

An Experimental Study to Analyse the Effect of Respiratory Proprioceptive Neuromuscular Facilitation Techniques along with Conventional Physiotherapy in Improving Oxygen Saturation, Respiratory Rate and Heart Rate in COVID-19 Patients Admitted in ICU

Binesh Asokan Poozhikunnath¹, Suthakar Raju²,
Sumeya Mohammed Al Hammadi³

¹Physiotherapist – Al Ain Hospital, UAE

²Senior Physiotherapist – Al Ain Hospital, UAE

³Manager Rehabilitation – Al Ain Hospital, UAE

Corresponding Author: Binesh Asokan Poozhikunnath

ABSTRACT

Objective: Patients with COVID-19 are admitted to ICU as a result of hypoxia caused due to pneumonia. Many of these patients are ventilated using Mechanical Ventilator in order to maintain the desired oxygen Saturation. Proprioceptive neuromuscular facilitation has shown beneficial effects among ventilatory patients. Objective of this study is to compare the efficacy of Proprioceptive Neuromuscular Facilitation on respiratory rate, saturation of peripheral oxygen and heart rate.

Methodology: 13 patients from ICU of Al Ain hospital were taken for the study who fulfilled the eligibility criteria and was systematically divided into Group A (PNF with Conventional Physiotherapy) and Group B (Conventional Physiotherapy). Patients were given the intervention according to their allocated group for 3 days and effects of these techniques on RR, SpO2 and HR parameters were observed. Data was taken at baseline and after 3 days of intervention.

Result: Data was analyzed using Paired and Unpaired t-test. Statistically significant improvements were observed in both groups but were more pronounced in Experimental Group in terms of Respiratory Rate (t value 2.626) and Oxygen Saturation (t value 1.33) compared to Control Group. However significant mean difference was noted in Experimental Group in terms of Respiratory Rate (8.67), Heart Rate (10.5), Oxygen Saturation (2) and Fraction of Inspired Oxygen (10.84) and also in Control Group in terms of Respiratory Rate (0.43), Heart Rate (9.71), Oxygen Saturation (2.57) and Fraction of Inspired Oxygen (13.29).

Conclusion: Study concluded that significant improvement was noticed in terms of Respiratory Rate and Oxygen Saturation in Experimental Group when compared to Control Group. However improvement was noted in other parameters like Heart Rate and Fraction of Inspired Oxygen, it was not significant statistically.

Keywords: Respiratory Proprioceptive Neuromuscular Facilitation, Respiratory Rate, Heart Rate, Oxygen Saturation, Fraction of inspired Oxygen

INTRODUCTION

Background and Context

Preliminary reports suggest that approximately 5% to 10% of patients with

proven COVID19 infections require intensive care unit (ICU) admission and mechanical ventilation.¹ A medical ventilator is a machine designed to move

Binesh Asokan Poozhikunnath et.al. An experimental study to analyse the effect of respiratory proprioceptive neuromuscular facilitation techniques along with conventional physiotherapy in improving oxygen saturation, respiratory rate and heart rate in COVID-19 patients admitted in ICU.

breathable air into and out of the lungs to provide mechanism of breathing for a patient who is suffering from breathing insufficiency(2,3). The chest care of unconscious and recombinant patients are difficult and challenging because they lack self (voluntary) breathing effort. In such cases mechanical ventilation helps in reducing work of breathing by preventing hypoxemia. Assist control ventilator delivers a set tidal volume when triggered by the patient's inspiratory effort and helps in weaning process.(4-5) .Neuromuscular Facilitation (RPNF) has shown beneficial effects on Respiratory Rate, Saturation of Peripheral Oxygen and Heart rate, among patients receiving Mechanical Ventilator. RPNF is the use of selective external proprioceptive and tactile stimuli that produce reflexive movement responses in the ventilator device to assist respiration

MATERIALS AND METHODS

Research design

Experimental Study Design

Methods and Sources

13 patients from ICU of Al Ain hospital was taken for the study who fulfilled the eligibility criteria and was randomly divided into Group A (PNF with Conventional Physiotherapy) and Group B(Conventional Physiotherapy). Patients were given the intervention according to their allocated group for 3 days and effects of these techniques on RR, SpO₂ and HR parameters were observed. Data was taken at baseline and after 3 days of intervention. Recorded data was analysed using Students Paired t - test and Unpaired t – test

STUDY DESIGN

Experimental Pre test –Post test study design.

GROUP A - Patients who will receive RPNF technique along with Conventional Physiotherapy.

GROUP B - Patients who will receive Conventional Physiotherapy alone

STUDY SETTING

Study was conducted in Intensive Care Unit, Al Ain Hospital

STUDY DURATION

Study was conducted for duration of 3 months.

SAMPLING METHOD

Random Sampling Method

SUBJECTS

Total of 13 patients was selected based on the selection and divided into two groups, Group A with 6 patients and Group B with 7 patients through randomization by sealed envelope

SELECTION CRITERIA

INCLUSION CRITERIA

Patients diagnosed with COVID 19.

Only Male patients was included.

Patients age group in between 35-65 yrs.

Patients with Spontaneous Mode Ventilation

EXCLUSION CRITERIA

Female Patients.

Age group other than 35 to 65

Patients receiving other modes of Ventilation

VARIABLES

INDEPENDENT VARIABLE

Respiratory Proprioceptive Neuromuscular Facilitation

Conventional Physiotherapy

DEPENDENT VARIABLE

Oxygen Saturation (Corresponding FiO₂ Value)

Respiratory Rate

Heart Rate

PROCEDURE

All patients was screened according to inclusion and exclusion criteria.

Informed consent was obtained.

Patients was randomly divided into 2 groups

Group A- RPNF along with Conventional Physiotherapy

Group B- Conventional Physiotherapy

OUTCOME MEASURES

Oxygen Saturation (Corresponding FiO₂ Value)

Binesh Asokan Poozhikunnath et.al. An experimental study to analyse the effect of respiratory proprioceptive neuromuscular facilitation techniques along with conventional physiotherapy in improving oxygen saturation, respiratory rate and heart rate in COVID-19 patients admitted in ICU.

Respiratory Rate
Heart Rate

Unpaired 't' test

The unpaired 't' test was used to compare the mean difference between group A and group B.

STATISTICAL TOOLS

Paired 't' Test

The paired 't' test was used to compare the mean difference between pre and post test values.

STATISTICAL ANALYSIS

Table 1: Respiratory Rate (Paired t-test)
Comparison of Pre Test and Post Test values of Group A (Experimental Group)

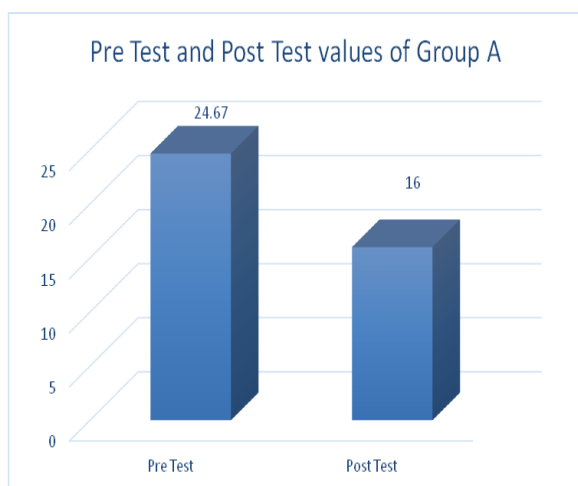
S No	Group A	Mean	Mean Difference	Standard Deviation	t value
1	Pre Test	24.67	8.67	2.512	3.45
2	Post Test	16.00			

Calculated 't' value is 3.45 which is greater than tabulated 't' value 2.2228

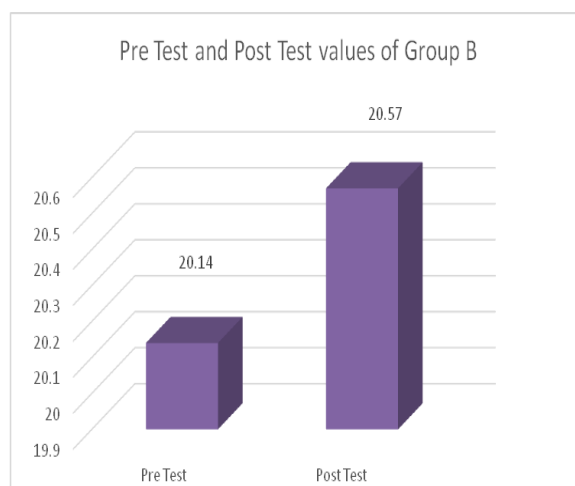
Table 2: Respiratory Rate (Paired t-test)
Comparison of Pre Test and Post Test values of Group B (Control Group)

S No	Group A	Mean	Mean Difference	Standard Deviation	t value
1	Pre Test	20.14	0.43	2.902	0.148
2	Post Test	20.57			

Calculated 't' value is 0.148 which is less than tabulated 't' value 2.179



Graph 1: Respiratory Rate (Paired t-test)
Comparison of Pre Test and Post Test values of Group A (Experimental Group)



Graph 1: Respiratory Rate (Paired t-test)
Comparison of Pre Test and Post Test values of Group B (Control Group)

Table 3: Respiratory Rate (Un Paired t-test)
Comparison of Post Test values of Group A and Group B

S No	Group	Mean	Mean Difference	Standard Deviation	t value
1	Group A	16	4.57	1.741	2.626
2	Group B	20.57			

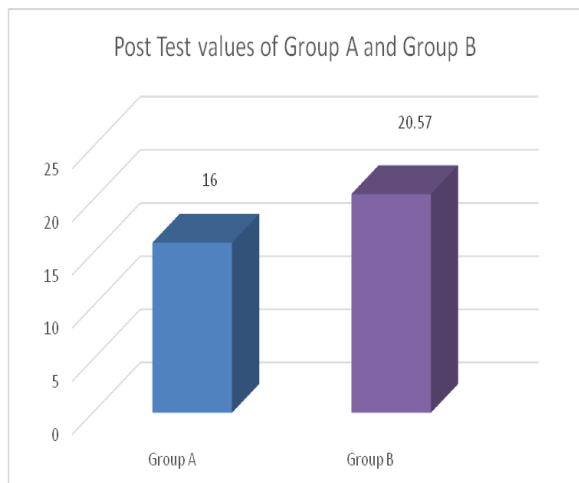
Calculated 't' value is 2.626 which is greater than tabulated 't' value 2.201

Table 4: Heart Rate (Paired t-test)
Comparison of Pre Test and Post Test values of Group A (Experimental Group)

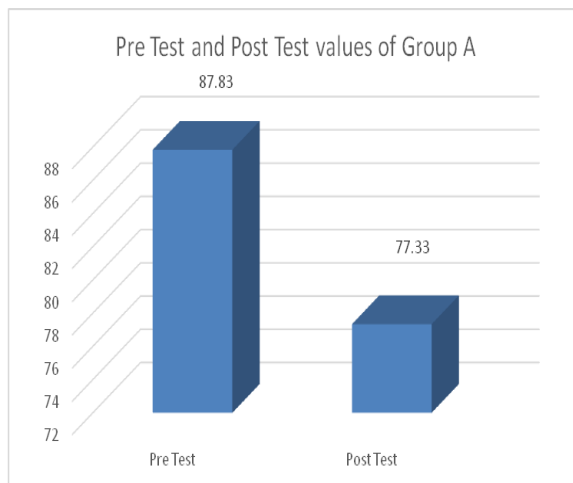
S No	Group A	Mean	Mean Difference	Standard Deviation	t value
1	Pre Test	87.83	10.5	2.529	4.0515
2	Post Test	77.33			

Calculated 't' value is 4.0515 which is greater than tabulated 't' value 2.228

Binesh Asokan Poozhikunnath et.al. An experimental study to analyse the effect of respiratory proprioceptive neuromuscular facilitation techniques along with conventional physiotherapy in improving oxygen saturation, respiratory rate and heart rate in COVID-19 patients admitted in ICU.



Graph 3: Respiratory Rate (Un Paired t-test)
Comparison of Post Test values of Group A and Group B



Graph 4: Heart Rate (Paired t-test)
Comparison of Pre Test and Post Test values of Group A (Experimental Group)

Table 5: Heart Rate (Paired t-test)
Comparison of Pre Test and Post Test values of Group B (Control Group)

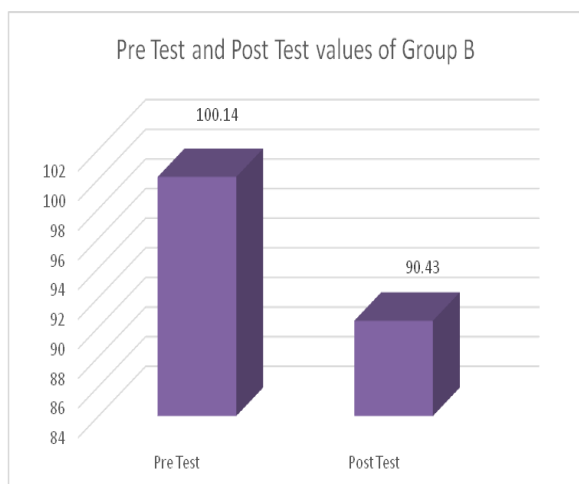
S No	Group A	Mean	Mean Difference	Standard Deviation	t value
1	Pre Test	100.14	9.71	2.135	4.551
2	Post Test	90.43			

Calculated 't' value is 4.551 which is greater than tabulated 't' value 2.179

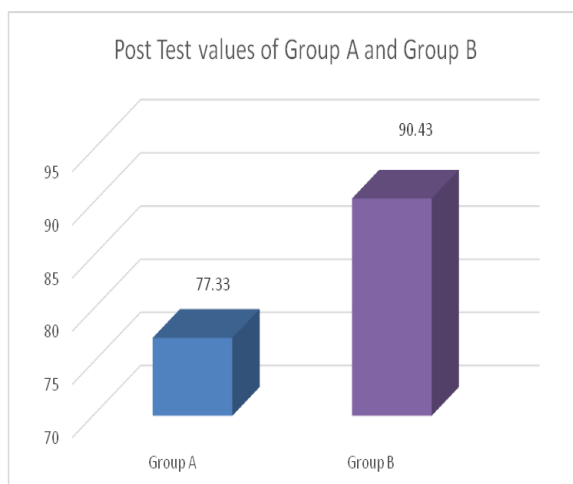
Table 6: Heart Rate (Un Paired t-test)
Comparison of Post Test values of Group A and Group B

S No	Group	Mean	Mean Difference	Standard Deviation	t value
1	Group A	77.33	13.1	10.53	1.24
2	Group B	90.43			

Calculated 't' value is 1.24 which is less than tabulated 't' value 2.201



Graph 5: Heart Rate (Paired t-test)
Comparison of Pre Test and Post Test values of Group B (Control Group)



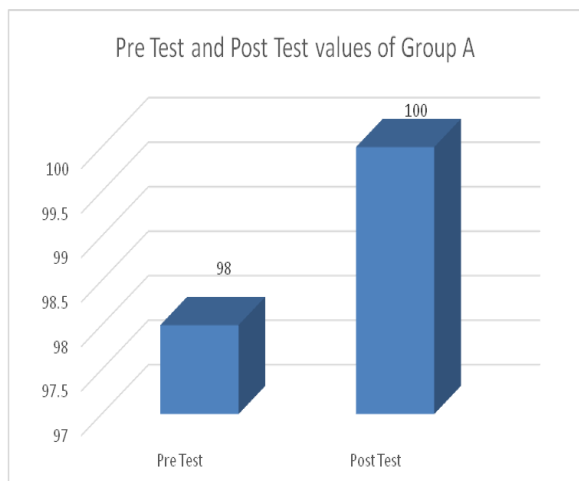
Graph 6: Heart Rate (Un Paired t-test)
Comparison of Post Test values of Group A and Group B

Table 7: Oxygen Saturation (Paired t-test)
Comparison of Pre Test and Post Test values of Group A (Experimental Group)

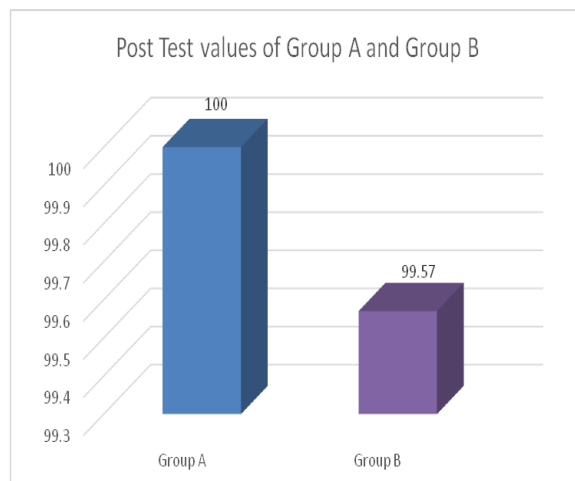
S No	Group A	Mean	Mean Difference	Standard Deviation	t value
1	Pre Test	98.0	2	1.61	1.24
2	Post Test	100			

Calculated 't' value is 1.24 which is less than tabulated 't' value 2.228

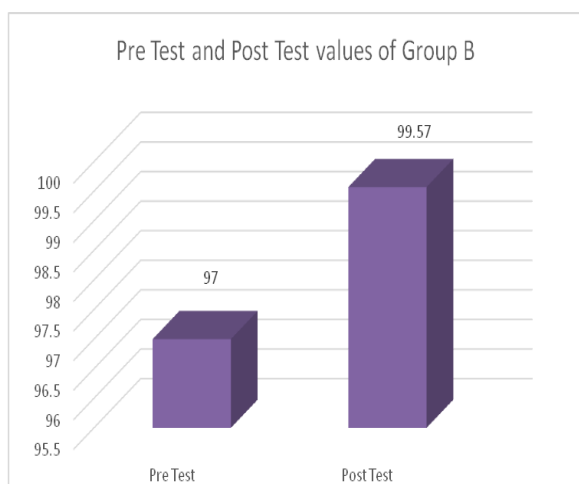
Binesh Asokan Poozhikunnath et.al. An experimental study to analyse the effect of respiratory proprioceptive neuromuscular facilitation techniques along with conventional physiotherapy in improving oxygen saturation, respiratory rate and heart rate in COVID-19 patients admitted in ICU.



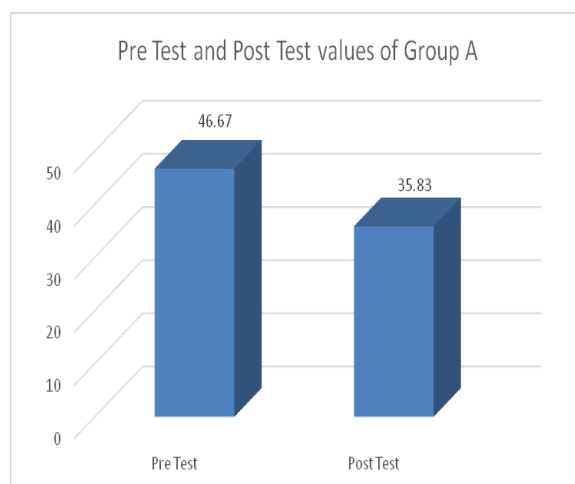
Graph 7: Oxygen Saturation (Paired t-test)
Comparison of Pre Test and Post Test values of Group A (Experimental Group)



Graph 9: Oxygen Saturation (Un Paired t-test)
Comparison of Post Test values of Group A and Group B



Graph 8: Oxygen Saturation (Paired t-test)
Comparison of Pre Test and Post Test values of Group B (Control Group)



Graph 10: Fraction of Inspired Oxygen (Paired t-test)
Comparison of Pre Test and Post Test values of Group A (Experimental Group)

Table 8: Oxygen Saturation (Paired t-test)
Comparison of Pre Test and Post Test values of Group B (Control Group)

S No	Group A	Mean	Mean Difference	Standard Deviation	t value
1	Pre Test	97	2.57	1.232	2.088
2	Post Test	99.57			

Calculated 't' value is 2.088 which is less than tabulated 't' value 2.179

Table 9: Oxygen Saturation (Un Paired t-test)
Comparison of Post Test values of Group A and Group B

S No	Group	Mean	Mean Difference	Standard Deviation	t value
1	Group A	100	0.43	0.323	1.33
2	Group B	99.57			

Calculated 't' value is 1.33 which is less than tabulated 't' value 2.201

Table 10: Fraction of Inspired Oxygen (Paired t-test)
Comparison of Pre Test and Post Test values of Group A (Experimental Group)

S No	Group A	Mean	Mean Difference	Standard Deviation	t value
1	Pre Test	46.67	10.84	4.17	2.6
2	Post Test	35.83			

Calculated 't' value is 2.6 which is less than tabulated 't' value 2.228

Binesh Asokan Poozhikunnath et.al. An experimental study to analyse the effect of respiratory proprioceptive neuromuscular facilitation techniques along with conventional physiotherapy in improving oxygen saturation, respiratory rate and heart rate in COVID-19 patients admitted in ICU.

**Table 11: Fraction of Inspired Oxygen (Paired t-test)
Comparison of Pre Test and Post Test values of Group B (Control Group)**

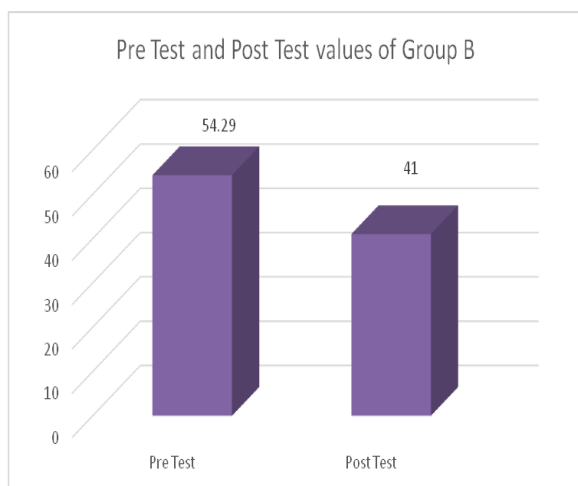
S No	Group A	Mean	Mean Difference	Standard Deviation	t value
1	Pre Test	54.29	13.29	15.48	0.86
2	Post Test	41			

Calculated 't' value is 0.86 which is less than tabulated 't' value 2.179

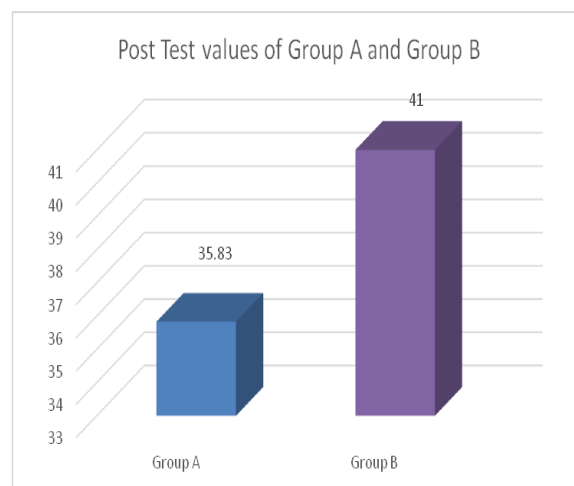
**Table 12: Fraction of Inspired Oxygen (Un Paired t-test)
Comparison of Post Test values of Group A and Group B**

S No	Group	Mean	Mean Difference	Standard Deviation	t value
1	Group A	35.83	4.17	9.78	0.53
2	Group B	41			

Calculated 't' value is 0.53 which is less than tabulated 't' value 2.201



**Graph 11: Fraction of Inspired Oxygen (Paired t-test)
Comparison of Pre Test and Post Test values of Group B (Control Group)**



**Graph 12: Fraction of Inspired Oxygen (Un Paired t-test)
Comparison of Post Test values of Group A and Group B**

RESULT

The study concludes that Respiratory Rate and Oxygen Saturation improved in Experimental Group when compared to Control Group.

DISCUSSION

The study was conducted including 13 patients who were diagnosed with Covid 19 and admitted in Intensive Care Unit with respiratory complications. Patients receiving spontaneous mode ventilation were chosen which later was randomized to Experimental Group who received Respiratory Proprioceptive Neuromuscular Facilitation and Control Group who received Conventional Physiotherapy. Outcome measures which included Oxygen Saturation, Respiratory Rate, Heart Rate was recorded Pre and Post Intervention.

Statistically significant improvements were observed in both groups but

were more pronounced in Experimental Group in terms of Respiratory Rate (t value 2.626) and Oxygen Saturation (t value 1.33) compared to Control Group. However significant mean difference was noted in Experimental Group in terms of Respiratory Rate (8.67), Heart Rate (10.5), Oxygen Saturation (2) and Fraction of Inspired Oxygen (10.84) and also in Control Group in terms of Respiratory Rate (0.43), Heart Rate (9.71), Oxygen Saturation (2.57) and Fraction of Inspired Oxygen (13.29).

Respiratory PNF techniques aid in reducing Respiratory Rate and Heart Rate by inducing parasympathetic activity. Techniques like Intercostal Stretch, Anterior Basal Shift and Thoracic Thrust help in improving improving ventilation by improving lung expansion and thereby improving Oxygenation.

Literature denotes that Respiratory PNF drastically helps in improving Lung

Binesh Asokan Poozhikunnath et.al. An experimental study to analyse the effect of respiratory proprioceptive neuromuscular facilitation techniques along with conventional physiotherapy in improving oxygen saturation, respiratory rate and heart rate in COVID-19 patients admitted in ICU.

parameters in terms of oxygenation as well as have significant positive effects on respiratory rate and heart rate.

CONCLUSION

Study concluded that significant improvement was noticed in terms of Respiratory Rate and Oxygen Saturation in Experimental Group when compared to Control Group. However improvement was noted in other parameters like Heart Rate and Fraction of Inspired Oxygen, it was not significant statistically.

REFERENCES

1. Oh TE. Intensive Care Manual. 4th ed. Butterworth- Heinemann Publishers: 1999
2. Intensive care hotline. Welcome to intensive care hotline - intensive care hotline. [online] available from: <http://intensivecarehotline.com>
3. A Esteban I, A Anzueto, I Alía, et al. How is mechanical ventilation employed in the intensive care unit? An international utilization review. *Am J Respir Crit Care Med.* 2000 May;161(5): 1450-8.
4. Jubran A, Tobin M. Path physiologic basis of acute respiratory distress in patients who fail a trial of weaning from mechanical ventilation.. *American journal of respiratory and critical care medicine.* 1997; vol.155,(3): pp 906-915
5. Leung P, Jubran A, Tobin M. Comparison of assisted ventilator modes on triggering, patient effort, and dyspnea.. *American journal of respiratory and critical care medicine.* 1997; vol. 155 ,(6):pp. 1940-1948
6. Marini J, Capps J, Culver B. The inspiratory work of breathing during assisted mechanical ventilation. *CHEST Journal.* 1985, 87 (5): pp.612-618
7. Sassoon CSH. Intermittent mandatory ventilation. In: Tobin MJ, ed. *Principles and Practice of Mechanical. Ventilation.* New York, McGraw-Hill Inc., 1994,pp. 1056-61
8. Kenneth Saladin: *Anatomy & Physiology: A Unity of Form and Function Fifth (5th) Edition* – January 2, 2009
9. Ronan O' Rahilly *Basic Human Anatomy: A Regional Study of Human Structure.*
10. De Troyer A, Kirkwood PA Wilson TA. Respiratory action of the IC muscles. *Physiol Rev* 2005; 85:717-56.
11. 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.
12. Sharma R, Narwal R, Kumar S. Comparison of proprioceptive neuromuscular facilitation vs resistance training of respiratory muscles on respiratory rate of patients in ICU during weaning off period. *Indian Journal of Physiotherapy and Occupational Therapy- An International Journal.* 2010; 4 (4): 125--128.
13. Nirali B Thakkar, Role of PNF techniques in chest physiotherapy; *Physiotherapy- The Journal of Indian Association of Physiotherapists.* April 2006; pages 10-14
14. Eklund G, von Euler C and Rutkowski S (1964): Spontaneous and reflex activity of Intercostal gamma Moto neurons. *Journal of Physiology* 171: 139-163.
15. Davis J, Sears T. The proprioceptive reflex control of the Intercostal muscles during their voluntary activation. *The Journal of Physiology.* 1970; 209 (3): 711-738

How to cite this article: Poozhikunnath BA, Raju S, Hammadi SMA. An experimental study to analyse the effect of respiratory proprioceptive neuromuscular facilitation techniques along with conventional physiotherapy in improving oxygen saturation, respiratory rate and heart rate in COVID-19 patients admitted in ICU. *Int J Health Sci Res.* 2020; 10(11):253-259.
