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Effect of respiratory exercises on neck pain patients: A pilot study

Vikram Mohan *, *Nabilah Bt Ahmad*, *Norain Bt Tambi*

Department of Physiotherapy, Faculty of Health Sciences, Universiti Teknologi MARA, Puncak Alam, Selangor, Malaysia

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ABSTRACT

Introduction: Neck exercises are reported to improve the patient's conditions in chronic neck pain (CNP). However, the existence of pain and loss of range of motion often results in CNP. As a result, respiratory functions are compromised and extended rehabilitation may be required for respiratory parameters among these populations.

Aim: The purpose of this study was to analyze the effects of respiratory exercises on respiratory muscle endurance, cervical range of motion and chest expansion after a set of prescribed respiratory exercise procedure among CNP.

Material and methods: Ten patients with CNP participated in this study. Subjects were divided randomly into either an experimental group, which received respiratory exercises or a control group, which received a routine physiotherapy exercises. The outcome measures such as pain, respiratory muscle endurance, cervical range of motion and chest expansion were assessed before and eight weeks following treatment by an assessor blinded to the treatment allocation of the patient.

Results and discussion: There was a highly significant increase in maximum voluntary ventilation (MVV) scores from before (mean 34.88, SD 21.81) to after treatment (mean 55.10, SD 16.76 and *t*-value 6.48) with $P = 0.003$ in the experimental group as compared to control group from before (mean 38.32, SD 19.50) to after treatment (mean 39.74, SD 17.56 and *t*-value 0.845) with $P = 0.446$. The two sets of scores in the active flexion and for the visual analogue scale also showed significant difference in the experimental group $P < 0.05$.

Conclusions: Respiratory exercise contributes to improvement in respiratory muscle endurance and reduces pain who is enduring from CNP.

1. Introduction

Neck pain is a common clinical context which happens in everybody's life. It ranked fourth highest in terms of disability and its accounts to 33.6 million in 2010 as reported by the global burden of neck pain.[1] It has been hypothesized and demonstrated that the chronic neck pain (CNP) patients presents a weakness of their respiratory muscles.[2,3] Similarly, studies have expressed that patient with CNP exhibited

* *Correspondence to*: Cardiorespiratory Laboratory, Department of Physiotherapy, Faculty of Health Sciences, Universiti Teknologi MARA, Puncak Alam Campus, 42300 Puncak Alam, Selangor, Malaysia. Tel.: +60 3 32584367; fax: +60 3 32584599.
E-mail address: vikkipt@gmail.com (V. Mohan).

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reduced neck muscle strength, chest expansion, endurance, maximal inspiratory and expiratory pressure.[4,5] These findings further fortify the impression that the chronic neck pain population presents a weakness of respiratory muscles.

Analyzing the motor control of neck by means of assessing respiratory muscles through a concept of kinetic control which was proposed for lumbar spine could be considered as a mode of assessing neck pain population.[6] The motor weakness in the respiratory muscles may alter the pattern of breathing, resulting in asymmetrical breathing and worsens the chest wall mechanics. This asymmetrical breathing places the respiratory muscles and accessory muscles of respiration at a mechanical disadvantage state by decreasing the respiratory muscle endurance. Hence, instructing appropriate breathing strategy for regulating the respiratory pattern may alter the breathing by means of promoting symmetry on the chest wall thereby it may encourage respiratory muscle endurance to improve. Research findings have also indicated implementation of respiratory function assessment and exercises into the routine practice for patients who are suffering from CNP.[3–5]

So far, respiratory exercises have been attempted on chronic obstructive pulmonary diseases (COPD), spinal cord injury and myasthenia gravis population using breathing exercises and with the help of devices.[7–10] Devices which are available in the routine use are of different varieties such as incentive spirometry device and portable re-breathing device. Portable re-breathing device demands the subjects to execute normocapnic hyperpnea training and incentive spirometry (IS) necessitates the subjects to perform breathing in and out through the mouthpiece. These kinds of respiratory exercises are proven to be effective in different clinical situation. However, these forms of exercises as indicated by earlier research have not been applied on CNP population. Considering those factors, merits and disadvantage of the exercises, we have designed an exercise protocol in specific to the respiratory muscle using volume oriented device incentive spirometer (VODIS).

2. Aim

The main aim of the study was to investigate the effect of respiratory muscle endurance training on respiratory and musculoskeletal parameters among patients with CNP.

3. Material and methods

3.1. Subjects

A total of 10 subjects (2 males and 8 females) aged 22–79 years old (48.50 ± 18.53) participated in the study. The body mass index (BMI) of the subjects was 25.94 ± 3.18 kg/m^2. All the patients were recruited from a Ministry Hospital in Malaysia and were able to comprehend English with secondary and tertiary level education. The subjects who had a history of CNP with or without headache for more than three months and free from respiratory and cardiac illness were recruited. Subjects who had a past history of surgery to the cervical spine and those who participated in physiotherapy exercise program were excluded from the present study. This study was approved by the institutional review and ethics board of the University and from the Ministry. Informed consent was obtained from all the participants prior to the study. Prior to grouping, the subjects were indulged in completing the demographic details. After obtaining the demographic details based on systematic sampling procedures, they were allotted to experimental (N = 5) and control groups (N = 5) through single blinding procedures in which the investigator who collected the data knows whether the subjects are in the control group or in the experimental group.

3.2. Measurement tools

3.2.1. Chest expansion

It was evaluated at axilla, fourth intercostal space and xiphoid level using a cloth tape measure. The measurement in centimeters was taken at peak inhalation and peak exhalation and this method of measurement was proved to be reliable.[11]

3.2.2. Respiratory muscle endurance testing

It was carried out using a hand held spirometry (Pony Fx Cosmed, Italy). Details such as age, height and weight using SECA weight and height scale (Vogel&Halke, Hamburg, Germany) were keyed in to the handheld spirometer before performing the test. Respiratory muscle endurance testing was tested using MVV indices (MVV_{ind}). The subjects were instructed to breathe in and out forcibly through the spirometry for a period of 15 s and the readings were calculated automatically by the equipment for a minute. The maneuver was performed three times in front of the spirometer and the best readings were accounted.[12]

3.2.3. Cervical range of motion

It was measured using a universal goniometer. The participants were initially positioned in the chair with back support, the knees positioned at 90° as reported in an earlier study.[13] The measurement of cervical flexion, extension, lateral flexion and rotation for both sides are carried out using an operationally defined goniometric placement as reported in an earlier study and this method is found to have greater reliability.[14]

3.2.4. Neck disability index

The measure of activity limitation for neck pain was measured using an English version of neck disability index (NDI) which consists of 10 sections of questions. The scoring was categorized into five stages ranging from minimal disability to cripple and it was carried out by a physiotherapist. The method of scoring demonstrated a high degree of reliability and internal consistency.[15]

3.2.5. Graduated numbered visual analogue scale (GN-VAS)

Pain was rated using graduated numbered visual analogue scale (GN-VAS) in which subjects rated each pain on a 1–10 scale. A rating of 10 on the scale is being considered as severe pain as reported in earlier literatures. The readings of all these outcome measures were taken initially as baseline readings and after eight weeks following training programs.[16,17]