International Journal of Science and Research (IJSR)
ISSN: 2319-7064
SJIF (2019): 7.583

Effect of Neurophysiological Facilitation of Respiration on Respiratory Rate and Chest Expansion in Children with Spastic Cerebral Palsy - An Experimental Study

Snehaben Patel[1], Hardini Prajapati[2]

[1]MPT in Cardiopulmonary, Student of Ahmedabad Institute of Medical Sciences

[2]MPT in Cardiopulmonary, Lecturer and PG Guide, Ahmedabad Institute of Medical Sciences

Abstract: ***Background: Spastic cerebral palsy is one of the most common type. The children with spastic cerebral palsy has decreased chest mobility due to tightness of the muscles, fascia and skin overlying the chest reduces expansion. Neurophysiological facilitation of respiration technique is used for improvement in neuromuscular disease and it is a proprioceptive and tactile stimulus that alter the depth and rate of breathing. Aim and Objectives: To evaluate effect of neurophysiological facilitation of respiration on respiratory rate and chest expansion at 2nd & 9th rib level in spastic cerebral palsy children. Method: An experimental study was conducted on spastic cerebral palsy children of different areas of Ahmedabad, to assess pre and post difference in RR and chest expansion at both levels by applying intercostal stretch, vertebral pressure and anterior stretch basal lift for 5 days a week for 2 weeks. Result: Statistical analysis showed that there was significant improvement in all outcome measures after application of NPF techniques. RR improved significantly [p < 0.05] and Chest expansion also increased at both levels [P<0.05]. Conclusion: NPF of respiration can improve RR and chest expansion at both levels.***

Keywords: Neurophysiological facilitation of respiration, intercostal stretch, vertebral pressure and anterior stretch basal lift, Spastic cerebral palsy

1. Introduction

Cerebral palsy describes a group of disorders of the development of movement and a posture, causing activity limitations that are attributed to non-progressive disturbances that occurred in developing fetal or infant brain. The motor disorders of cerebral palsy are often accompanied by disturbances of sensation, cognition, communication, perception and/or behavior and a seizure disorders.These problems include spasticity, dystonia, contractures and poor balance. The incidence of cerebral palsy is up to 2 to 2.5 cases per 1000 live births. There are an estimated over 25 lakh children and people in India with cerebral palsy.Spastic cerebral palsy is one of the most common type. Spasticity occurs as a result of a loss of upper motor neuron inhibition on the lower motor neurons which results in increased or impaired motor unit firing and altered muscle tone. This results in muscle stiffness and increased muscle tone.

As in cerebral palsy we are mainly focusing on the motor, sensory, balance function. We should also focus in the cardio-respiratory system to prevent the secondary complications. The children with spastic cerebral palsy has decreased chest mobility due to tightness of the muscles, fascia and skin overlying the chest reduces expansion. Neurophysiological facilitation of respiration technique is used for improvement in neuromuscular disease. Facilitator stimulus in the form of neurophysiological Facilitation of respiration is adopted to produce reflux respiratory movement responses. Neurophysiological Facilitation of respiration techniques are externally applied proprioceptive and tactile stimuli that produce reflex respiratory movement responses that appear to alter the rate and depth of breathing. Intercostal stretch, vertebral pressure, anterior stretch basal lift are one of the technique of neurophysiological facilitation of respiration. Which technique help in improving breathing pattern, respiratory muscle activity, increase chest expansion, increased epigastric excursion and pressure over the vertebrae results in increased respiratory movement.

Payal Gupta et al (2014) in Gujarat studied Effect of Intercostal Stretch Technique and Anterior Stretch Basal Lift Technique on Respiratory Rate, Saturation of Peripheral Oxygen and Heart Rate among ICU Patients in 30 patients were systematically divided into Group A (Intercostal stretch) and Group B (Anterior Stretch Basal Lift) and concluded that intercostal stretch is more effective in reduction of respiratory rate and heart rate and improving oxygen saturation over anterior stretch basal lift technique because of application of a stretch to the chest wall just prior to inspiration, increases the gamma motor neuron discharge and alpha motor neuron activity is enhanced which regulate respiratory drive.

Dangi Ashwini et al (2017) in Navi Mumbai studied Comparison of Intercostal Stretch Technique Versus Diaphragmatic Breathing on Dyspnea, Chest Expansion And Functional Capacity in Stable Copd in 18 subjects they were divided randomly in two groups group A (intercostal stretch) and group B (diaphragmatic breathing along with conventional chest physiotherapy) and concluded that both intercostal stretch technique and diaphragmatic breathing are equally effective in reducing dyspnea, improving chest expansion and functional capacity in stable COPD because

with intercostal stretching and diaphragmatic breathing, the lung compliance and the chest wall mobility is improved which indirectly increasing the functional capacity.

2. Material and Methodology

Total 18 males [n=12] and female [n=6] patients with spastic cerebral palsy were assessed as per inclusion and exclusion criteria recruited from outpatient physiotherapy department of Ahmedabad. Patients who were diagnosed with spastic quadriplegic CP, spastic hemiplegic CP and spastic diplegic CP with age group between 2-12 years and willingness of their guardians or parents included in the study. Other type of CP, down's syndrome, hypersensitive child, any recent cardio thoracic surgery before 6 months, undergone Botoxtherapy, thoracic cage anomaly, medical illness was excluded from study. The procedure, nature and purpose of study explained to parents or guardians of all patients and written informed consent was taken from parents of children or their legal guardian before study. All NPF techniques were given in supine lying position with limbs in neutral position. Techniques given were Intercostal stretch, vertebral pressure and anterior stretch basal lift.

Each patient was given intercostal stretch, vertebral pressure and anterior stretch basal lift for 2 minutes with 1-minute break in between each technique for one session per day for 5 days per week for 2 weeks. RR and chest expansion at 2nd and 9th rib level were taken before intervention and after 2 weeks.

Intercostal stretch [Technique1] was given in supine lying position of patient with arms by side and therapist was behind the patient than remove cloth over chest area and intercostal stretch was applied over anterior ribs 2 and 3 with the help of index finger and middle finger and application of stretch given during exhalation and cycle was repeated for 2 minutes. This is provided by applying pressure to upper border of the rib in order to stretch the intercostal muscles in a downward direction. Alternatively, vertebral pressure [Technique2] The technique was given with the patient in supine position and a firm pressure was applied to the upper most thoracic vertebrae(T1-T2) to increase the epigastric excursion in the presence of a relaxed abdominal wall and pressure was applied to the lower thoracic vertebrae(T10-T12) to improve the inspiratory movement of the apical thorax and cycle was repeated for 2 minutes. The pressure should be firm enough to provide intrafusal stretch. Anterior stretch basal lift technique [Technique3] The technique was given by placing the hands under the lower ribs of the supine patient and gently lifting upwards at the time of expiration bilaterally and sustained stretch was maintained and increasing movement of the ribs in a lateral and posterior direction can be seen and felt and cycle was repeated for 2 minutes with 1-minute rest in between every technique. As the lift sustained stretch was maintained which in turn causes obvious epigastric movement.

3. Result

Total 18 patients were selected on the basis of inclusion criteria and pre data were taken in form of RR and chest expansion at both levels (2nd and 9th level.). Then treatment in form of neurophysiological facilitation of respiration was given for one session per day for 5 days in a week for 2 weeks and then post data were taken and result was analyzed using Statistical Package for Social Sciences version 23 (SPSS v.23) and Microsoft Excel 2007. Pre and post values comparison was analyzed by using Wilcoxon Signed Ranks Test for outcome measure RR and chest expansion at 2nd and 9th rib level. A difference when p was < 0.05 was considered significant.

Table 1: pre and post mean of RR in spastic CP

Outcome	Pre (Mean ± SD)	Post (Mean ± SD)	Z-value	P-value
RR	27.5± 3.74	22.66±3.41	3.735	0.001

Table 2: Pre and post mean of chest expansion at 2nd rib level in spastic CP

Outcome	Pre (Mean ± SD)	Post (Mean ± SD)	Z-value	P-value
C.E. (2^{nd})	1.72± 0.95	2.94±0.87	3.787	0.001

Table 3: Pre and post mean of chest expansion at 9^{th} rib level in spastic CP

Outcome	Pre (Mean ± SD)	Post (Mean ± SD)	Z-value	P-value
C.E. (9^{th})	2.44± 0.85	3.72±0.89	3.782	0.001

Table 4: Pre and post mean of RR in different spastic CP children

Group	Pre (Mean±SD)	Post (Mean ± SD)	Z-value	P-value
Spastic Quadriplegic CP	27.25 ± 4.52	22.12 ± 4.08	2.527	0.012
Spastic Diplegic CP	27.57 ± 3.77	22.57 ± 3.20	2.375	0.018
Spastic Hemiplegic CP	28± 2	23.66 ± 3.21	1.604	0.109

Table 5: Pre and post mean of chest expansion at 2^{nd} rib level in different spastic CP children

Group	Pre (Mean±SD)	Post (Mean ± SD)	Z-value	P-value
Spastic Quadriplegic CP	1.62 ± 1.06		2.460	0.014
Spastic Diplegic CP	2 ± 1	3.28 ± 0.75	2.460	0.014
Spastic Hemiplegic CP	1.33 ± 0.57	2.33± 0.57	1.732	0.083

Table 6: Pre and post mean of chest expansion at 9^{th} rib level in different spastic CP children

Group	Pre (Mean ± SD)	Post (Mean ± SD)	Z-value	P-value
Spastic Quadriplegic CP	1.75 ± 0.46	3.125 ± 0.99	2.414	0.016
Spastic Diplegic CP	3.28 ± 0.48	4.28 ± 0.48	2.646	0.008
Spastic Hemiplegic CP	2.33 ± 0.57	3.66 ± 0.577	1.633	0.102

4. Discussion

There was positive effect of neurophysiological Facilitation of respiration on RR and chest expansion in children with spastic cerebral palsy. Pucker et al. (2002) studied with the effect of intercostal stretch on third and the eighth intercostal space in which they proved there was decrease in breathing frequency when a stretch performed on third and eighth

intercostal spaces. This study did not have statistically significant values between the groups on respiratory rate. However, the rate of respiration lessened only in the experimental group, which showed there were impacts on respiratory rate also when an intercostal stretch was performed. Sumeera Jan et al (2017) in India studied effect of ventilatory facilitation on chest expansion and pulmonary functions in children with spastic cerebral Palsy on 30 patients and concluded that ventilatory movement strategies along with incentive spirometry in addition to conventional exercises were effective in improving respiratory parameters, trunk control and gross motor functions in children with spastic cerebral palsy because improved chest wall mobility all muscles of ventilation are at mechanical advantage i.e. optimal resting length. The theory of Laplace's law suggests that the length of muscle relates to the maximal force of either diaphragm or intercostal muscles, which affect ventilation in the lung. So, due to ventilatory movement strategies all the muscles of ventilation are facilitated to work at optimal length which further results in increase in the recruitment of fibers and also in the increased strength and endurance of the muscles of ventilation. Long term follows up was not taken and patients with different GMFCS levels were taken were limitations of the study. The children with spastic cerebral palsy has decreased chest mobility and due to that they suffer from a high incidence of respiratory dysfunction. So, we also have to focus in the cardio respiratory system to prevent the secondary complications along with neurological manifestations. In this short period of time, improvement noticed in RR and chest expansion at 2nd and 9th rib level so study suggested that neurophysiological Facilitation of respiration should be implacable in clinics which improve patient's pulmonary function, RR and chest expansion at both level.

5. Future Scope

These type of study also can be done with different type of cerebral palsy patients as well as classify according to different GMFCS level. Neurophysiological facilitation of respiration can be added in the conventional therapy for CP to focus on the pulmonary functions.

6. Conclusion

It can be concluded from the study that neurophysiological facilitation of respiration is effective in improving RR and improving chest expansion at 2nd and 9th rib level in spastic CP statistically and clinically.

References

[1] Shraddha J. Diwan*, Ankita B. Bansal, Hetal Chovatiya, Dhara Kotak, Neeta Vyas: Effect of anterior chest wall myofascial release on thoracic expansion in children with spastic cerebral palsy. May2014
[2] Murat Ersöz, Barın Selçuk, Ramazan Gündüz, Aydan Kurtaran, Müfit Akyüz. Decreased chest mobility in children with spastic cerebral palsy.2006
[3] Pryor and weber: Physiotherapy for respiratory and cardiac problems.2nd edition
[4] Payal Gupta, Gopal Nambi S, Gagan Gupta, Rimpi Nagar, Priyanka Mehta, Ankita Makwana.. Effect of Intercostal Stretch Technique and Anterior Basal Lift Technique on Respiratory Rate, Saturation of Peripheral Oxygen and Heart Rate among ICU Patients.January 2014
[5] Peter Rosenbaum. A report: the definition and classification of cerebral palsy. April 2006.
[6] Dinah S Reddihough and Kevin J Collins. The epidemiology and causes of cerebral palsy.2003
[7] Sophie Levitt. Treatment of cerebral palsy and motor delay.4th edition.
[8] Jan Stephen Tecklin. Pediatric Physical Therapy.3rd edition.
[9] Snehalben Chaudhari. A study to determine normative chest expansion values in normal children of age 5-11 years.2010
[10] 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.April 2017
[11] Dangi Ashwini, Sheth Bhagyashri, Deo Medha. Comparison of Intercostal Stretch Technique Versus Diaphragmatic Breathing on Dyspnoea, Chest Expansion and Functional Capacity in Stable Copd.May 2017
[12] Casas M, Kenny D, McPherson K. Swallowing/ventilation interactions during oral swallow in normal children and children with cerebral palsy. Dysphagia 1994
[13] Mirrett P, Riski JE, Glascott J, Johnson V. Videofluoroscopic assessment of dysphagia in children with severe spastic cerebral palsy. Dysphagia 1994.
[14] Kwon YH, Lee HY. Differences of respiratory function in children with spastic diplegic and hemiplegic cerebral palsy, compared with normally developed children. Journal of pediatric rehabilitation medicine 2013;6(2):113-7
[15] Glady. Physiotherapy in neuro-conditions.2006
[16] Bax MC, Flodmark O, Tydemen C. Definition and classification of cerebral palsy. From syndrome toward disease. Dev Med Child neuroal suppl.2007
[17] Jane M. Braverman. Airway clearance Dysfunction Associated with Cerebral Palsy: An Overview. Hill – Rom Services ,2001
[18] Yong Hyun Kwon, et al. Difference of respiratory function according to level of the gross motor function classification system in children with cerebral palsy.J. Phys.Ther.2014
[19] Eklund G, von Euler C and Rutkowski S (1964): Spontaneous and reflex activity of Intercostal gamma Moto neurons. Journal of Physiology.
[20] Davis J, Sears T. The proprioceptive reflex control of the Intercostal muscles during their voluntary activation. The Journal of Physiology. 1970
[21] P C Seddon, et al (2003) Respiratory problems in children with neurological impairment
[22] Nanci Yuan et al (2010). Safety, Tolerability, and Efficacy of High Frequency Chest Wall Oscillation in Pediatric Patients with Cerebral Palsy and

Neuromuscular Diseases: An Exploratory Randomized Controlled Trial
[23] Dr Andrew Wilson et al (2014) Breathing problems in children with cerebral palsy
[24] Giancarlo Garuti et al (2016) Management of bronchial secretions with Free Aspire in children with cerebral palsy: impact on clinical outcomes and healthcare resources
[25] Balachandran A (2005) Chest physiotherapy in pediatric practise
[26] Braverman J (2001) Airway clearance dysfunction associated with Cerebral palsy an overview
[27] Van Zelst BR, Miler MD, Russo RN. Activities of daily living in children with hemiplegic cerebral palsy: a cross sectional evaluation using the assessment of Motor and Process Skills.Dev Mid Child Neurol.2006
[28] Fowler EG, Kolobe TH, Damiano DL, et al. Promotion of physical fitness and prevention of secondary conditions for children with cerebral palsy: section on paediatrics research summit proceedings.Phys Ther.2007

Author Profile

Dr. Snehaben Patel (Main Author) [MPT in Cardiopulmonary] Student of Ahmedabad Institute of Medical Sciences,

Dr. Hardini Prajapati [MPT in Cardiopulmonary], Lecturer and PG Guide, Ahmedabad Institute of Medical Sciences, Nr. S P ring road, Gota-Kalol Highway, Lapkaman, Ahmedabad, Gujarat.