



EFFECT OF ABDOMINAL COMPRESSION BINDER ON PULMONARY FUNCTION IN ADULT PARAPLEGICS

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ABSTRACT

Respiratory dysfunction is a major source of morbidity and mortality in patients with spinal cord injury (SCI) and an abdominal binder improves efficiency of the diaphragm and in turn has an effect on respiratory function. To find out the effect on Pulmonary Function with Abdominal Compression Binder in Adult Paraplegics. Method: 20 Paraplegic was selected, informed consent was taken. In sitting position spirometry was performed. FVC, FEV₁/FVC and PEF were recorded without the abdominal binder. The Abdominal binder was applied and a Pressure biofeedback machine was placed between the binder and fastened to the pressure level of 20 mm Hg. The FVC, FEV₁/FVC and PEF values in this position were recorded and subjected for analysis. Paired t test was used, FVC (p=0.551), FEV₁/FVC (p=0.156), PEF (p=0.339) values are statistically not significant. Abdominal Compression Binder has no effect on pulmonary function in Adult paraplegics.

KEYWORDS: Abdominal Binder, Paraplegics, Pulmonary Function, Pressure Biofeedback.



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INTRODUCTION

Respiratory dysfunction is most common problem in Patients with spinal cord injury (SCI) [1-3], and results from weakness of inspiratory muscles along with most of the expiratory muscles, including the abdominal muscles [4, 5]. Stiffening of the abdominal wall with change in posture [6-8] or abdominal binding [9, 10] improves efficiency of diaphragm and in-turn improving respiratory function. Hence use of Corsets is widely used in SCI patients. Various studies in this area found no beneficial effects on respiratory function in seated SCI patients.[11] Individuals with spinal cord injury (SCI) exhibit respiratory muscle weakness show reduced lung volumes and flow rates. The combined effects of injury level and posture have not been investigated. [12]. Impairment in expiratory muscle in many individuals with spinal cord injury (e.g., injury T8) show profound effects on cough effectiveness and, specifically on clearance of secretions which increases susceptibility to lower respiratory tract infections.[13] The best spirometry recordings are found in supine posture in patients with SCI. However patients with SCI

maintain sitting posture for prolonged periods of time, so it is important to know how different sitting postures affect pulmonary function. [14] Use of Back braces and abdominal girdles improves truncal stability in patients with spinal cord injury (SCI) which provides little benefit to pulmonary function. But with subsequent study simple abdominal binding techniques showed improved lung volumes in subjects with seating position. [15] Hence, in this study, we aimed to find out improvement of pulmonary functions of paraplegic patients with abdominal compression binder.

OBJECTIVES

1. To assess FVC and PEF in a patient in a seated position in Adult Paraplegics without Abdominal Compression Binder.
2. To assess FVC and PEF with Abdominal Compression Binder in a patient in a seated position in Adult Paraplegics.
3. To compare FVC and PEF values with and without Abdominal Compression Binder in Adult Paraplegics.

MATERIALS AND METHODOLOGY

STUDY DESIGN	: Pre Post Experimental Design
STUDY SETTING	: Army Paraplegia Center, Khadki, Pune
TARGET POPULATION	: Paraplegia Patient with SCI upto T6 level and Above.
SAMPLE POPULATION	: Paraplegia Patient
SAMPLE SIZE	: 20
SAMPLING METHOD	: Convenient Sampling
MATERIALS	: Pressure Biofeedback, Abdominal Binder, PFT, Nose clip, Mouth piece
INCLUSION CRITERIA	: Paraplegics with level of lesion T6 and above
EXCLUSION CRITERIA	: Patients with High cervical lesions, Cognitive impairments, Autonomic Dysreflexia

PROCEDURE

Informed consent was taken and a pilot study was conducted on subjects of the same age and sex to find the comfort of patients with the maximal abdominal pressure developed with help of abdominal binder and was considered set at the higher limit for the study population. Any medication, which might affect the respiratory function, was avoided for six hours prior to the procedure. The patients were made to sit upright with the full

back supported. The procedure to perform spirometry was explained, patients were made familiar with the help of demonstration. FVC, FEV1/FVC and PEF were recorded without the abdominal binder. The abdominal binder was applied to patients. A Pressure biofeedback machine was placed between the binder to record the pressure. The change in cuff pressure would be directly proportional to the rise in the abdominal pressure due to fastening of abdominal

binder. The binder was fastened to the pressure level of 20 mm Hg. The FVC, FEV₁/FVC and PEFR values in this position were recorded.

SPIRO METER

The PFT can measure more than 30 parameters with automatic test interpretation. It has a turbine flow sensor which needs no calibration. It gives results in BTSPS (Body Temperature and Pressure, Saturated) because it has its own temperature sensor. The standard Error of the instrument is +/- 3%. It is updated according to ATS recommendations of standardization of spirometry 1994 for flows and volume. A separate sterilized mouth piece was used for every subject.

RESULT : Data were analyzed by Paired 't' test to find out the difference in lung function test in sitting posture with and without abdominal binder. All variables, including FEV₁, FVC, and PEFR were analyzed.

1. The mean difference in FVC of patients with abdominal binder was 2.125 ± 0.5684 whereas the difference in FVC without binders was 2.209 ± 0.4441 . The P value is 0.551.

2. The mean difference in FEV₁ in patients with abdominal binder was 1.972 ± 0.6211 whereas the difference in FEV₁ without abdominal binder was 1.923 ± 0.4901 . P values is 0.709.

3. The mean difference in FEV₁/FVC in patients with abdominal binder was 89.74 ± 9.159 whereas the difference in FEV₁/FVC in patients without binders was 86.87 ± 12.32 . The P value is 0.156.

4. The mean difference in PEFR in patients with abdominal binder was 10.76 ± 23.84 whereas the difference in PEFR in patients without binders was 9.71 ± 21.18 . The P value is 0.339. All variables, including FEV₁, FVC, and PEFR were analyzed in sitting posture are statistically not significant.

DISCUSSION: The main objective of this study was to find out the advantage of abdomen Compression Binder on pulmonary function. The study shows that abdominal Compression Binder does not create statistically significant change on pulmonary function i.e., FVC and FEV₁ and FEV₁/FVC, PEFR values in adult paraplegics. Subjects

with complete SCI with paraplegia T6 Level and above, averaged only a few percent below predicted values for FVC and FEV₁, and all of them fall within the normal range of the reference population. However, their mean PEFR was significantly below 100% of predicted, but some individuals showed values which fell below the normal range. In the low paraplegia patients, had no effect on FVC or FEV₁. The values were associated with a 10-percentage point decrease in PEFR%, however, that decrease was not statistically significant. [16] The respiratory parameters in SCI patients, including forced vital capacity (FVC) and forced expiratory volume during first second (FEV₁) were collected on each subject in supine, sitting and standing postures. The results revealed that SCI patient had impaired FVCs ($p < 0.05$), the degree of impairment depending upon the level of cord injury ($r = 0.81$). The FEV₁/FVC ratio of SCI was normal. The FVCs of paraplegics during all postures were around 80% of the Predicted values. [17] In the upright position, the abdominal contents remain unsupported, and correction of postural tone in the abdominal muscles does not occur because the belly is unsupported and the diaphragm lies flat. So the excursion of the diaphragm is smaller in upright positions. [12] A Research on Hemodynamic parameters and pulmonary function with abdominal binder was assessed. Pulmonary function test was performed seated, measuring the oxygen saturation by pulse oximetry for one hour. Spirometry was also performed, measuring vital capacity (VC), forced vital capacity (FVC) and forced expiratory volume during the first second of exhaling (FEV₁) which showed that there are no changes in respiratory parameters even after wearing the binder. [18] In upright position, Healthy individuals show better respiratory function [19], whereas for SCI patients have abdominal muscle weakness, which increases abdominal compliance and promotes descent of the diaphragm with a proportional decrease in the area of apposition of the diaphragm to the ribcage reducing its ability to elevate the ribcage [20, 21]. The diaphragm is at more advantageous position for ventilation in supine position [8, 12]. With abdominal binder a similar effect is

obtained which increases VC and decreases functional residual capacity and residual volume in tetraplegics [9, 10] although it is associated with an increase in the diaphragmatic load, which in turn improves efficiency of diaphragm [15]. A significant correlation was found between the improvement in VC induced by lying supine and the improvement in VC induced by wearing a corset. Vital capacity (VC) of patient wearing a corset did not differ in the supine position. VC increased significantly in the supine position compared to the seated position with patient using corsets. The VC increase with the corset in the upright position correlated significantly with the VC increase induced by being supine, compared to sitting without the corset. [11] Supine position results in an increase in spirometry measurements, with the largest change observed in the IC. These findings are in keeping with previous studies which demonstrate the increase in IC and VC with assumption of the supine position is related to the effect of gravity on the abdominal contents and a concomitant reduction in residual volume. [12]

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CONCLUSION

The study concludes that abdominal Compression Binder does not show statistical significance on pulmonary function, but are clinically significant in seated position with adult paraplegics. With Increased sample population and varying abdominal pressure of patient this study will be proceeded for more accurate significant result. The abdominal compression binder pressure can be varied above 20 mm of Hg and pulmonary function can be assessed as the future scope of the study.

ABBREVIATIONS

Forced Vital Capacity- FVC, Forced Expiratory Volume at 1 second- FEV₁, Peak Expiratory flow Rate-PEFR, Spinal Cord Injury- SCI.

Conflict of Interest: Conflict of interest declared none.

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