ORIGINAL RESEARCH PAPER

Physiotherapy

KEY WORDS: Chronic obstructive pulmonary disease (COPD), respiratory muscles, muscular stretching, respiratory mechanics, dyspnea

EFFECT OF AEROBIC TRAINING COMBINED WITH RESPIRATORY MUSCLE STRETCHING ON THE FUNCTIONAL EXERCISE CAPACITYIN PATIENTS WITH CHRONIC OBSTRUCTIVE PULMONARY DISEASE (COPD) - A REVIEW

Shobha Keswani Department of Physiotherapy and Rehabilitation, Max Super Speciality Hospital, Saket, New Delhi.

Sumit Kalra* Department of Physiotherapy and Rehabilitation, Max Super Speciality Hospital, Saket, New Delhi*Corresponding Author.

Varun Khurana Department of Physiotherapy and Rehabilitation, Max Super Speciality Hospital, Saket, New Delhi.

Kanchan Shekhawat Department of Physiotherapy and Rehabilitation, Max Super Speciality Hospital, Saket, New Delhi.

ABSTRACT

Chronic obstructive pulmonary disease is very common. To improve functional exercise capacity these techniques are use.
The aim of this paper is to comprehensively review the literature concerning this topic and summarize existing knowledge on the effect of Aerobic training combined with respiratory muscle stretching on the functional exercise capacity in patients with Chronic obstructive pulmonary disease (COPD). This paper provides a narrative review of literature in this area.
Furthermore, this review identifies areas for further research and makes recommendation for clinical practice.

INTRODUCTION

Chronic obstructive pulmonary disease (COPD) is characterized by a progressive and persistent airflow limitation and decreased parenchymal elasticity.[1] The respiratory muscles remain contracted for prolonged periods in an attempt to meet the increased ventilatory flow demand on the respiratory muscles.[2,3] The association between both hyperinflation and increased respiratory demand reduces the contractile range of sarcomere of the respiratory muscles, resulting in even more severe dyspnea further stimulation increase in the ventilatory demand.[3,4]

Dyspnea and shortening of respiratory muscles hamper the performance of activities, which results in physical deconditioning in patients with COPD.[5] Aerobic training improves their physical capacity and reduces dyspnea.[6] Muscle stretching modifies the properties of tissues, increasing sarcomere size and muscle viscoelasticity. [8] Respiratory muscle stretching increases the capacity for chest wall expansion.[8,9] Currently ,there is no evidence to support the recommendation of respiratory muscle stretching for treating patients with COPD, [10,11]Respiratory muscle stretching might potentiate the benefits of aerobic training by improving thoracoabdominal mobility.[12]

REVIEW OF LITERATURE

Noll DR et al (2009) determined the immediate effect of four osteopathic techniques on pulmonary function measures in persons with Chronic obstructive pulmonary disease relative to a minimal touch control protocol.[1] The effect of diaphragmatic breathing learning on chest wall motion, mechanical efficiency of the respiratory muscles, breathing pattern and dyspnea sensation was studied by Gosselink RA et al (1995). Tidal volume , respiratory frequency and duty cycle did not change significantly during diaphragmatic breathing.[2]

Yamaguti WP et al (2012) studied the effects of a diaphragmatic breathing training program on functional capacity in patients with chronic obstructive pulmonary disease. He concluded that diaphragmatic breathing training program for patients with COPD disease induced increased diaphragm participation during natural breathing.[3] Ventilatory techniques to optimize mechanical ventilation in acute exacerbation of COPD studied by Reddy RM et al (2007).[4] Paradoxical movement of the lower ribcage at rest and during exercise in Chronic obstructive pulmonary disease. Lower ribcage paradox at rest is responsible and hyperinflation of the chest wall and predominant dyspnea at end- exercise. This study was conducted by Calverley PM et al (2009).[5]

Dynamic hyperinflation of the lungs impairs exercises performance in Chronic obstructive pulmonary disease (COPD). Dynamic hyperinflation is not the only mechanism limiting exercise performance in patients with stable Chronic obstructive pulmonary disease. This studied by Stevenson N et al (2004).[6] Polkey MI et al (2013) studied six-minute walk test in Chronic obstructive pulmonary disease[7] and Zainuldin MR et al (2007) studied cycle training intensity for patients with Chronic obstructive pulmonary disease is normally based on an incremental cycle test and cycle training intensity by utilising a simple, reliable and inexpensive 6MWT, thus providing a better standard of care for patients with COPD referred to pulmonary rehabilitation.[8] Lung and chest wall mechanics can be modelled and which are the mechanical constraints imposed on the ventilatory system studied by Aliverti A et al (2008).[9]

Heneghan NR et al (2015) studied manual therapy for Chronic obstructive pulmonary airway disease.[10] and Specific hold and relax stretching techniques was capable of reversing the effect of tight chest wall muscles by increasing chest expansion, vital capacity and decreasing perceived dyspnea and respiratory rate in persons with COPD studied by Putt MT et al (2008)[11] and Rilay DA et al (2012) studied active stretch is necessary for regulating muscle fibre length and effect of stretching muscle fibres is expected when the lengthening exceeds the optimum fibre length.[12] Geogiadou O et al (2007) studied the effect of pulmonary rehabilitation on the regulation of total chest wall and compartment volumes during exercise in patients with COPD. [13]

Pulmonary rehabilitation is recognized as a core component of the management of individuals with COPD conducted by Spruit MA et al (2013)[14] and Dodd JW et al (2011) conducted the Chronic obstructive pulmonary disease (COPD) assessment test (CAT) is a recently introduced, simple to use patient completed quality of life instruments and CAT score is simple to implement as an outcome measures, improves in responses to PR. [15] Minoguchi H et al (2002) studied the effects of respiratory muscle stretch gymnastics, proposed as a possible additional form of rehabilitation for patients with COPD, with inspiratory muscle training.[16] The control of breathing results from a complex interaction involving the respiratory centres, feed signals to a central control mechanism and in turn ,provides output to the effector muscles.[17]

Ito M et al (1999) investigated the immediate effect of respiratory muscle stretch gymnastics and diaphragmatic breathing on the respiratory pattern in patients with COPD[18] and the effect of inspiratory muscle thixotropy on the 6-min walk distance in COPD studied by Satake M et al (2008)19and Gagliardi E et al (2014)

studied interrelations among chest wall kinematics, ventilatory profile following cycle exercise training have not systematically evaluated in hyperinflation COPD.20

CONCLUSION

Our results suggest that an aerobic training program combined with respiratory muscle stretching reduces dyspnea and increases functional and ventilatory capacities in patient with Chronic obstructive pulmonary disease (COPD). The program used in this study increased inspiratory muscle efficiency.

REFERENCES

1. Noll DR, Johnson JC, Barr RW, Snider EJ. The immediate effect of individual manipulation techniques on pulmonary function measures in persons with Chronic obstructive pulmonary disease (COPD). Osteopath Med Prim Care. 2009;3(9):1 – 12.
2. Gosselink RA, Wagenaar RC, Rijswijk H, Sergeant AJ, DecramerML. Diaphragmatic breathing reduces efficiency of breathing in patients with chronic obstructive pulmonary disease. Am Just Respiratory Crit Care Med. 1995;151(4):1136 -1142.
3. Yamaguti WP, Claudio RC, Neto AP, et al. Abdominal motion during natural breathing in patients with chronic obstructive pulmonary disease: a randomized controlled trial. Arch Phys Med Rehabil. 2011;93(4):571 – 577.
4. Reddy MR, Guntupalli KK. Review of ventilatory techniques to optimize mechanical ventilation in acute exacerbation of chronic obstructive pulmonary disease. Int J Chron Obstruct Pulmon Dis. 2007;2(4):2680 – 2689.
5. Aliverti A, Quaranta M, Chakrabarti B, Albuquerque AL, Calverley PM. Paradoxical movement of the lower ribcage at rest and during exercise in COPD patients. EUR Respir J. 2009;33(1):49 –60.
6. Aliverti A, Stevenson N, Dellaca R, Lo M, Pedotti A, Calverley P. Regional chest wall volumes during exercise in chronic obstructive pulmonary disease. Thorax. 2004;59(3):210 – 216.
7. Figueiredo PHS, GuimaraesFS. The average speed from six minutes walking test as a parameter to determine the training load for physical reconditioning of chronic pulmonary disease. ActaFisiatr. 2009;16(4): 156 – 161.
8. Zainuldin MR, Knoke D, Mackey DG, Luxton N, Alison JA. Prescribing cycle training intensity from the six – minute walk test for patients with COPD. BMC Pulm Med. 2007;7(9):1 – 7.
9. Aliverti A, Lung and chest wall mechanics during exercise : effects of expiratory flow limitation. RespirPhysioNeurobiol. 2008;163(1-3):90 – 99.
10. Heneghan NR, Adab P, George M, Rachel E. Manual therapy for Chronic obstructive airways disease : a systematic review of current evidence. Man Ther. 2012;17(6): 507 – 518.
11. Putt MT, Watson M, Sealed H, Paratz JD. Muscle stretching technique increases vital capacity and range of motion in patients with chronic obstructive pulmonary disease. Arch Phys Med Rehabil. 2008;89(6):1103 –1107.
12. Rilay DA, Van Dyke JM. The effects of active and passive stretching on muscle length. Phys Med RehabilClin N Am. 2012;23(1):51 –57.
13. Georgiadou O, Vogiatzis I, Stratakos G. Effects of pulmonary rehabilitation on operational chest wall volumes during exercise in COPD patients. EurRespir J. 2007;29(2):284 – 291.
14. Spruit MA, Singh SJ, Garvey C, et al. ATS/ERS Task Force on Pulmonary Rehabilitation An official American thoracic society /European respiratory society statement:key concepts and advances in Pulmonary rehabilitation. Am J RespirCrit Care Med. 2013;188(8):13-64.
15. Dodd JW, Hogg L, Nolan J, et al. The COPD assessment test (CAT): response to pulmonary rehabilitation. A multi entre, prospective study. Thorax. 2011;66 (5):425-429.
16. Minoguchi H, Shibuya M, Miyagawa T, et al. Cross-over comparison between respiratory muscle stretch gymnastics and inspiratory muscle training. Intern Med. 2002;41(10):805-812.
17. Montaldo BC, Gleeson K, Zwillich CW. The control of breathing in clinical practice. Chest. 2000;117(1):205-225.
18. Ito M, KakizakiF, Tsuzura Y, Yamada M. Immediate effect of respiratory muscle stretch gymnastics and diaphragmatic breathing on respiratory pattern. Intern Med. 1999;38(2):126-132.
19. Izumizaki M, Masahiro S, Takashi H, Keiyu S, Shioya T, Homma I. Effects of inspiratory muscle thixotropy on the 6-min walk distance in COPD. Respir Med. 2008;102(7):970-977.
20. Gagliardi E, Bruno GI, Presil, Gigliotti F, Scano G. Thoracoabdominal motion/displacement does not affect dyspnea following exercise training in COPD patients. RespirPhysiolNeurobiol. 2014;190:124-130.
21. Kokkonen J, Nelson AG, Eldredge C, Winchester J. Chronic static stretching improves exercise performance. Med Sci Sports Exerc. 2007;39(10)1825-1831.
22. Pereira CAC, Sato T, Rodriguez SC. New reference values for forced spirometry in white adults Brazil. J Bras Pneumol. 2007;33(4):397-406.