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Combined Effect of Intercostal Stretch Technique and Perioral Stimulation Technique on Respiratory Rate and Saturation of Peripheral Oxygen Among ICU Patients

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ABSTRACT

Background and objective: Neurological intensive care unit (ICU) is a rapidly developing sub-specialty of neurosciences. Intensive care management includes vigilant nursing care, medical care and physiotherapy, irrespective of their specialty such as neurological ICU, cardiac ICU, or trauma ICU. In this study we have compared intercostal stretch and perioral stimulation in adults on spontaneous mode of ventilation and checked effects on respiratory rate and peripheral oxygen saturation. Since no one has compared these two techniques and also information regarding perioral stimulation technique is limited, so the aim of our study is to compare both these techniques in order to gain a conclusion by observing and comparing the results.
Materials and methods: 30 patients on spontaneous mode of ventilation are included in the study. They are randomly divided into two different groups. Group A: 15 (subjects receiving intercostal stretching) and group B: 15 (subjects receive perioral stimulation)
Result: There was a significant decrease in respiratory rate and also significant improvement in SpO2 ($p < 0.001$) in ICU patients. Both intercostal stretching well as perioral stimulation is effective in ICU.
Conclusion: The results of the study indicate that intercostal stretching well as perioral stimulation is effective in reducing respiratory rate and improvement in SpO2 ICU patients.

Keywords: Intercostal stretching, perioral stimulation, ICU management.

INTRODUCTION

In the critical care setting, patients with acute and life-threatening conditions often require intensive care unit (ICU) management, involving close monitoring and specialized interventions. [(1)] Physiological stress responses in these patients lead to increased vital signs, necessitating careful attention to maintain normal bodily functions. Medical ventilators play a crucial role in supporting patients with breathing insufficiency, especially in the immediate post-injury period. [(2,3)]

Patients with severe neurological injuries may undergo intubation, ventilation, sedation, and paralysis to prevent secondary brain damage. Respiratory complications are common during this phase, requiring respiratory physiotherapy for effective management. [(4,5)] As patients stabilize, the transition to breathing independently introduces new challenges, with a continued risk of complications. Respiratory physiotherapy techniques, including secretion mobilization and removal, are employed to mitigate risks and enhance recovery. [(6)]

Neurophysiological facilitation techniques, as described by Bethune (1975), aim to increase breathing depth, decrease respiratory rate, and enhance arousal in patients with decreased consciousness levels. Despite their reported efficacy, these techniques lack objective testing to confirm their impact on breathing depth. [7] The care of unconscious individuals presents challenges, as traditional treatments relying on voluntary effort may not be feasible. Chest care, including percussion and vibrations, may be tolerated, but optimal positioning for postural drainage can be difficult. Instrumentation considerations, such as monitoring cranial pressure and the presence of intubation and external ventilation, complicate chest care. Shallow and monotonous respiration poses a danger, leading to the retention of secretions and the need for frequent suctioning. Mechanical respiratory function may be compromised due to trauma or lack of muscle tone, requiring targeted interventions. Facilitatory stimuli consistently elicit responses in unconscious patients, normal subjects, and laboratory animals, manifesting as visible deeper respirations, increased rib expansion, altered respiratory rate, involuntary coughing, and improved respiratory patterns. These responses are most pronounced in deeply unconscious patients. The techniques involve perioral pressure, intercostal stretch, vertebral pressure, anterior stretch-lifting, and maintained manual pressure. [8] The diaphragm, the main muscle for inspiration, and intercostal muscles, both internal and external, play crucial roles in respiration. Physical inactivity can lead to atrophy of these muscles, affecting chest wall mobility, chest expansion, and lung compliance. [9] Intercostal stretch and peri-oral stimulation, as proprioceptive and tactile stimuli, aim to improve breathing patterns and respiratory muscle activity. Intercostal stretch enhances chest wall elevation, increasing chest expansion and diaphragm excursion, while peri-oral stimulation increases epigastric excursion and deep breathing. [10,11]

In a comparative study, the effects of intercostal stretch and peri-oral stimulation on adults in spontaneous ventilation mode were investigated. The study aimed to assess their impact on respiratory rate and peripheral oxygen saturation. As there is limited information on peri-oral stimulation, this research represents a preliminary attempt to provide evidence-based insights into techniques that could aid patients in discontinuing mechanical ventilation. In summary, managing patients in the ICU with life-threatening conditions involves a multidisciplinary approach, including ventilator support and respiratory physiotherapy. Neurophysiological facilitation techniques offer potential benefits, but their objective testing remains an area of interest. Chest care for unconscious patients presents challenges, necessitating specialized approaches. Understanding the role of diaphragm and intercostal muscles and exploring novel techniques like intercostal stretch and peri-oral stimulation contribute to refining respiratory care strategies in critical care settings. [7]

MATERIALS & METHODS

Ethical clearance was obtained from institutional review board. The subjects were screened based on the inclusion and exclusion criteria and signified their voluntary decision to participate. Demographic data was obtained from the subjects. The purpose and procedure of the study was explained to the subjects and informed consent was obtained. 30 subjects of who have kept on spontaneous mode of ventilator will be systemically were included in the study who fulfills the inclusion criteria after thorough physical objective evaluation, clinical reasoning process. Male patients of Age 18 to 55 years were included who were mechanically ventilated; having stable cardio-vascular function with Heart rate <140/min; Blood pressure (systolic: <180mmHg). Patients who were on spontaneous mode; who were having fever, chest infection, malignancy;

Subjects who were on CMV mode, who underwent cardiac surgery and abdominal surgery; Patients with rib fracture and untreated haemothorax or pneumothorax were excluded from the study. The baseline data were obtained from both the groups using pulse oxymeter. The subjects of Group A and Group B were explained about the importance of exercise. Group A received Intercostal stretch and Group B received perioral stimulation for 2 times/day for 3 days.

Group A-Inter Costal Stretch:

Subject positioning was standardized to supine flat, limbs positioned in neutral. The position of the therapist is behind the patient. First palpate the supra sternal notch. Then goes downward about 5cm and palpate the angle of Louis. 2nd rib lies at the level of angle of Louis. From the angle of Louis trace the finger laterally. The Intercostal stretch technique is applied over 2nd and 3rd rib bilaterally. The technique is given with the help of index finger. The direction of the pressure is downward towards the next rib. Technique is applied during expiration phase. It is applied for three breathes with 1minute rest and three times repetition. This technique will be applied twice in a day.

Group B- Perioral stimulation:

Subject positioning was standardized to supine flat, limbs positioned in neutral. The position of the therapist is in side of the patient. It is applied by firm-maintained pressure to the patient's top lip, being careful not to occlude the nasal passage. The response to this stimulus is a brief (approximately 5 seconds) period of apnoea followed by increased epigastric excursions. Pressure is maintained for the length of the time therapist wishes the patient to breath in the activated pattern.

Both the techniques will be given for 2 times/day for 3 days. Before and after third day of treatment Heart rate and Oxygen saturation has been taken.

RESULT

All the statistical analysis was done by using SPSS 17 for windows software. Descriptive analysis for both groups was also done. Using Paired t test for both the groups did Intragroup comparison for RR and SpO2. The RR and SpO2 were analyzed with mean and standard deviation before and after intervention. The inter group comparison for both were analyzed by using independent t test to check the homogeneity between two groups. Independent t test was used to see the treatment effect between two groups for RR and SpO2.

Table 1: Pre and post treatment comparison of group A- RR

Respiratory rate						
	Minimum	**Maximum**	**Mean**	**SD**	**t value**	**p value**
Pre treatment	1.35	1.81	24.866	1.995		
Post treatment	2.14	0.68	20.460	2.166	15.19	0.000

Table 2: Pre and post treatment comparison of group A- SpO2

SpO2						
	Minimum	**Maximum**	**Mean**	**SD**	**t value**	**p value**
Pre treatment	1.35	1.81	84.333	3.716		
Post treatment	3.35	1.75	94.666	3.199	17.48	0.000

Table 3: Pre and post treatment comparison of group B- RR

Respiratory rate						
	Minimum	**Maximum**	**Mean**	**SD**	**t value**	**p value**
Pre treatment	1.35	1.88	24.600	2.323		
Post treatment	2.15	0.68	21.200	1.567	11.12	0.000

Table 4: Pre and post treatment comparison of group B- SpO2

SpO2						
	Minimum	**Maximum**	**Mean**	**SD**	**t value**	**p value**
Pre treatment	3.36	1.76	95.133	3.090		
Post treatment	1.48	2.95	93.933	2.711	9.886	0.000

Table 5: Post treatment group comparison- RR

Respiratory rate						
Groups	**Minimum**	**Maximum**	**Mean**	**SD**	**t value**	**p value**
A	1.48	2.95	24.46	2.166		
B	2.14	0.68	21.20	1.567	1.06	0.27

Graph 1: showing post treatment mean values of Group A and B RR

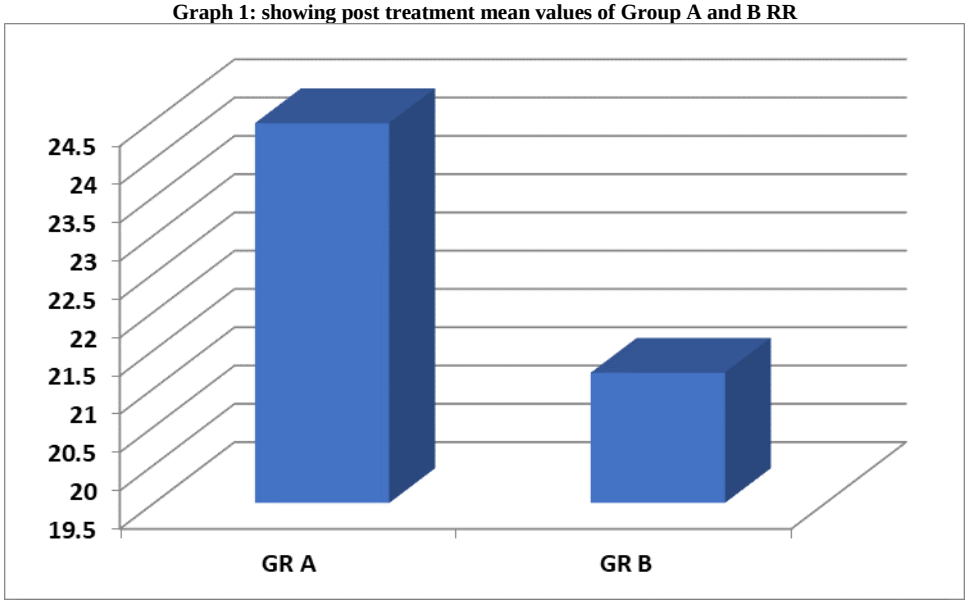
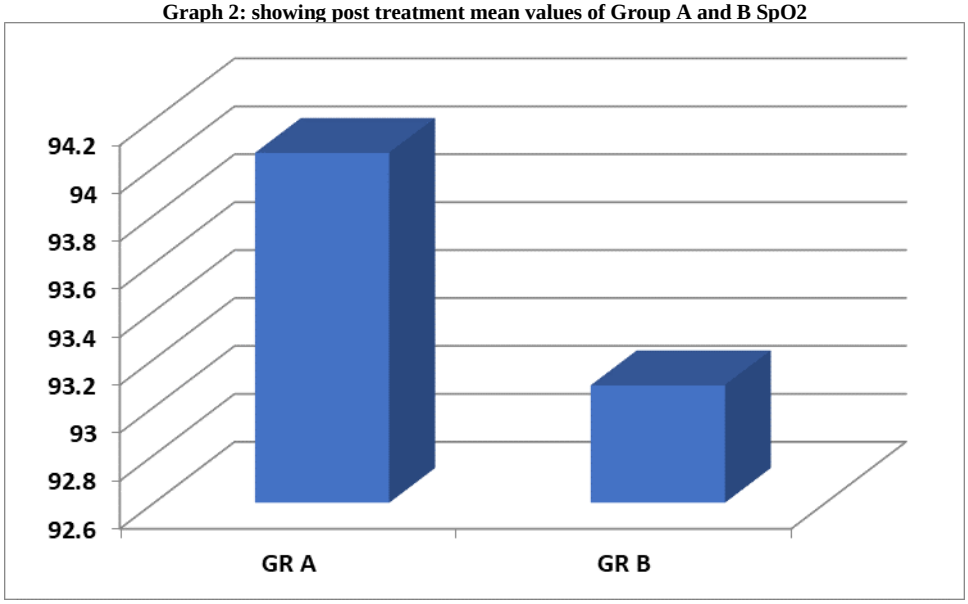


Table 6: Post treatment group comparison- SpO2

SpO2						
Groups	**Minimum**	**Maximum**	**Mean**	**SD**	**t value**	**p value**
A	1.48	2.95	94.6	3.199		
B	1.48	2.95	93.9	2.711	0.67	0.35

Graph 2: showing post treatment mean values of Group A and B SpO2



DISCUSSION

The purpose of this study was to compare the effectiveness of intercostal stretching and perioral stimulation in respiratory rate and SpO2 in ICU patients. The implication of this study may justify the efficacy of intercostal stretching and perioral stimulation in ICU patients. The outcome measures used were respiratory rate and SpO2. The groups were synchronized with age. All the participants were treated with standardized exercise programme.

Beneficial effects significantly found in both the groups for respiratory rate and SpO2 level.

Various research studies demonstrated that IC stretching improved expired tidal volume, decreased the level of dyspnea level and increased chest expansion clinically which results in better gaseous exchange in human subjects. [16] IC stretch is performed actively by thoracic mobility exercises. Passively IC stretch can be performed by thoracic rotation, mid sternum rotation, lateral thoracic stretching, through thoracic mobility exercises as well as through manual stretching of IC spaces. [17] The external IC muscles, which are helpful during inspiration, showed a higher discharge activity during forcible inhalation. Similarly, a stretch of 15 micrometers applied to IC spaces showed an increase in muscle activity in cats. [18] The increase in muscle activity of the IC muscles could lead to increase in lung volume and capacities.

According to Puckree et al. (2002), IC stretching is effective in improving breathing pattern and respiratory muscle activity among healthy conscious adults.[19] However; none of the research studies examined the effect of IC stretching on dynamic pulmonary function parameters among healthy subjects.

The result of this led to inference that both intercostal stretching and perioral stimulation is effective in reducing respiratory rate and improving SpO2 in ICU patients. Numerous studies have come up with effectiveness of intercostal stretching in ICU patients. [19,20] Although there were less evidences on perioral stimulation.

Analysis was done with the base line data and post treatment scores. There was significant improvement ($p<0.001$) in both the groups after the treatment session with both the techniques. There was no significant difference in post treatment comparison between intercostal stretching and perioral stimulation. The clinical findings and analysis showed that both intercostal stretching and perioral stimulation were effective in reducing respiratory rate and improving SpO_2 in ICU patients.

CONCLUSION

This study concludes that intercostal stretching and perioral stimulation both is effective in reducing respiratory rate and improving SpO2 in ICU patients. There are some limitations to this present study. Sample size used for the study was small and Effects of spontaneous mode on ventilation have been checked. Further studies can be conducted with randomized control trial for the effectiveness of intercostal stretching and perioral stimulation were effective in reducing respiratory rate and improving SpO2 in ICU patients, sample of this study design was small and it can be done on larger sample, studies can be conducted with different age groups and gender. Effects of these exercises on other mode of ventilation can be done in future.

Declaration by Authors

Ethical Approval: Approved

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REFERENCES

1. Mottahedian Tabrizi E, Tadrisi D, Mohammadyari A, Ebadi A, Mirhashemi S. Validity and reliability of Ramsy sedation scale in adult patients hospitalized in critical care units. IJCCN.2010;3:15–6.
2. Besel JM. Montana state university; 2006; 2013. The effects of music therapy on comfort in the mechanically ventilated patient in the intensive care unit. A thesis submitted in partial fulfillment of the requirements for the degree of Master of Nursing.
3. Khost N, Moshtagh Z, Imani E, AlaviMajd H. Vol. 14. Journal of Shahid Sadoughi University of Medical Sciences And Health Services; 2006. Effect of foot massage on physiologic indicators in critically ill patients admitted in the ICU; pp. 69–75

4. Oh TE. Intensive Care Manual. 4th ed. Butterworth- Heinemann Publishers: 1999
5. Intensive care hotline. Welcome to intensive care hotline - intensive care hotline. [online] available from: http://intensivecarehotline.com
6. Esteban A, Anzueto A, Alia I, et al. How is mechanical ventilation employed in the intensive care unit? An international utilization review. American Journal of Respiratory and Critical Care Medicine. 2000; vol.161,(5): pp1450-1458
7. Pryor JA and Webber BA (2002): Physiotherapy techniques. In Pryor JA and Prasad SA (Eds): Physiotherapy for Respiratory and Cardiac Disorders. (3rd ed.) London: Churchill Livingstone, pp. 161-242.
8. Guyton (1991): Textbook of Medical Physiology (8th ed.) Philadelphia: WB Saunders, pp. 525-535.
9. Demling R and Riessen R (1990): Pulmonary dysfunction after cerebral injury. *Critical Care Medicine* 18: 768-774.
10. Ada L, Canning C and Paratz J (1990): Care of the unconscious head-injured patient. In Ada L and Canning C (Eds): Key Issues in Neurological Physiotherapy.Oxford: Butterworth Heinemann, pp. 249-289.
11. Chen LM, Martin CM, Keenan SP and Sibbald WJ (1998):Patients readmitted to the intensive care unit during the same hospitalisation: clinical features and outcomes *Critical Care Medicine* 26: 1834-1841.
12. Elkins M, Dentice R. Inspiratory muscle training facilitates weaning from mechanical ventilation among patients in the intensive care unit: a systematic review. J Physiother. 2015 Jul;61(3):125-34. doi: 10.1016/j.jphys.2015.05.016. Epub 2015 Jun 16.
13. Dharmesh Parmar, Anjali Bhise. The Immediate Effect of Chest Mobilization Technique on Chest Expansion in Patients of COPD with Restrictive Impairment. Volume 4 Issue 6, June 2015
14. Dharmesh Parmar, Anjali Bhise. The Immediate Effect of Chest Mobilization Technique on Chest Expansion in Patients of COPD with Restrictive Impairment. Volume 4 Issue 6, June 2015
15. Gupta P, Nambi GS, Gupta G et. al. Effect of intercoastal stretch technique and anterior basal lift technique on respiratory rate, saturation of peripheral oxygen and heart rate among ICU patients. Int J Health Sci Res. 2014;4(2):26-30.
16. Anup Bhat, Kalyana Chakravarthy, and Bhamini K. Rao. Chest physiotherapy techniques in neurological intensive care units of India: a survey. Indian J Crit Care Med. 2014 Jun; 18(6): 363–368. doi: 10.4103/0972-5229.133890
17. Leelarungrayub D, Pothongsunun P, et al. 2009 Acute clinical benefits of chest wall-stretching exercise on expired tidal volume, dyspnea and chest expansion in a patient with chronic obstructive pulmonary disease: a single case study. J BodywMovTher. 2009 Oct;13(4):338-43.
18. Bolser DC, Lindsey BG, Shannon R. Medullary inspiratory activity: Influence of IC tendon organs and muscle spindle endings. J Appl Physiol 1987;62:1046-56.
19. Puckree T, Cerny T, Bishop B. Does IC stretch alter breathing pattern and respiratory muscle activity in conscious adults? Physiotherapy 2002;88:89-97.
20. Dr Jennifer Nitz , M Phty, Phty and Brandon Burke, A study of the facilitation of respiration in myotonic dystrophy Physiotherapy Research International Volume 7, Issue 4, pages 228–238, November 2002

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