



**ORIGINAL RESEARCH PAPER**

**Physiotherapy**

**ROLE OF PROPRIOCEPTIVE NEUROMUSCULAR FACILITATION TECHNIQUES OF RESPIRATION IN INTENSIVE CARE UNIT PATIENTS- A REVIEW**

**KEY WORDS:** Chest complications, chest physiotherapy, chest PNF techniques

<b>Shobha Keswani</b>	Department Of Physiotherapy And Rehabilitation, Max Superspeciality, Saket , New Delhi
<b>Sumit Kalra</b>	Department Of Physiotherapy And Rehabilitation, Max Superspeciality, Saket , New Delhi
<b>Akanksha Sharma</b>	Department Of Physiotherapy And Rehabilitation, Max Superspeciality, Saket , New Delhi

**ABSTRACT**

Chest complications are very common in patients of intensive care unit. To prevent these complications various physiotherapy techniques are used. Proprioceptive neuromuscular techniques for respiration are one of those techniques. The aim of this paper is to comprehensively review the literature concerning this topic and summarise existing knowledge on the role of proprioceptive neuromuscular facilitation techniques of respiration in intensive care unit patients. This paper provides a narrative review of literature in this area. Furthermore, this review identifies areas for further research and makes recommendations for clinical practice.

**INTRODUCTION**

Respiration is defined as the movement of oxygen from the outside environment to the cells within tissues, and the transport of carbon dioxide in the opposite direction.<sup>1</sup> Air-breathing in humans includes four stages: Ventilation, Pulmonary gas exchange, Gas transport and Peripheral gas exchange.<sup>2</sup> Intensive Care Unit (ICU) patients require close, constant monitoring and support from special equipments and medications in order to maintain normal bodily functions.<sup>3</sup> The chest care of unconscious and recumbent patients are difficult and challenging because they lack self (voluntary) breathing effort.<sup>4</sup> Common chest complications during ICU stay are respiratory failure ,atelectasis, acute lung injury, pneumonia, pneumothorax ,pneumonitis ,exacerbation COPD<sup>5</sup>, atelectasis due to secretions retained secretions, abnormal breathing pattern due to primary or secondary pulmonary dysfunction and musculoskeletal deformity that makes breathing pattern and cough ineffective<sup>6</sup>. Commonly used physiotherapy techniques in ICU are Postural drainage, Percussion and vibration, Mechanical devices, Manual lung inflation, Coughing tracheal suctioning<sup>7</sup>, intrapulmonary percussive ventilation, Insufflation-exsufflation.<sup>8</sup> Proprioceptive Neuromuscular Facilitation (PNF) is a stretching technique utilized to improve muscle elasticity and has been shown to have a positive effect on active and passive range of motions.<sup>9</sup> Types Of PNF Patterns are upper limb ,lower limb ,trunk, chest PNF.<sup>10</sup> Appropriate resistance at the time of applying one of the PNF techniques strengthens the muscles and guides the chest motion. PNF is a new technique to improve the respiratory function (IC,ERV,IRV,PEFR,FVC,TV)<sup>11</sup>

PNF of respiratory muscles is the term used to describe externally applied proprioceptive and tactile stimulus that produces reflex respiratory movement.<sup>12</sup> After some neurological insults, strictly diaphragmatic breathing may not be possible or even preferred. So restoration of independent, efficient breathing patterns for such patients may require regular use of accessory muscles.<sup>13</sup> Proposed mechanisms of PNF stretching is Autogenic inhibition, which refers to the reduction in the excitability of a contracted or stretched muscle attributed to increased inhibitory input, and subsequently decreased efferent drive, arising from the Golgi tendon organs and Reciprocal inhibition, which essentially refers to the inhibition that occurs in a muscle when there is a contraction of its antagonist.<sup>14</sup>

**REVIEW OF LITERATURE**

M.Paul Raj et al (2017) studied about effectiveness of PNF of respiration to improve exercise capacity in COPD patients by comparing two groups. This study concluded that the PNF of respiration was more effective and can be a useful therapy in improving exercise capacity in patients with COPD.<sup>15</sup>

According to a study done by Dr. Sneha S Chordiya et al (2017 ), chest Physiotherapy along with PNF technique in the management

of mechanically ventilated patients with pulmonary complication proved efficient for preventing pulmonary complications, clearing the mucous secretions and better prognosis in patients with OP poisoning.<sup>16</sup>One more study by Vaishali et al (2010) showed that the proprioceptive and tactile stimuli produced expansion of the thoracic cage, reduced asymmetry and decreased respiratory rate in a 24 day old full term female baby with atelectasis and pulmonary hemorrhage.<sup>17</sup>

In a study done by Payal Gupta et al (2013), it has been found that IC stretch is more effective in reduction of respiratory rate and heart rate and improving oxygen saturation over anterior basal lift technique.<sup>18</sup> Eklund G et al(1970) concluded that IC Stretch increases alpha motor neuron activity, causing the muscle fibers to contract.<sup>19</sup>

N. B. Thakkar (2006) and Jennifer A. Pryor discussed that there is an advantage of application of PNF stretch technique in ICU patients as it helps in lowering the raised RR and HR and in improving SPO2 levels within near to range which is acceptable for ventilator weaning process thereby it is helpful in reducing the hospital stay of patients and social isolation.<sup>20,21</sup> Rajiv Sharma et al (2010) also found that PNF was successful in reducing the respiratory rate in ICU when compared to abdominal weights training.<sup>22</sup>

Nitz J et al (2002) demonstrated that application of respiratory PNF techniques improves respiratory function in subjects with myotonic dystrophy weaning from mechanical ventilation.<sup>23</sup> Similarly Angela Chang et al (2002) provides preliminary evidence of improved short term ventilatory function following PNF techniques.<sup>24</sup>

Lanza Fde et al. (2014) analysed that chest mobility in healthy subjects is related to respiratory muscle strength and lung function; the higher the axillary cirtometry and thoracic cirtometry values, the greater the maximum inspiratory pressure, maximum expiratory pressure, and lung volumes in healthy subject.<sup>25</sup>

In a study done by Wada et al (2016) ,it has been found that respiratory muscle stretching improves the ventilatory capacity and functional capacity of the individual by reducing dyspnoea in COPD.<sup>26</sup>Minoguchi et al. (2002) compared the effect of respiratory muscle stretch proposed as a possible additional form of rehabilitation for patients with chronic obstructive pulmonary disease (COPD), with that of inspiratory muscle training and concluded that respiratory muscle stretch were clinically benefitted than inspiratory muscle training.<sup>27</sup>According to another study done by Dangi Ashwini et al (2017), PNF technique in the form of intercostal stretch is effective in reducing dyspnoea, improving chest expansion and increasing the functional capacity

in COPD.<sup>28</sup>Michael T. Put, et al (2008) also found that PNF stretching technique increases ROM in the chest and shoulder girdle and increases vital capacity in COPD patients in the short term.<sup>29</sup> Marli M. Knorst et al (2012) also showed that PNF of accessory muscles improves the intercostal and thoracic expansion in subjects without COPD and COPD, the increases PEmax in COPD patients.<sup>30</sup> Rekha et al (2016) determined that respiratory accessory muscle stretching significantly improved chest expansion, reduced dyspnoea, and increase exercise tolerance level in patients with COPD.<sup>31</sup>

Gui bin Song et al (2015) showed that both chest resistance and chest expansion exercises were effective for improving respiratory function and trunk control ability in stroke patients; however, chest resistance exercise is more efficient for increasing trunk control ability.<sup>32</sup>

In a study done by Gopi Parth Mehta et al (2015) and Dr. Dhara B Desai et al (2017) on geriatric population to study the effect of respiratory Proprioceptive Neuromuscular Facilitation (PNF) exercises on the pulmonary function showed that respiratory PNF exercise improves the pulmonary function in geriatric population.<sup>33,34</sup>

Anup Bhat et al (2014) formulated a questionnaire to assess the current chest physiotherapy practices in neurological ICUs of India. According to this survey, nearly 85% of physiotherapists practiced PNF techniques in neurological ICU patients for lung expansion therapy when appropriate.<sup>35</sup>

**CONCLUSION**

Many researchers have shown that using respiratory PNF techniques is beneficial for patients under various conditions.

In line with previous studies, it can be concluded that Proprioceptive Neuromuscular Techniques for respiration are effective for patients in intensive care unit.

**REFERENCES**

1. Jose Nidhin .Respiration Physiology. International Journal of Current Research and Review.2010;2(1):56-57
2. Shetty Akshay. The human respiration process. Respire Care.2013;58(12):2107-12
3. 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; 155(6):1940-1948
4. Marek SM, Cramer JT, Fincher AL, Massey LL, Dangelmaier SM, Purkayastha S, Fitz KA, Culbertson JY. Acute effects of static and proprioceptive neuromuscular facilitation stretching on muscle strength and power output. Journal of Athletic Training. 2005;40(2):94
5. Chris Wasson.Post Operative complications.NHS Foundation Trust Journal.2013;23(4):46
6. Danelle Preston.Chest Physiotherapy in ICU. International Journal of World Research.2013;1(32):57
7. Nicolino Ambrosino, MD and Dewi N. Makhabah MD. Physiotherapy in the ICU.Physical Therapy journal.2014;87(2):80
8. Nancy D Ciesla.Chest .Physical Therapy for Patients in the Intensive Care Unit.Physical Therapy journal. 1996;76:6
9. Funk DC, Swank AM, Mikla BM .Impact of Prior Exercise on Hamstring Flexibility: A Comparison of Proprioceptive Neuromuscular Facilitation and Static Stretching. Natl Str Cond Assoc J. 2003;17(3):489-492
10. L. Saliba, Gregory ,S. Johnson, and Cheryl Wardlaw;Proprioceptive Neuromuscular Facilitation.Institute of physical art.Physiotherapy1994;88(2):89-97
11. Defne kayan .Proprioception: the forgotten sixth sense; Respiration and Proprioception.1995;5:89
12. Frownfelter DL, Dean E. Principles and practice of cardiopulmonary physical therapy. Mosby Incorporated. 1996.pg290
13. Marek SM, Cramer JT, Fincher AL.Acute effects of static and proprioceptive neuromuscular facilitation stretching on muscle strength and power output. Journal of Athletic Training.2005;40(2):94
14. Fagen TA, Farr BK .Immediate effect of PNF stretching;The Sports Physiotherapist journal.2011;1:27-28
15. M.PaulRaj ,S.Deepika Shristhudhi, Dr. Supriya K ,Vinod, & K. AnandBabu.effectiveness of pnf of respiration to improve the exercise capacity in patients with COPD: a pilot study .International Journal of World Research.2017;1(35):6
16. Chordiya S Sneha, Kazi Atharuddin, Shetty Akshaya.Effect of respiratory proprioceptive neuromuscular facilitation technique with chest physiotherapy in mechanically ventilated Organophosphorus poisoning patients. International Journal of Multidisciplinary Research and Development.2017; 4( 6): 01-06
17. Vaishali, Jithendra Kumar, V. Prem, Sushmitha.N, Shailendra Lende.chest physiotherapy for atelectasis in neonate with pulmonary hemorrhage- a case report. International Journal of Current Research and Review.2010 ;2(1):28-31
18. Gui bin Song, Eun cho Park.Effects of chest resistance exercise and chest expansion exercise on stroke patients’ respiratory function and trunk control ability.J. Phys. Ther. Sci..2015; 27: 1655-1658
19. Eklund G, von Euler C and Rutkowski S . Spontaneous and reflex activity of Intercostal gamma Moto neurons. Journal of Physiology1964; 171: 139-163.

20. Nirali B Thakkar.Role of PNF techniques in chest physiotherapy. Physiotherapy- The Journal of Indian Association of Physiotherapist.2006;2: 10-14
21. 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
22. 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
23. Nitz J, Burke B.A study of the facilitation of respiration in myotonic dystrophy .Physiother Res Int. 2002;7(4):228-38.
24. Chang Angela,Paratz Jennifer. Ventilatory effects of neurophysiological facilitation and passive movement in patients with neurological injury.Australian Physiotherapy Association Journal.2002;48(4):305-10
25. Lanza Fde C, de Camargo AA, Archija LR.Chest wall mobility is related to respiratory muscle strength and lung volumes in healthy subjects. Respir Care. 2013;58(12):2107-12.
26. Wada J, Borges-santos E, Silva RA, Porras DC, Paisani D, Silva CM, et al.Effects of respiratory muscle stretching on thoracoabdominal mechanics, functional capacity and dyspnea in COPD patients. Eur Respir J. 2014;44: 36-62.
27. Minoguchi H, Shibuya M, Miyagawa T, Kokubu F, Yamada M, Tanaka H, et al.Cross-over comparison between respiratory muscle stretch gymnastics and inspiratory muscle training.Intern Med 2002;41(10):805-12
28. Dangi Ashwini, Sheth Bhagyashri, Deo Medha .Comparison of Intercostal Stretch Technique Versus Diaphragmatic Breathing on Dyspnoea, Chest Expansion And Functional Capacity in Stable COPD. International Journal of Scientific and Research Publications.2017; 7( 5) :2250-3153
29. Michael T. Putt, Michelle Watson, Helen Seale, Jennifer D.Paratz;Muscle Stretching Technique Increases Vital Capacity and Range of Motion in Patients With Chronic Obstructive Pulmonary Disease. Arch Phys Med Rehabil .2008;89:1103-1106
30. Knorst M.M,Dumke A,Falkembeck D.Effects Of A Proprioceptive Neuromuscular Facilitation Stretching Technique Of The Accessory Respiratory Muscles On Patients With And Without COPD. American Journal of Respiratory and Critical Care Medicine .2012; 185:A1556
31. Rekha , Rai Shristi, Vaiyapuri Anandh, Samuel Sundar Doss. Effect of stretching respiratory accessory muscles in chronic obstructive pulmonary disease.asian journal of pharmaceutical and research.2016;9(1):105-108
32. Gui bin Song, Eun cho Park. Effects of chest resistance exercise and chest expansion exercise on stroke patients’ respiratory function and trunk control ability .J. Phys. Ther. Sci..2015; 27: 1655-1658
33. Mehta Gopi Parth , Babu Vinod .K ,Akshata Akalwadi ,Sai Kumar .N .Combined effects of PNF stretching with chest mobility exercises in elderly.Int J Physiother. 2015 ;2(3):563-571
34. Desai Dr. Dhara B Desai, Mulla Ayesha S.A study to determine the effect of respiratory proprioceptive neuromuscular facilitation (PNF) exercises on the pulmonary function in geriatric population: An interventional study .International Journal of Multidisciplinary Research and Development .2017; 4(4):238-241
35. Bhat Anup, Chakravarthy Kalyana and Bhamini K.Chest physiotherapy techniques in neurological intensive care units of India;A survey.Indian J Crit Care Med. 2014 ; 18(6): 363-368.