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Dorsalgia rehabilitation in static disorders of the spine by therapeutic swimming in young adults

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Abstract

The purpose of this paper is to point out and propose the most effective means of therapeutic swimming in the use of work programs for patients with dorsalgia in spinal static disorders. The knowledge degree of therapeutic swimming is not sufficiently promoted and used, which is why we propose the following hypothesis: we start from the premise that therapeutic swimming can reduce the dorsalgia in the spine, improve lung capacity and physical condition in young adults. The objectives of this work are to identify subjects with spinal static dorsalgia and to establish the sample for the experiment; in the selection of therapeutic swimming means for the elaboration of the work program; in the registration and interpretation of the data in the form of tables and charts. The experiment took place at the Kinetic Therapy Practice of Mr. Constantinescu Mihai, as well as at the swimming pool in Cornisa, Botoşani county, with a sample consisting of 15 subjects aged between 18 and 22, all of whom suffered dorsalgia (in the spine). In this respect, we set out to implement a therapeutic swimming program for 6 months to achieve positive results.

Keywords: *dorsalgia, spinal static disorders, therapeutic swimming,*

Introduction

Pain in the spine occurs in children, adolescents, adults, and it is a global concept that includes pain in the cervical, dorsal and lumbar spine (1).

Cervical pain is commonly found in adults, whereas the pain localized in the dorsal and lumbar levels is predominant in adolescents and young adults (2,3).

The incidence of dorsalgia is higher during the growing period, which is why the therapeutic intervention starts in school. Even if there are specific programs on maintaining health and preventing dorsalgia, they cannot change long-term behavior.

Dorsalgia involves sociodemographic, physiological, or psychosocial factors (4). Multifactorial concentration is essential especially in adolescence because most biomechanical and physiological parameters change during this growth period (5).

These changes are also found in the habits of adolescents who prefer to spend their free time in sedentary activities, with their friends, to the detriment of physical activity (6).

In this context, dorsalgia is influenced by sex and age (7).

The skeleton contains approximately 99% of the total calcium, whereas small amounts of it are found in the plasma and the extravascular fluid. Low calcium consumption can contribute to the appearance of rickets in children, to modifications in the physical development of the adolescent and later, of the young adult. This is why it is very important to know the normal calcium reference ranges, by age and sex groups (8).

Magnesium, together with calcium, plays an important role in muscle contraction, cardiac excitability, and insulin metabolism and it influences the vasomotor tone (9).

In this paper, we will address dorsalgia in spinal static disorders in patients between the ages of 18 and 22, the age at which the young adult is subject to a sedentary lifestyle, but also because of professions that overburden the body. Prolonged standing causes malalignments in the spine, whereas back pain occurs predominantly in the lumbar and cervical-thoracic areas. As regards the anatomically lumbar region, it is composed of 5 voluminous vertebrae, which are subjected to higher voltages than the other regions, and the cervical region is composed of

seven vertebrae and the thoracic region of 12 vertebrae, all of which are joined by intervertebral discs and related ligament structures. The muscles of the spine are also subject to continuous demands that can keep certain muscular stress called contracture, and if not treated properly it causes pain, functional impotence, and even some degenerative processes of morpho-functional structures.

It is known that due to the overuse and induced pressures on the spine, they react by modifying the body posture, by adopting vicious (antalgic) postures, which leads to the main physical deficiencies (kyphosis, lordosis, and scoliosis). Kyphosis has a sagittal spinal deviation with posteriorly oriented convexity; lordosis consists of a sagittal spine deviation with anteriorly oriented convexity, and scoliosis is a deficiency of the spine in the frontal plane with lateral convexity with a curvature or several ones.

In this regard, we will develop and implement a therapeutic swimming program in which to optimize the health condition, reduce spinal pain, and increase the effort capacity of patients who undergo the experiment.

The specialty literature shows that the morpho-functional, prophylactic, or therapeutic valences of swimming have been known since ancient times and have had continuity in various researches, by pointing out the benefits of swimming (10).

The influence of therapeutic swimming on muscular-skeletal structures causes joint mobility, toning, the stability of the spine with positive effects on the body posture (11); by adopting the horizontal position, positive influences of the osteoarticular system are exerted by favoring the reduction of pain mentioned by patients (12,13).

In the morpho-functional recovery, swimming induces demands to the body and causes positive modifications, which lead to the release of the spine from tension and favors the decrease of pain and the resumption of ADL (activity daily living). As for the cardiovascular system, the heart rate reaches the maximum values of 190-214 of b/min and returns to rest values in a few tens of minutes.

The German physiologists Dargatz and Koch (1995) considered that only one session of movement in the water can determine the increase in the physical yield of the maximum possibility of oxygen processing and vital capacity, During a session the alveolar-capillary diffusion increases (the gas exchange at the alveolar level), but also the tissue breathing increases, thus increasing the percentage of myoglobin, while the respiratory volume per minute, the residual respiratory volume and the rest frequency decrease. To achieve the expected results, patients must be initiated into techniques specific to swimming (10).

The purpose of the work is to select the most effective means of therapeutic swimming, to reduce pain in the spine of the subjects included in the experiment.

Material and method

The hypothesis of the work: it is assumed that therapeutic swimming can reduce the dorsalgia of spinal static disorders, improve lung capacity and physical condition in young adults.

Objectives of the work:

- To identify subjects with spinal static dorsalgia and to determine the sample for the experiment;
- To select therapeutic swimming means for the elaboration of the work program;
- To record and interpret data as tables and charts.

The organization and conduct of the experiment: The selection of subjects for the experiment led to 15 subjects aged 18 to 22 that was done at the Private Practice of Kinetic Therapy Practice of Mr. Constantinescu Mihai, Suceava. For a period of about two weeks from 01.09.2020 to 16.09.2020, we observed and established the working sample, following the diagnosis given by the doctor (Mrs. Dr. Silisteanu Calina) to each patient. From 16.09.2020 to 31.09.2020 at the same location, the work program was carried out on land, using the therapeutic swimming technique. From 01.10.2020 to 28.02.2021, the program was carried out at the swimming pool in Cornisa, Botoşani county. The frequency of the water training was for an hour twice a week.

The study was conducted according to the ethics rules in force.

Selection criteria: persons aged 18-22, without acute or neuropsychic disorders, and who gave their consent to participate in the study.

Exclusion criteria: people aged <18 and > 22, with chronic respiratory, cardiac, digestive, or neurological diseases and who did not want to participate in the study.

Exercise program applied to the target group:

Getting used to the water: front swimming, rear swimming, walking through the water by moving the arms near the body, then bent from the elbow joint; diving; games.

1st Stage: To reduce pain, to install and to keep a correct attitudinal reflex that ensures the recovery of the pelvis, torso, and lower limbs during the static and dynamic activity.

- at the edge of the pool with hands against the edge, movements of the feet with the face on the water, and after 6 feet movements breathe in, on one side, 3x; floating on the water, feet movements, crawl and breaststroke on different distances, 2x7;12,5; 25m; feet movements backward, floating face on the water, arms held in the extension of the head 2x12,5; 25m; feet movements with hands held behind the head 7; 12,5 m; double swimming on the back 7; 12,5; 25m.

2nd Stage: The recovery of the spine, mobility, muscle toning, stability.

- forward rollovers or forward turns 3x; from swimming crawl with rolling forward at 12,5m; feet movements crawl, with arms near the body 2x7m; face on the water feet movements 2x 7; 12,5 m; from sliding, movements of arms 3x7m.

3rd Stage: The improvement of the parameters of cardiorespiratory function and effort capacity.

- swimming crawl on different distances 2x12,5; 25; 75, 100 m; swimming on the back on different distances 3x 12,5; 25; 75, 100; 150 m; breaststroke swimming on different distances 12,5; 25; 75, 100 m; freestyle swimming on different distances 2x 7 and 12.5 m

Results and discussions

Dorsalgia was evaluated by using the VAS analog scale (0-10 mm). Other followed parameters were respiratory frequency and heart rate. (Table no 1)

In the test "VAS scale" test, it is easy to see: the average of the group at the initial test is 6.47, which shows that the patients' spinal dorsalgia cannot be ignored for a very long time, whereas the average of the group at the final test is 3.13, which indicates that the therapeutic swimming program was effective, the pain can be ignored if patients are involved in the daily work. (Figure no 1)

In the respiratory frequency test, the average of the group at the initial test is 17.87 cpm, at the final test, the average is 17,60 cpm at rest, if we talk about the respiratory frequency in an effort, the average of the group at the initial test is 21.13 cpm, and the average of the group at the final test is 19.67 cpm, with a difference of 1.47 cpm. (Figure no 2)

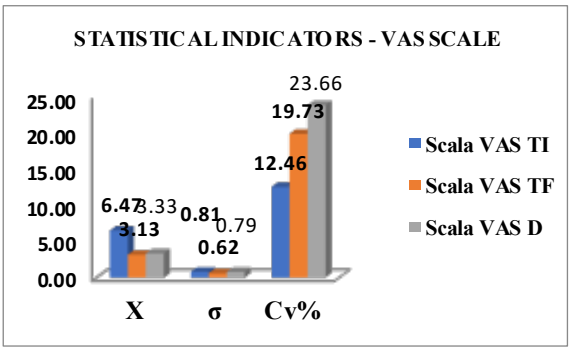

Figure no. 1 VAS Scale

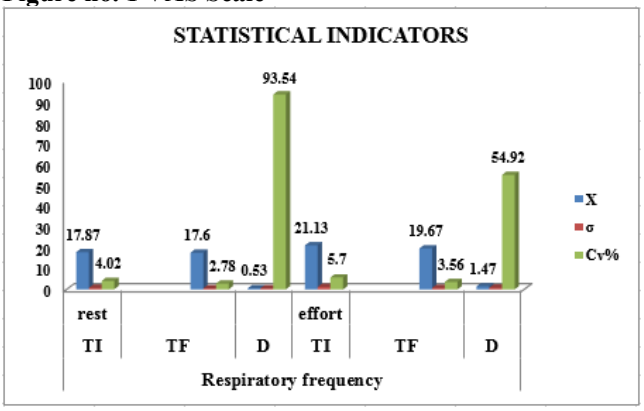

Figure no. 2 Respiratory frequency

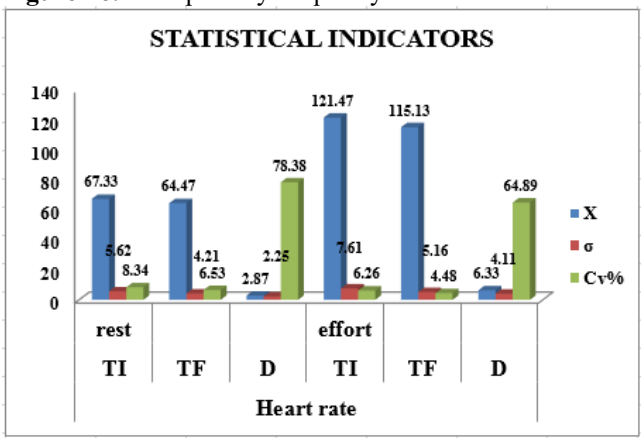

Figure no. 3. Heart rate

In the heart rate test, the average of the group at rest is 2.87 b/min, and the average of the group in the effort is 6.33 b/min with a difference of 6.33 b/min.(Figure no 3)

As for the test Chin sternum index in flexion, the average of the group between the initial test and the final one is 1.20 cm. In the same test, but in extension, the difference of the average is 1.07 cm. In the test Tragus-acromion left index, the difference between the initial test and the final one is 3.80 cm. In the same test but the one on the right, it is easy to see a difference of 2.67 cm. (Figure no 4,5)

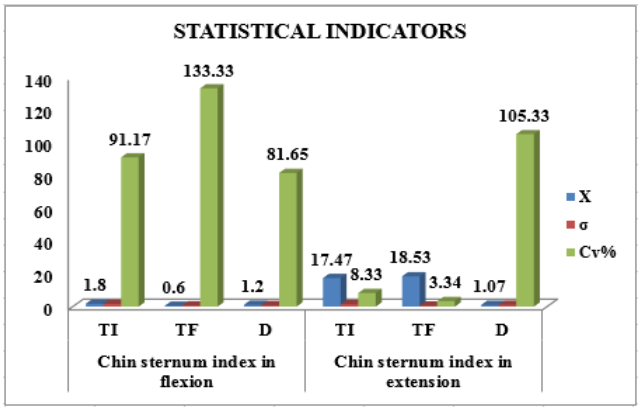

Figure no. 4 Chin sternum index

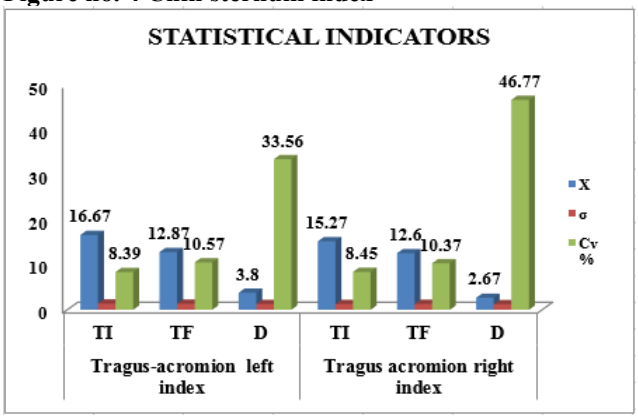

Figure no. 5 Tragus-acromion index

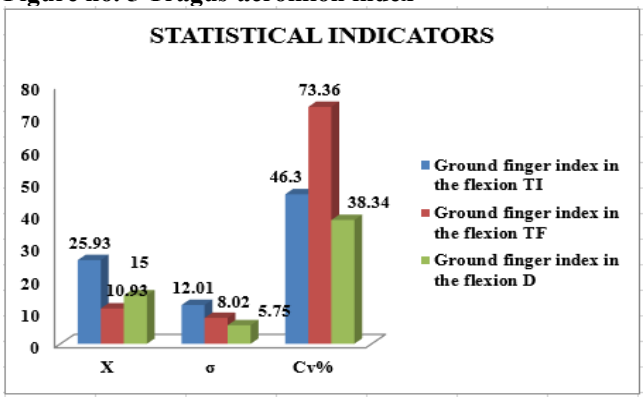

Figure no. 6 Ground finger index

In the Ground finger index test, there is a difference between the initial test and the final one, an average of 15,00 cm. (Figure no 6)

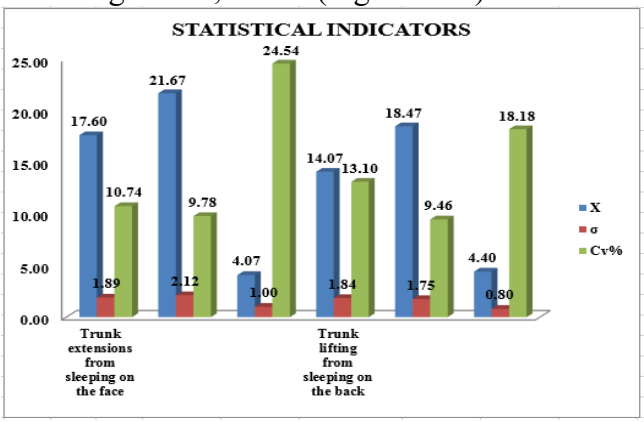

Figure no. 7 Trunk extensions/ lifting

In the Trunk extensions from sleeping on the face test, there is a difference of the average of 4.07 rept/ 20sec. In the Trunk lifting from sleeping on the back test, there is a difference of the average of 4.40 rept/20 sec.(Figure no 7)

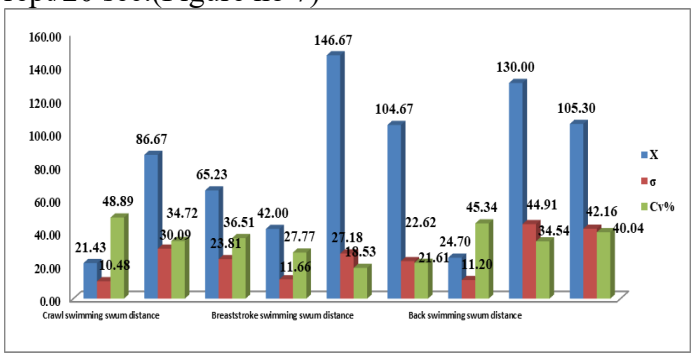

Figure no. 8 crawl, breaststroke, back swimming

In tests specific to swimming, there is a difference of the average between the initial test and the final one of 65.23 m in the crawl swimming. In the back swimming, the difference of the average is 105.30 m, whereas in the breaststroke type, the difference of the average is 104.67 m.(Table no 3 and Figure no 8)

Conclusions

The hypothesis of this paper was confirmed by the fact that therapeutic swimming can optimize health, reduce back pain and improve patients' lung capacity.

Where the tests show a $p<0.05$, the statistical link is significant (S, 95% confidence) and when the tests show a p< than 0.01, the statistical link is significant (S, 99% confidence).

Of all the therapeutic swimming means applied to patients with spinal static dorsalgia, the means of dorsal decubit were the most effective and most agreeable ones.

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Table no.1. Functional indicators

	VAS SCALE			Respiratory frequency						Heart rate					
				cpm						No. b/min					
N=15	TI	TF	D	I	F		I	F		I	F		I	F	
				rest			effort			rest			effort		
X	6.47	3.13	3.33	17.87	17.6	0.53	21.13	19.67	1.47	67.33	64.47	2.87	121.47	115.1	6.33
σ	0.81	0.62	0.79	0.72	0.49	0.5	1.2	0.7	0.81	5.62	4.21	2.25	7.61	5.16	4.11
Cv%	12.46	19.7	23.66	4.02	2.78	93.54	5.7	3.56	54.92	8.34	6.53	78.38	6.26	4.48	64.89
	t=2.52999 p<0.01			t=0.164318 p<0.05			t=2.84917 p<0.01			t=0.000297 p<0.05			t=4.88293 p>0.001		

Table no. 2. Joint balance

N=15	Index menton stern in flexion			Index menton- stern in extension			Index tragus -acromion left			Index tragus-acromion straight			Index finger- ground in flexion		
	TI	TF	D	TI	TF	D	TI	TF	D	TI	TF	D	TI	TF	D
X	1.8	0.6	1.2	17.47	18.53	1.07	16.67	12.87	3.8	15.27	12.6	2.67	25.93	10.93	15
σ	1.64	0.8	0.98	1.45	0.62	1.12	1.4	1.36	1.28	1.29	1.31	1.25	12.01	8.02	5.75
Cv%	81.17	133.33	81.7	8.33	3.34	105.33	8.39	10.57	33.56	8.45	10.37	46.77	46.3	73.36	38.34
	t=0.00042 p<0.05			t=0.00318 p<0.05			t=2.39279 p<0.01			t=1.36946 p<0.05			t=1.26066 p<0.05		

Table no. 3. Strength indicators and tests specific to swimming

N=15	Trunk extensions from sleeping on the face (number of repetitions 20/sec)			Trunk lifting from sleeping o the back (number of repetitions 20/sec)			Crawl swimming swum distance (m)			Breaststroke swimming swum distance (m)			Back swimming swum distance (m)		
	TI	TF	D	TI	TF	D	TI	TF	D	TI	TF	D	TI	TF	D
X	17.6	21.67	4.07	14.07	18.47	4.4	21.43	86.67	65.23	42	146.67	104.67	24.8	130	105.3
σ	1.89	2.12	1	1.84	1.75	0.8	10.48	30.09	23.81	11.66	27.18	22.62	11.2	44.91	42.16
Cv%	10.74	9.78	24.54	13.1	9.46	18.18	48.89	34.72	36.51	27.77	18.53	21.61	45.34	34.54	40.04
	t=1.04049 p<0.05			t=2.50544 p<0.01			t=2.41132 p<0.01			t=1.41431 p<0.05			t=2.14612 p<0.01		