Repetitive Peripheral Inductive Stimulation In Comprehensive Physiotherapeutic Approach - A Case Study

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Abstract

Background:
Repetitive peripheral inductive stimulation (rPIS) uses high intensity electromagnetic field, which interacts with the human body and causes depolarization of the neuromuscular tissue. This can be used to achieve different therapeutic effects, such as to strengthen weakened muscles or relieve the pain.

Aim:
Aim of the case study was to evaluate the efficacy of the rPIS in a 4-week protocol of comprehensive rehabilitation, which consisted of strengthening of breathing muscles and treatment of musculoskeletal disorders in central motor impairment.

Methods:
To compare patient´s condition ´before and after´, spirometry and kinesiology evaluation were performed. In comprehensive rehabilitation protocol, the BTL-6000 Super Inductive System was incorporated.

Results:
After 4-week intensive rehabilitation protocol, significant improvement of spirometric parameters as well as amelioration of patient´s musculoskeletal system were observed.

Conclusion:
rPIS can be effectively integrated in comprehensive physiotherapy treatment and cover various therapeutic effects.

Key words:
BTL-6000 Super Inductive System, spirometry, kinesiology, physiotherapy

Introduction

Comprehensive rehabilitation usually consists of physiotherapeutic methods as well as physical therapy. By combination of different methods, we can tailor therapy to our patients needs and improve their quality of life. One of possibilities certainly is a repetitive peripheral inductive stimulation (rPIS), which seems very promising from many aspects. rPIS uses high intensity electromagnetic field, passing through neural tissue in which, electric current causing change in action potential is induced. As the currents are carrying an electric signal to the muscle, muscle contraction is achieved. rPIS is a method covering multiple therapeutic effects and can be indicated in treatment of various conditions of musculoskeletal and neural system. According to specific therapeutic parameters, such as frequency and intensity of stimulation, you can relieve pain, strengthen muscles or release joint blockage. In this paper, we propose how to integrate rPIS in a comprehensive physiotherapeutic approach.

Materials and methods

Herein, we present a 29-year-old man, who was seriously injured in a car accident in early childhood. Due to the accident, he has persistent postraumatic respiratory and musculoskeletal disease even in adult age (see Picture 1). We integrated him into a 4-week comprehensive rehabilitation program. Patient was assessed by spirometry to evaluate his ventilation parameters. Results of spirometry evaluation confirmed a combination of restrictive and obstructive respiratory disease. Due to respiratory muscles weakness, values of ventilation parameters, such as slow vital capacity (SVC); force vital capacity (FVC) or maximal voluntary volume (MVV) were below the normal threshold.

In the kinesiology evaluation, the right-sided hemiparesis was the most obvious clinical problem from many aspects. On one hand, hemiparesis leads to discoordinated and efficient breathing pattern. On the other hand, it leads to asymmetry of his shoulder and pelvic girdle resulting into scoliosis. These evaluations were performed ´before and after´ to compare his condition.

Subjectively, patient reports breathing difficulties, especially during inspiration. He feels limitation even more during physical activity (e.g. jogging). His assymetric posture and efficient breathing pattern lead to back pain, especially in thoracic and lumbar area, joint blockages and discoordination of the trunk muscles.

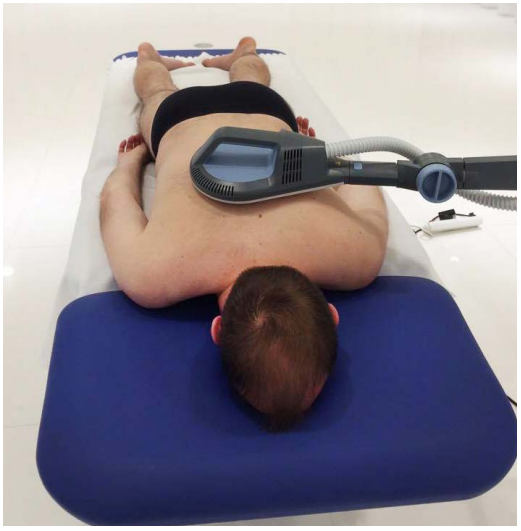
Picture No.1:
Patient affected by right-sided hemiparesis

Aim of therapy was to improve his ventilation parameters as well as to eliminate problems in his musculoskeletal system (numerous trigger points, joint blockages etc.), which secondary affect breathing pattern.

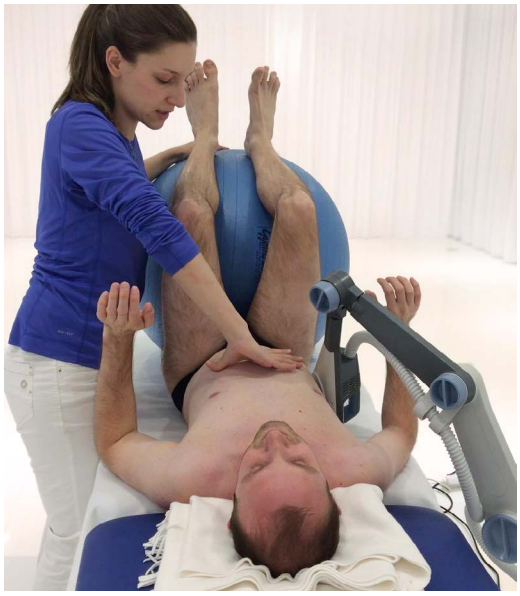
Patient underwent a therapeutic protocol comprised of total 16 therapies. He attended therapies up to 4 times a week. Duration of one therapy was 60 minutes.

Therapy consisted of 2 parts – preparatory and active phase. In both phases, the BTL-6000 Super Inductive System (SIS) and a hand-held focused field applicator were used. Preparatory phase was important to optimize the condition of soft tissues, relieve the pain, eliminate trigger points or release joint blockage in the thoracic spine (see Picture 2). For this purpose, BTL-6000 Super Inductive System and combination of manual techniques were used. This process facilitated further relearning of motor patterns such as optimal breathing pattern.

In the active phase, stimulation of breathing muscles with BTL-6000 Super Inductive System was performed only on the patient´s affected side. Consequently, active relearning of the new breathing pattern was performed in various postural positions (see Picture 3). Intensity of the therapy with BTL-6000 Super Inductive System was set to above the sensitivity up to above the motor threshold.



Picture No. 2:
Thoracic spine mobilization with SIS



Picture No.3:
Stimulation of the breathing muscles with SIS

Results

The 4-week protocol, in which BTL-6000 Super Inductive System was incorporated, resulted into improvement of spirometric parameters. Significant improvements were observed mainly in SVC parameters, which report the maximum volume of air that can be exhaled slowly after slow maximum inhalation. The most obvious was 45% amelioration of the IRV parameter. In FVC, mostly PEF parameter was improved about 12 %. This parameter is reporting the speed of air flow. MVV profile was improved about 9 %. This parameter reports the maximum amount of air that can be inhaled and exhaled within one minute (see Table 1).

A positive effect of the therapy was also observed in patient´s musculoskeletal system, where numerous painful muscle spasms, leading to scoliotic trunk assymetry were eliminated. This positively reflects on the patient´s posture (Picture 4).

From patient´s subjective evaluation, he reported effortless inspiration and more comfort during physical activity, where he has almost no breathing limitation.

Parameter	Unit of measurement	Prediction ECCS/ERS 1993	Before	After	Improvement in %
FVC	l	4,63	4,64	4,82	3,88
FEV1	l	3,94	3,29	3,58	8,81
PEF	l/s	9,29	4,41	4,92	11,56
FEV1/FVC	%	82	70,97	74,24	4,61
SVC	l	4,85	3,73	4,41	18,23
ERV	l	1,50	0,95	1,25	31,58
IRV	l	-	2,04	2,95	44,61
IC	l	-	3,16	3,80	20,25
MVV	l/min	139,53	70,54	76,45	8,38

Table No.1:
Results of spirometry evaluation

Picture No.4:
Patient´s uprighted posture after therapies

Discussion

We consider that distinguishing the ´preparatory´ and ´active´ phase were determining for the therapy results. Firstly, to optimize the condition of patient´s thorax and soft tissues and consequent muscle stimulation resulted into the improvement of ventilation parameters. The improvement of patient´s ventilation parameters was mainly observed in SVC parameters. These parameters and evaluation are performed slowly. When slowly inhaling and exhaling, patient is able to control his breathing pattern and breathe more efficiently. In therapy, stimulation of both inspiration and expiration muscles was performed as well as muscle coordination was trained.

Conclusion

In this case study we suggest that rPIS can be effectively integrated in comprehensive physiotherapy treatment and covers various therapeutic effects. Although, the study represents only one case, significant changes in patient´s respiratory and musculoskeletal system were observed.