centre in Sri Lanka, limiting generalisability.

Conclusion

The turning clock represents a practical, low-cost intervention that significantly improved repositioning adherence and was associated with a marked reduction in the incidence of hospital-acquired pressure ulcers in a neurology and stroke rehabilitation unit. Its simplicity, minimal cost, and ease of implementation make it a potentially scalable tool for pressure ulcer prevention across resource-limited healthcare settings. Future research using randomised controlled designs and longer follow-up periods is warranted to confirm these findings and evaluate sustained effectiveness.

Author declaration

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The study was self-funded.

Conflicts of interest

There are no conflicts of interest.

Ethical Declaration

This study was approved by the Scientific Review Committee of the Teaching Hospital, Ratnapura, Sri Lanka.

Artificial Intelligence use disclosure

An artificial intelligence tool (Claude, Anthropic) was used in the preparation of this manuscript to assist with grammatical and structural refinement of the language and the organisation of sections within the manuscript. All AI-assisted content was reviewed, verified, and validated by the authors, who take full responsibility for the accuracy, integrity, and originality of the submitted work.

Criteria for Authorship

All authors have met the established criteria for authorship. Each contributed substantially to the conception and design of the study, data collection, analysis and interpretation. All authors participated in drafting or critically revising the manuscript and approved the final version for publication.

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