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EFFECTIVENESS OF BREATHER DEVICE IN CERVICAL SPINAL CORD INJURY- A CASE REPORT

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ABSTRACT

Respiratory complications are a leading cause of morbidity and mortality in the SCI population as a result of denervation of the inspiratory and expiratory muscle. This predisposes patients to develop atelectasis, sputum retention, respiratory infection and ultimately respiratory failure. Respiratory muscle strength is a predictor for respiratory complications that are important to individuals with SCI. The patient was a 50 year old male diagnosed with traumatic spastic quadriparesis with C5-6, C6-7 spinal cord Compression, admitted in Spinal cord rehabilitation unit presented with ineffective cough. The patient was assessed for respiratory muscle strength by measuring maximum inspiratory (Pimax) and expiratory pressure (Pemax) and Peak Cough Flow (PCF). By using breather device, patient underwent respiratory muscle training for twice a day, 5 days per week for 6 weeks. An improvement in Pimax, Pemax and PCF was noted. This case report evident the successful use of Breather device in SCI patient. The breather device could further be used for improving and maintaining the respiratory muscle strength thus preventing the development of respiratory complications.

KEY WORDS: *Breather device, Pimax, Pemax, PCF, Spinal Cord Injury.*

INTRODUCTION

Traumatic spinal cord injury is defined as an acute injury of the spinal cord which results in a varying degree of paralysis and/or sensory disorder.[1] It is a serious medical condition that causes functional, psychological, socioeconomic disorder and causes significant impairments in various aspects of life.[2] The spinal cord is affected by both the immediate physical effects of trauma, and secondary pathologic processes, especially ischemia and edema which may get worse during the first few hours after the injury.[1] Thus the goals of rehabilitation and other treatment approaches in SCI mainly focus on improvement in their functional level, decrease secondary morbidity and enhance health-related quality of life.[2]

In most people with acute spinal cord injury, respiratory function is seriously impaired even though partial recovery takes place during the first year after onset. Many people have respiratory impairments (e g, weak respiratory muscle strength, low lung volumes and flows, weak or ineffective cough) which consequently leads to elevated risk of respiratory complications as occurs in patients with cervical involvement.[3] The weakened respiratory muscles can neither fully expand the lungs up to the maximum capacity nor compress them to the point of the smallest residual volume which leads to reduction in the chest wall compliance by shortening and stiffening of the unstretched tissue and ultimately results in fibrosis of the weakened muscles.[4]

Abdominal muscle plays an important role in coughing. The abdominal muscle exerts a compressive force which increases the intrathoracic pressure leading to forceful exalation of the air. Ineffective cough is a common problem in the population with an SCI which occurs due to the loss of supraspinal control of the respiratory muscles below the spinal cord lesion. This inadequate clearance of the secretions which is caused due to ineffective cough may leads to various respiratory complications in patients with an SCI.[4]

Respiratory muscle strength is a predictor for respiratory complications that are important to individuals with SCI.[5] As poor respiratory muscle function is always associated with many respiratory dysfunction including dyspnea and ineffective cough, it is reasonable to believe that specific Respiratory Muscle Training (RMT) may have a beneficial influence upon the respiratory muscle and in its function once the patient is hemodynamically stable after injury. Such respiratory muscle training can achieved by using the breather device which can train both inspiratory as well as expiratory muscle. Thus the present case study will discuss the effect of breather device on various respiratory parameters in patient with cervical spinal cord injury.

CASE DESCRIPTION

A 50 year old male patient was a diagnosed case of traumatic spastic quadriparesis with C5-6, C6-7 P.I.D with cord compression with autonomic dysfunction. Patient was apparently alright 8 months back when he met with an accident on motorcycle. He was then taken to the hospital were investigations were done and patient was operated for anterior cervical discectomy (C5-6, C6-7) with fusion. After operation patient was shifted in ICU for 4 days where he received chest physiotherapy and then was shifted to general ward for 5 days and later got discharged. He was on regular neurophysiotherapy treatment at home. He then came to Pravara hospital where he was admitted in Spinal cord rehabilitation centre. Patient complained of difficulty in clearing secretion during coughing from the time of injury. He was then assessed for respiratory parameters which included respiratory muscle strength and peak cough flow.

Investigation

CT scan was done which revealed C4-C5-C6 intervertebral disc protrusion along with mild compression of theca and spinal cord with narrowing of bilateral foramina.

Outcome

Patients pre-intervention Pimax was -40cmH_2O, Pemax was 30cmH_2O measured by using hand held pressure manometer (Pimax device) and Peak cough flow (PCF) was 150 L/min, measured by using hand held peak flow meter device.

Consent

The purpose and procedure of the study was explained to the patient before starting the intervention. A brief review about the outcomes and its benefits was explained and then written patient informed consent was taken.

Management:

Initially patient's breathing pattern was assessed. Patient was taught how to perform diaphragmatic breathing. Patient was taken in semi-fowlers position by elevating the head-end of the bed for 45º. The breather device was held by the patient and was asked to perform the breathing exercise.

Intervention:

The intervention was explained to the patient and was asked to inform if he feels discomfort during the intervention. The resistance for both inspiration and expiration was set according to Pimax and Pemax. Initially patient was asked to perform diaphragmatic breathing exercise for 5-6 times, then the patient was asked to hold the breather device in between his mouth and not the teeth with one hand and other hand on the abdomen. He was then instructed to breathe in and hold the breath for 2-3 seconds and then breathe out for 2-3 second through the breather device. This was repeated for 10 times with 2 set along with a 5-6mins of rest in between the sets. The duration of the intervention consisted of 15-20mins, twice a day, 5days per week for 6 weeks. After 6 weeks of intervention post assessment was done.

Post intervention score:

After the intervention the treatment session of 6 weeks, patient's Pimax was -85 cmH_2O, Pemax was 65 cmH_2O and PCF was 250 L/min.

DISCUSSION

Respiratory muscle training is known to improve muscle strength in patient with neurological and neuromuscular disorders. Various protocols of respiratory training have been employed as a means of improving respiratory function in individuals with SCI.

This patient has shown great increase in Pimax, Pemax and in PCF. This could explain that respiratory muscle responds to the training stimuli in the same manner as other skeletal muscle, i e by undergoing adaptation to their structure and function that are specific to the training stimuli.[6] Although expiratory muscle adaptation have been less comprehensively studied, it can be seen that expiratory muscle respond to training stimuli in a similar manner as the inspiratory muscle which could be one of the reason for the improvement in cough. This improvement in respiratory muscle could have occur as muscle contraction stimulates a positive feedback loop via the spinal cord that increases motor drive to the respiratory muscle and thus the strength. This response ensures that an increase in the resistance to inhalation is met with a compensatory increase in muscle recruitment.[7] Changes in strength occurring within first 2 weeks of strength training have traditionally been attributed to a neural adaptation process, i.e improving the coordinated activation of the synergistic muscle. This improvement in the strength could confirm the presences of rapid fibre hypertrophy in response to load.[8]

As there was improvement in the expiratory muscle strength (Pemax), patient's ability to cough was significantly increased as these muscle plays an important role in the compression and expulsion phase of cough. This improved strength of expiratory muscles also help to generate sufficient dynamic airway compression to produce peak cough flow. This improvement has developed patient's positive attitude towards the treatment and has increased a lot of confident in the therapist.

CONCLUSION

This case report supports the clinical use of breather device for improving respiratory muscle strength and effective cough in patients with cervical spinal cord injury.

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