SUMMARY

Title: Influence of breathing exercises in people after spinal cord injury

Objective: The objective of this research was to determine the effects of breathing in people after spinal cord injuries, create breathing exercises and analyze their effectiveness.

Methods: The research study was divided into two pilot studies (PS). Each study took six months.

In this study were investigated the following parameters: 1) X-ray of the lungs while sitting during inspiration and during exhalation (only the second PS); 2) chest excursion; 3) determination of forced vital capacity (FVC) and one-second vital capacity (FEV1); 4) measurement of respiratory rate; 5) questionnaire survey (only the first PS), a form of personal interviews.

First pilot study: Within mapping and research investigation were followed 15 people with chronic spinal cord injury (SCI); High tetraplegia (C4 and C5) - 1 person, low tetraplegia (C6-C8) - 7 persons, high paraplegia (Th1-Th6) 3 persons, low paraplegia (Th7 and below) - 4 persons. Sex distribution were six women and nine men, the age limit was from 19 to 50 years. Each person have been in average 6-8 years after the accident. The experiment was with a frequency of five times per week, ranging from 20 to 30 minutes. Individuals were gradually introduced to a complex of breathing exercises. It was assumed that breathing exercises allow sufficient lung expansion, the movement of the ribs at all levels and directions, and influence the development of strong lungs.

Second pilot study: Subjects of the research is the effect of breathing exercises in people after SCI. For objectification of breathing exercises were used X-ray of lungs, and a row of other tests. We observed a difference of movement of the lower ribs during inhalation and

exhalation. Within of research we have worked with a group of people after spinal cord injury. In total were followed 15 subjects (8 men and 7 women): high tetraplegia (C4 and C5) - 3 persons, low tetraplegia (C6 - C8) - 6 persons, high paraplegia (Th1 - Th6) - 2 persons, low paraplegia (Th7 and below) - 4 persons. The age limit is 25 - 60 years. On average, each person was 3-15 years after the accident. Four persons from fifteen smoked, on average 23.5 years. Pilot studies lasted with a frequency five times per weekin the range from 20 to 30 minutes.

Results:

First pilot study: In questionnaire survey achieved positive results. Respondents said that after exercise better breathing in and disappeared pain of internal organs. They perceived feeling of muscle relaxation in the neck, shoulders and whole body. The circumference of chest during inspiration increased by 2.62%. It showed a statistically significant difference ($p < 0.05$), but with a slight coefficient of effect size (ES) ($d = 0.2$). The confidence interval does not contain zero (-0.2, -0.5). The circumference of chest during exhalation decreased by 1.05%, while the coefficient of ES $d = 0.0$, the statistical significance level $p = 0.00$. The confidence interval does not contain zero (-1.6, -0.4). Respiratory rate decreased on average by 13.12%. FEV1 increased by 2.34% but posttest value versus pretest did not reach after six months factually and statistically significant increase of FEV1 p = 0, 4; d = 0, 0; 95% confidence interval contained zero (-0.2; 0.1). FVC before versus after FVC after six months increased. Between the first and second measurements were not statistically significant and factual changes - p = 0.3; d = 0.0; 95% confidence interval contained zero (-0.2; 9.2). Our aim has been achieved. We succeeded to prove that breathing exercises have definitely positive impact on people with spinal cord injury, which was evidenced by a questionnaire survey, increasing of chestexcursion and spirometric parameters.

Second pilot study: There was a significant increase in the movement of the lower ribs after using of breathing exercises (M = 18, SD = 11.6) compared to the state before use (M = 11.7, SD = 8.5); t = 3.60, p = 0.001. Confidence interval does not include zero which suggests rejecting the null hypothesis (-9,9; -2,4). Calculation of ES d showed medium size

difference (d = 0.6). X-ray examination showed that the difference in the movement of the lower ribs during inhalation and exhalation increased by 49% (about 6-45 mm). The circumference of chest during inhalation is increased by 3.5%. At circumference of chest during inhalation weak coefficient of effect size (d = 0.2) was found statistical significance (p <0.00). However, the confidence interval contains zero (-4.6, -1.8), which shows us to rejecting of the null hypothesis. The circumference of of chest during exhalation decreased by 1.27%. Also was recorded factual significance in circumference of chest during exhalation. Cohen's ES showed little difference (d = 0.0). However, there was significant improvement in the level of statistical significance p = 0.00. Confidence interval does not contains zero, which indicating rejection of the null hypothesis (- 1.6, - 0.6). One second vital capacity increased by 5.68%, post a text value versus pretestovým did not reach after six months of factual and statistical significant increase in FEV1 (p = 0.1); (d = 0.2) contained zero confidence interval (-0.2, 0.0). Forced vital capacity increased by 7.61% between the first and second measurements were not factually and statistically significant changes (p = 0.1); (d = 0.2); 95% confidence interval contains zero (-0.3, 4.9). Respiratory rate is decreased by an average of 16.22%. In this study, by using the X-ray and other tests, we have recorded an objective effect of breathing exercises on respiratory muscles in people with SCI. Results of the study showed a positive meaning of breathing exercises for people with SCI. Breathing exercises positively influence excursion of chest and spirometric parameters of people with SCI. Breathing exercises affect the respiratory muscles of subjects in this study it is likely that this exercises has formative affect on posture, which in retrospectively affects other organs and functions.

Keywords: breathing exercises, spinal cord injury, lung function, X-ray of lungs, breathing muscles.