



IMPACT OF RUSSIAN CURRENTS ON QUADRICEPS WEAKNESS AMONG CHRONIC OBSTRUCTIVE PULMONARY DISEASE

Physiotherapy

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ABSTRACT

BACKGROUND: There are many treatments given for Chronic Obstructive Pulmonary disease patients to strengthen their quadriceps muscle which includes the exercise training, neuromuscular electrical stimulation. However studies involving Russian current stimulation to strengthen the muscle for the Chronic Obstructive Pulmonary disease patients are limited to this date. **Objective:** To find out the impact of Russian currents on quadriceps weakness among Chronic Obstructive Pulmonary disease patients. **Study design:** Quasi Experimental Study design. **Subjects :** 15 subjects were taken for the study.

Procedure: The strength of the quadriceps is assessed by the handheld dynamometer. The subjects were positioned in comfortable supine lying position, electrodes are placed and the subjects maximum tolerable intensity is kept. There is an isometric voluntary Contractions for 10 minutes. Post- test is done at the end of the treatment duration.

Outcome measures: Handheld dynamometer.

Results: There is significant increase in the quadriceps muscle strength.

Conclusions: Russian current stimulation has statistically significant effect on quadriceps muscle strength among the Chronic Obstructive Pulmonary disease patients.

KEYWORDS

INTRODUCTION

COPD has both pulmonary and systemic effects (extra-pulmonary). The systemic effects increase the risk of skeletal defects. Skeletal muscle dysfunction, particularly of the Quadriceps is well acknowledged in COPD¹. There is loss of muscle mass perceived in COPD patients which is due to the physical inactivity and it causes the skeletal muscle dysfunction². Quadriceps femoris is the muscle which consists of 1. Rectus femoris the two joint muscle 2. Vastus Medialis 3. Vastus lateralis 4. Vastus intermedius. Vastus medialis composed of vastus medialis obliquus and vastus medialis longus.³ The action of quadriceps muscle is knee extension. The muscle has the capable of producing the tension by activating the skeletal muscle fibres called muscular strength. The effectiveness of work done can be determined by the muscular strength¹¹.

Russian currents are the evenly alternating medium frequency currents with a frequency of 2500Hz (2000-10000Hz). The currents are applied with a series of separate bursts, i.e. Polyphasic AC waveforms. It is one kind of Burst Mode Alternating Current. Thus there is 50 periods of 20ms duration consisting of 10ms burst and 10ms interval. It is effective in increasing the muscle strength¹. The treatment regime used in this study is 10/50/10 i.e. Stimulation of 10 seconds, rest period of 50 seconds for 10 minutes duration which results in 10 isometric contractions at a maximum tolerable intensity⁹. Innumerable studies have been done on using 10/50/10 treatment regimen and their effects on strength.⁴

The faradic stimulation increases the strength of the muscle, endurance, working capacity, and excitability of the muscle groups are trained^{12,13}. But Massey.et.al.,(1965) pointed out that the corresponding of muscle by means of electrical stimulation was not as effective for increasing strength as the traditional, isometric, and isotonic, methods of exercise⁷.

Procedure:

This was Quasi Experimental Study design. Total of 15 subjects (13 males and 2 females) were included in the study based on the inclusion and exclusion criteria. The procedure was explained in detail and the consent form was obtained. Pre-test is done to check the muscular strength. The quadriceps muscle strength was assessed by the handheld dynamometer. The subjects were seated at the edge of the couch and the knee is positioned at knee 90 degree flexion perpendicular to the floor. The dynamometer was positioned above the malleolus on the anterior aspect of the tibia. The subjects were informed to place their arms across their chest and pull the knee against the dynamometer plate. The strength of the quadriceps were received in kilograms and noted. This procedure is done before the electrical stimulation. Then the subjects were treated with the Russian current.

The subject is in comfortable supine lying position. One electrode is placed over upper thigh and other electrode over the distance of 4cm from the superior pole of the patella. The intensity applied was set as the maximal tolerable intensity by the subject and it is gradually increased each session. The Stimulation is given for 3 days a week of 4 weeks of duration. Totally 12 sessions of stimulation were given and Post-test is done by following the same procedure as in Pre-test. The strength of the muscle is assessed.

Treatment Parameter Treatment duration- 10 minutes

Contraction Time - 10 seconds. Relaxation Time – 50 seconds

RESULTS:

Table 1: comparison of pre-test and post-test values of Russian current stimulation

Duration	Mean	Standard deviation	t-value	p-value
Pre-Test	6.77	1.1336	4.081	0.001
Post-Test	7.61	1.1070		

The paired t-value (4.081) shows that there is statistically significant change at P value of .001, from Pre-test to Post-test using Russian currents. The comparison shows that there is a significant increase in strength of Quadriceps muscle using Russian Currents.

DISCUSSION:

The main objective of this study is to find out the effectiveness of the Russian Currents in Quadriceps weakness for Chronic Obstructive Pulmonary Disease patients. From the statistical analysis, the mean value of the strength of the quadriceps muscle shows marked improvement from 6.77 to 7.61. The value is significant which has a value of less than 0.1. The effects of Russian current in increasing the strength of quadriceps muscle were analysed using paired "t" test. The results of this study shows that there is a significant difference between pre-test and post-test with P value less than 0.1.

Cornell C et al., observed that the muscle weakness is in highly proportionate among 45 to 60 years of age in COPD patients. Recent studies concluded that the quadriceps muscle weakness is present in 1/3 of the COPD patients. The reduced level of physical activity due to the air flow limitation and obstruction leads to adapt them the sedentary lifestyles which is the major cause for the muscle weakness.

Muscle stimulation has been known to us for a longer time but the use of electrical stimulation has been very much limited to initiate the contraction of the muscle or to maintain the properties of the muscle. Still more controversies exists over the use of electrical stimulation as an adjunct to enhance the strength of the muscle and power. However, recent improvements in equipment and techniques have made

electrical stimulation a more applicable strengthening mode.

Hon Sun Lai et. Al.,(1988) proved in the study that the period of 3 weeks duration of electrical stimulation produces the sufficient muscle strength being greater in the group treated with high intensity electrical stimulation than in the group treated with lower intensities. It also shows that the Russian current is more effective in the improvement of the Quadriceps muscle strength.

The recent studies demonstrated the effectiveness of Russian current stimulation. The exercise regime progressed the increased force production in slow twitch, fatigue resistant muscle fibres they recruit first than the fast twitch muscle fibres and mostly there are forceful voluntary contractions whereas the electrical stimulation prefers the fast twitch muscle fibres to recruit first which are innervated by the large diameter motor neurons. On this belief, optimum force gain program should include the both electrical stimulation and exercise to increase the strength and force production of both the muscle fibres.

Selkowitz.et.al., (2001) claimed that there is satisfied evident for increase in the muscle strength and force but few studies showed that the force gain can be achieved by the combination of both the exercises and neuromuscular electrical stimulation.

Various researches done by Eriksson et. Al.,(1994), Lake DA(1992) have recommended the use of electrical stimulation in various manifested forms of rehabilitation.

Ultimately this study has reported that Russian currents with a 10/50/10 treatment scheme for 3 sessions per week is more effective in enhancing the quadriceps muscle strength and this can be performed along with the voluntary exercise program and furthermore improve the quality of life and welfare of the patients.

Conclusion

The study concludes that the Russian Currents is very effective in increasing the Quadriceps muscle strength among the COPD patients. Therefore Russian current can be used in the rehabilitation program for enhancing the muscle strength.

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