

Can an alternative pillow solution offer better pressure redistribution during prone positioning?

Ambreen Chohan¹, Yik Nok Bryan Lee¹, Catherine Edward², Stephen Sunday Ede¹, Jo-Anne Webb³

¹Allied Health Research Unit, University of Central Lancashire, Preston, UK

²Physiotherapy Department, Lancashire Teaching Hospitals NHS Foundation Trust, Preston, UK.

³Adapt and Live, Disabled Living, Manchester, UK.

Email: AChohan@uclan.ac.uk

Summary

Prone positioning is an effective non-invasive technique used to improve ventilation in patients with respiratory distress. Effective pressure management is core to maintaining comfort and ensuring patient compliance, whilst preventing pressure injury. This within-subject comparative study on healthy adults was designed to explore the effect of three conscious prone positioning methods (standard pillow only, hospital three-pillow solution, new prone pillow solution) on surface-body interface pressure. Results showed a new alternative prone positioning solution reduced Peak Pressure Index (PPI) in key areas (trunk and head) compared to standard hospital proning solutions. Comfort ratings for both the pillow proning solutions were significantly better than proning with head support only. This study showed a new low-tech alternative proning pillow solution had the potential to improve tolerance and adherence in patients requiring prone positioning.

Introduction

Prone positioning or “proning” is a technique to improve blood oxygenation using standard pillows for support by turning and lying the patient on their abdomen [1]. Whilst originally developed in conjunction with mechanical intubation to manage ARDS in unconscious patients, a non-invasive approach was recently adopted and incorporated as first-line management to treat COVID-19 patients whilst conscious to promote self-management and reduce staff manual handling [2]. Sustained pressure, force or shear applied to tissue from proning is a significant causative factor in pressure ulcer formation, commonly seen in community and hospital settings due to inadequate support surfaces which would affect their tolerance [3,4]. Effective pressure management and comfort during prone positioning are core to patient tolerance. This study explored the impact of a new pillow solution on interface pressure and comfort during prone positioning compared to standard hospital solutions.

Methods

In this quantitative healthy cohort study, surface-body interface pressures were calculated for three different conditions: a standard hospital pillow at the head (HPO), a three-pillow standard hospital proning solution (3HP), and a new two-pillow prone positioning solution (NPP) with additional standard head pillow (Levitex Foams Ltd., UK) [5]. Contact surface area, Peak and mean pressure, Peak Pressure Index (PPI) at the head, trunk, pelvis, legs (Sumed, UK), and subjective comfort (VAS Scale) were calculated for all conditions over 21 minutes, (inc. 6 minutes settling time).

Results and Discussion

Twenty healthy volunteers (11F, 9M; Age: 31.6 years) participated in this study. The new alternative prone pillow solution (NPP) lowered PPI at the trunk compared to standard pillow proning (3HP) ($p<0.017$) and proning with head support only (condition 1) ($p<0.001$) (Table 1). The new alternative solution significantly reduced head PPI compared to lying with only a head support. Both pillow proning conditions (3HP & NPP) significantly improved comfort compared to standard pillow only (HPO). The new alternative prone pillow solution improved pressure management and comfort, compared to existing solutions.

Table 1: Mean (σ) data for all body interface outcomes.

Region of Interest	HPO	3HP	NPP
	Mean Pressure (mmHg)		
Full Body	22.22 (2.16) ^	20.95 (2.01) ^	21.9 (1.61) ^
Average Contact Surface Area (cm ²)			
Full Body	2728.2 (659.9)	2753.3 (854.7)	2890.5 (584.7)
Head	316.2 (125.5) ^	221.8 (83.0) ^	209.0 (78.4) ^
Trunk	1023.6 (355.9)	1164.4 (321.8)	1038.1 (412.2)
Pelvis	425.6 (152.1) ^	551.5 (185.6) ^	593.5 (215.5) ^
Right leg	420.8 (120.7)	435.9 (135.1)	413.1 (112.8)
Left leg	417.2 (124.1)	422.2 (120.7)	409.8 (118.2)
Peak pressure Index (mmHg)			
Head	30.6 (6.3) ^	28.3 (5.2) ^	26.5 (3.3) ^
Trunk	39.1 (5.2) ^	37.1 (5.9) ^	34.2 (3.4) ^
Pelvis	28.2 (5.4)	26.5 (6.0)	26.5 (5.3)
Right leg	48.2 (13.8)	46.1 (20.3)	46.8 (16.0)
Left leg	45.2 (9.8)	49.2 (20.2)	44.6 (16.6)
Peak Pressure (mmHg)			
Head	41.64 (10.4) ^	36.3 (5.9) ^	37.2 (5.9) ^
Trunk	45.5 (9.9) ^	41.3 (7.8) ^	37.9 (3.83) ^
Pelvis	37.7 (12.2)	32.1 (7.8)	33.2 (4.4)
Right leg	82.8 (48.0)	73.9 (31.7)	94.1 (61.01)
Left leg	67.4 (21.9)	86.3 (54.3)	85.2 (48.2)
Comfort Score			
Overall Score (0-10)	5.7 (1.9) ^	7.2 (1.6) ^	7.4 (1.2) ^

Conclusions

Earlier intervention may be offered at home with the new low-tech prone pillow solution. This solution could improve tolerance and adherence to patient proning, offering potential for self-management, reducing hospital stay while improving outcomes.

Acknowledgments

This study was partially funded by the European Regional Development Fund UNITE with business programme.

References

- [1] Guérin C et al (2013). *New Eng J Med*; **368**; 2159-68.
- [2] Chad, T & Sampson C (2020). *Clin. Med (Lond)*; **20**(4).
- [3] Alderden, J et al. (2017). *Int. J of Nurs Stud*; **71**: 97–114.
- [4] Joshi D et al. (2015) *Am J Resp Crit Care Med*; **191**:A3138.
- [5] Laha S et al. (2021)DOI: [10.17030/uclan.data.00000291](https://doi.org/10.17030/uclan.data.00000291)