Following correlations between degree of disability and Esnault, Biering, Ito and Pile tests results after application of kinesitherapeutic methodology to patients with chronic stage of lumbalgy

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***Abstract*– To follow the correlation between the degree of disability and the results of Esnault, Biering, Ito and Pile tests after the application of kinesitherapeutic methodology to patients with a chronic stage of lumbalgy The study included 110 patients diagnosed with chronic low back pain, divided equally into two treatment groups. The participants of the experimental group performed the recommended special exercises 3 times a week at home and those in the control group only followed the guidelines of the physician. At the beginning of the 12th month an Esnault test, Biering test, Ito test, Pile test and test of Oswestry were applied to all the participants.**

There has been established a direct and moderate correlation of Esnault test results with Oswestry test results in the experimental group at the beginning and end of the observation. There has also been established an inverse and moderate correlation between Biering test results and Oswestry test results in the experimental group at the end of the observation. There has been ascertained inverse and moderate correlation between Ito test results and Oswestry test results in the experimental group at the beginning and end of the observation.

The lower results in Esnault, Biering and Ito tests in the experimental group were a predictor of higher levels of disability among participants.

***Index Terms* – chronic lumbalgy, kinesitherapeutic program**

I. INTRODUCTION

Low back pain is a common source of pain and disability and a major health problem across the globe. Estimates of lifetime incidence of low back pain range from 60 to 80%. More than 80-90% of the people who experience low back pain are expected to recover within 6 weeks [1]. Measuring pain and disability are important to set goals, plan treatment and assess outcomes in Low back pain patients. To quantify patients' self-assessment pain of their disability we need valid, reliable and responsive self-report measures.

The education of the patient in the chronic stage of this condition is a priority for WHO. Healthcare expenditure has been growing in many countries, which is the reason to create programs in which the patient is a "partner", well-informed, trained and able to take control of their health problems when medications are not enough, as is the case with chronic lumbalgy. The balanced management of physical activities are recorded as a goal in those programs.

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II. AIM OF THE STUDY

The aim of this study is to determine the correlations between disability index and functional tests after application of kinesitherapeutic program to patients with chronic lumbalgy.

III. PATIENTS AND METHODS

The study is representative, prospective, with test-retest design and tracking, with questionnaires to fill out at the beginning and end of the observation (12 months). It was carried out with the participation of a representative sample of 110 patients with chronic low back pain, distributed equally into two treatment groups (experimental and control) of uniform age and gender. The selection of patients was done according to their appearance in the consulting room of the physiotherapy diagnosis and counseling center in Stambolijski by involving all those who met the inclusion criteria. They were each diagnosed and were undergoing therapy at the time, having been referred to the center by a general practitioner after consultation with a neurologist.

All procedures related to the study were performed in accordance with the guidelines of good clinical practices. Prior to procedures, each patient was familiarized with the design of the study and signed an informed consent form.

The following inclusion criteria for the study were used: a signed informed consent, age 30 to 60 years; presence of X-ray of the lumbar spine and consultation with a neurologist; diagnosed chronic low back pain; lack of a herniated disc, tumor, trauma, inflammation of the spine and osteoporosis, etiologically related to low back pain; lack of focal neurological deficit - motor, sensory, pelvic reservoir violations; lack of accompanying psychiatric disorders with a view to a better cooperation. 135 consecutive patients with chronic low back pain were initially screened, 25 of which were not included in the survey due to non-compliance with the inclusion criteria. Of 110 patients included in the final stage of the study, a total of 51 patients dropped out (22 of the experimental group due to a temporary improvement or social commitments and 29 in the control group due to lack of motivation).

Patient information was obtained by taking case history and focused review of available medical records of the therapist and neurologist. The experimental group was trained to

perform special exercises 3 times a week at home, while the participants in the control group followed the recommendations of a physician for medical treatment. Patients' follow-up lasted for a year. At the beginning and end of the study there were applied Oswestry, Esnault test, Biering test, Ito test and Pile tests.

DESCRIPTION OF TESTS

1.The Oswestry Disability Index (aka: Oswestry Low Back Pain Disability Questionnaire) is an extremely important tool that researchers and disability evaluators use to measure a patient's permanent functional disability. The test has been around for 25 years [3] and is considered the "gold standard" of low back functional outcome tools [4].

Instructions: Simply answer the below questions by choosing the 'best answer' that describes your 'typical' pain and/or limitations within the last week or two. You can only choose ONE answer. If your limitations fall in-between two questions, pick the higher point value question. After you have finished the test, add up your points, divide that number by 50, and multiply by 100 to get your percent disability.

There are currently four English versions of the OSI floating around. I will use version 2.0 which is the same that Stanford uses.

Section 1: Pain Intensity

I can tolerate the pain I have without having to use pain killers. (0 points)

The pain is bad but I manage without taking pain killers. (1 point)

Pain killers give complete relief from pain . (2 points)

Pain killers give moderate relief from pain. (3 points)

Pain killers give very little relief from pain. (4 points)

Pain killers have no effect on the pain and I do not use them. (5 points)

Section 2: Personal Care

I can look after myself normally without causing extra pain. (0 points)

I can look after myself normally but it causes extra pain. (1 point)

It is painful to look after myself and I am slow and careful. (2 points)

I need some help but manage most of my personal care. (3 points)

I need help every day in most aspects of self care. (4 points)

Section 3: Lifting

I can lift heavy weights without extra pain. (0 points)

I can lift heavy weights but it gives extra pain. (1 point)

Pain prevents me from lifting heavy weights off the floor but I can manage if they are conveniently positioned for example on a table. (2 points)

Pain prevents me from lifting heavy weights but I can manage light to medium weights if they are conveniently positioned. (3 points)

I can lift only very light weights. (4 points)

I cannot lift or carry anything at all.(5 points)

Section 4: Walking (bad question)

Pain does not prevent me walking any distance. (0 points)

Pain prevents me walking more than 1 mile. (1 point)

Pain prevents me walking more than 0.5 miles. (2 points)

Pain prevents me walking more than 0.25 miles. (3 points)

I can only walk using a stick or crutches. (4 points)

I am in bed most of the time and have to crawl to the toilet. (5 points)

Section 5: Sitting ("Favorite chair" includes a recliner.)

I can sit in any chair as long as I like. (0 points)

I can only sit in my favorite chair as long as I like. (1 point)

Pain prevents me sitting more than 1 hour. (2 points)

Pain prevents me from sitting more than 0.5 hours. (3 points)

Pain prevents me from sitting more than 10 minutes. (4 points)

Pain prevents me from sitting at all. (5 points)

Section 6: Standing (Remember, standing is NOT walking.)

I can stand as long as I want without extra pain. (0 points)

I can stand as long as I want but it gives me extra pain. (1 point)

Pain prevents me from standing for more than 1 hour. (2 points)

Pain prevents me from standing for more than 30 minutes. (3 points)

Pain prevents me from standing for more than 10 minutes. (4 points)

Pain prevents me from standing at all. (5 points)

Section 7: Sleeping

Pain does not prevent me from sleeping well. (0 points)

I can sleep well only by using tablets. (1 point)

Even when I take tablets I have less than 6 hours sleep. (2 points)

Even when I take tablets I have less than 4 hours sleep. (3 points)

Even when I take tablets I have less than 2 hours of sleep. (4 points)

Pain prevents me from sleeping at all. (5 points)

Section 8: Sex Life (by pain = for fear of causing pain)

My sex life is normal and causes no extra pain. (0 points)

My sex life is normal but causes some extra pain. (1 point)

My sex life is nearly normal but is very painful. (2 points)

My sex life is severely restricted by pain. (3 points)

My sex life is nearly absent because of pain. (4 points)

Pain prevents any sex life at all. (5 points)

Section 9: Social Life

My social life is normal and gives me no extra pain. (0 points)

My social life is normal but increases the degree of pain. (1 point)

Pain has no significant effect on my social life apart from limiting energetic interests such as dancing. (2 points)

Pain has restricted my social life and I do not go out as often. (3 points)

Pain has restricted my social life to my home. (4 points)

I have no social life because of pain. (5 points)

Section 10: Traveling

I can travel anywhere without extra pain. (0 points)

I can travel anywhere but it gives me extra pain. (1 point)

Pain is bad but I manage journeys over 2 hours. (2 points)

Pain restricts me to journeys of less than 1 hour. (3 points)

Pain restricts me to short necessary journeys under 30 minutes. (4 points)

Pain prevents me from traveling except to the doctor or hospital. (5 points)

Interpretation:

Now, simply add up your points for each section and plug it in to the following formula in order to calculate your level of

disability: point total / 50 X 100 = % disability (aka: 'point total' divided by '50' multiply by ' 100 = percent disability) For example: my Current level of disability, 11-11-04 is calculated as follows:
14 / 50 X 100= 28%

Odi scoring:

0% to 20%: minimal disability: The patient can cope with most living activities. Usually no treatment is indicated apart from advice on lifting sitting and exercise.

21%-40%: moderate disability: The patient experiences more pain and difficulty with sitting lifting and standing. Travel and social life are more difficult and they may be disabled from work. Personal care sexual activity and sleeping are not grossly affected and the patient can usually be managed by conservative means.

41%-60%: severe disability: Pain remains the main problem in this group but activities of daily living are affected. These patients require a detailed investigation.

61%-80%: crippled: Back pain impinges on all aspects of the patient's life. Positive intervention is required.

81%-100% These patients are either bed-bound or exaggerating their symptoms.

2. Esnault test.

The test requires a patient to lift an object from the ground and was first described by the French physiotherapist Michèle Esnault in 1991. It examines the mobility of the pelvic joints in lifting an object from the floor [5]. Depending on the way of lifting the object, a score is given ranging from 0 to 3.

Protocol:

The patient lifts paper placed on the floor.

0 - lifts the paper with ease and in different ways.

1 - manages to carry out the test with minimal effort and slight stiffness.

2 – manages to carry out the test with difficulty, shows inflexibility or props hands on the knee.

3 - fails to realize the test or needs support.

3 .Biering-Sorensen test.

The isometric Biering-Sorensen test is the only clinically validated tool for testing the strength of the lumbar trunk extensors, wherein a chair is used for exercises while the subject keeps the trunk in a horizontal position against gravity in a single contraction. The test involves measuring the time for which a person can hold their body in a horizontal position with fixed lower limbs to a Roman chair. The test is used in many studies in its original form or in different variants [6].

4. Shirado-Ito test

Ito test assesses the isometric endurance of abdominal musculature [7]. Its high test-retest reliability [7] and validity [8] have been proved. It consists of lifting the upper body while lying supine, the arms crossed, the legs flexed 90° in hip and knee joints and the neck flexed as much as possible. The time for holding this position is measured by a chronometer and recorded in seconds. The test is terminated when the fixed position cannot be held longer or if there is pain.

5. Pile test

Weight lifting test for assessment of endurance in exertionwas carried out (dynamic test - modification of the US test "Progressive Isoinertial Lifting Evaluation"). It was based on WEST Standard Evaluation (WSE), developed by Leonard Matheson in the 1970s, and also modified by Tom Mayer in the mid 1980 s [9].

Protocol:

The patient raises a lightweight plastic tray to a height of 75 cm. Lifting the tape causes work in lumbar share in frontal plan from the floor to the stand, located at the height of 75 cm. Men perform the test with 5 kg., and women with 2.5 kg. It measures the number of cycles completed in 20 seconds,while a cycleis considered to involve moving from one level to another i.e. floor- stand or stand - floor /.

The study is suspended at the request of the patient or by a timeout of 20 seconds.

The kinesitherapeutic program applied in patients with chronic low back pain in the experimental group included five types of training:

1. Training for mobility: suppling in flexion position, supplying in extensional position, axial withdrawal from a bent knee position, abductor muscle active tension, adductor muscle active tension, active tension of the ischiocrural muscle group.

2. Flexor workout: exercise for strengthening the abdominal muscles from side leg positions, co-contraction trainingfor the anterior oblique system involving the anterior abdominal fascia, dynamic strength training m.obliquus abdominis externus and m.obliquus abdominis internus

3. Training for sensory-motor reprogramming: exercises for the body rotators with abduction of the upper limb to improve the stabilizing function of the spine from its original seating position on a Swiss-ball; exercises for upper limb flexion and extension of homolateral lower limbs from side leg position on a Swiss-ball for improving the proprioception of the spinal column structures, exercises to maintain the neutral position by moving the Swiss-ball on the wall.

4. Extensors workout: exercises for extension of the spine from a prone position with hands support and holding for 30 sec. in extensional position; strength training of the gluteal muscles from prone position, co-contraction for strength of m. gluteus maximus and m. latissimus dorsi.

5. Training for lumbar stability: elevation of the pelvis to maintain neutral position, axial withdrawal during co-contraction, maintaining co-contraction with elevation of one foot and abduction of the upper limb, bending the body forward while maintaining a neutral lumbar position, moving from sitting into an upright position while maintaining neutral lumbar position.

Monitoring and evaluation of the results of kinesitherapeutic program was carried out by an experienced physiotherapist.

The collected primary information was checked, encoded, and entered into a computer database for statistical analysis. Data were processed using SPSS 13.0. Results for quantitative variables were expressed as mean ± SE (standard error) and results for qualitative variables as percentages.

IV. RESULTS AND DISCUTION

At the beginning of the survey the average age of the experimental group was (43.31 ± 1.11), while at the end of the survey it was 44.24 ± 1.35. The average age of the participants in the control group at baseline was 43.90 ± 0.87, and at the end of the survey - 44.57 ± 0.55.

The gender distribution in the experimental group showed that at the beginning of the survey -26 (47.27%) were male and 29 (52.73%) were women, and at the end of the survey -

11 (39.39%) were male and 20 (60.61%) were women. In the control group the gender breakdown shows that at the beginning of the survey 24 (43.63%) were male and 31 (56.37%) were women, and at the end of the survey - 8 (30.76%) were male and 18 (69.24%) - women.

In the control group at the beginning of the survey 32 (58.18%) of the participants reported risk factors, while 33 (41.82%) did not. At the end of the survey in the same group in 15 (57.69%) of the participants there were risk factors present, while of 11 (42.31%) of the participants there were not.

At the beginning of the survey period in the experimental group 33 (60.00%) of all the participants reported risk factors, and 22 (40.00%) such factors were not reported. At the end of the survey in the same group in 19 (57.57%) of the participants there were risk factors, and in 14 (42.43%) of the participants there were not any.

At the beginning of the study there were ascertained no significant differences between the participants in the experimental and control groups in terms of mean age P > 0.05 (u = 0.41), gender P > 0.05 ($\chi 2$ = 0.15) and present risk factors, P > 0.05 ($\chi 2$ = 0.04). No correlation was found between the participants' gender and the presence of risk factors P > 0.05 ($\chi 2$ = 3.51) as well as between age and the presence of risk factors P> 0.05 ($\chi 2$ = 2.81).

The analysis of the relationships between the results of functional tests (Esnault, Bring, Ito and Pile) and the Oswestry test results in the experimental and control groups respectively in the study phase, establish direct and moderate correlation of the Esnault test results with the Oswestry test results in the experimental group at the beginning and end of the observation P <0,01 (rxy = +0,38). The more difficult the Esnault test to perform, the greater disability is shown in the Oswestry test.

Table 1:

Correlation between Esnault и Oswestry tests

Stages	Esnault test	Abs. number	mean ± SE	SD	F	P
0 months	**With minimal effort**	**19**	**31,58±1,96**	**8,520**	4,54	<0,05
	With difficulty in performing test	**25**	**36,76±2,21**	**11,065**		
	Test not performed	**11**	**43,09±3,18**	**10,540**		
12 months	**With minimal effort**	**13**	**24,46±2,20**	**7,944**	**3,18**	**>0,05**
	With difficulty in performing test	**14**	**33,50±2,82**	**10,567**		
	Test not performed	**5**	**33,80±6,00**	**13,424**		

There is no correlation between the Esnault test results and the Oswestry test results in the control group, P> 0.05.

When comparing the results of Biering test and Oswestry test in the experimental group there has been established a fundamental difference of the 12th month, with the difference being notable between patients performing Biering test in the intervals 81-100 sec. and those in the interval of over 101 sec. Participants who manage to stay above 101 sec. in the Biering test have statistically significant lower average Oswestry test, ie they have a less marked disability.

There has been establish inverse and moderate correlation between Biering test results and Oswestry test results in the experimental group at the end of the observation P <0,05 (rxy = -0,39).

Table 2:

Correlation between degree of disability according to Oswestry и Biering tests

Stages	Disability	Abs. number	mean ± SE	SD	F	P
0 months	**Minimal**	**1**	**120,00±**	**-**	4,36	<0,05
	Moderate	**32**	**91,88±3,08**	**17,70**		
	Severe	**22**	**80,71±3,68**	**16,88**		
12 months	**Minimal**	**10**	**104,40±6,73**	**21,272**	**2,62**	**>0,05**
	Moderate	**15**	**87,33±5,16**	**19,977**		
	Severe	**7**	**85,71±7,18**	**19,006**		

No correlation has been registered between the Biering test results and the Oswestry test results in the control group P> 0.05.

A comparison of test results of Ito and test Oswestry in the experimental group shows a significant difference in both stages of the study, with the difference being notable between patients performing the Ito test in the intervals to 90 seconds. and those performing the test in the interval of more than 120 sec. Participants who manage to stay in position over 121 sec. in Ito test have significantly milder disabilities according to the Oswestry test.

There has been establish inverse and moderate correlation between Ito test results and Oswestry test results in the experimental group at the end of the observation P <0,001 (rxy = -0,37).

Table 3:

Correlation between degree of disability according to Oswestry и Ito tests.

Stages	Disability	Abs. number	mean ± SE	SD	F	P
0 мес.	Minimal	1	168,00± -	-		
	Moderate	32	119,41±4,38	24,749	9,38	<0,001
	Severe	22	97,68±3,90	18,311		
12 мес.	Minimal	10	134,80±10,62	33,585		
	Moderate	15	103,07±9,63	37,307	3,53	<0,05
	Severe	7	98,86±6,17	16,334		

No correlation has been registered in the control group between the results of two tests P> 0.05.

There has been registered no correlation between the Pile test results and the Oswestry test results in both groups at both the beginning and the end of the observation P> 0.05.

Table 4:

Correlation between degree of disability according to Oswestry и Pile tests.

Stages	Disability	Abs. number	mean ± SE	SD	F	P
0 мес.	Minimal	4	8,50±1,44	2,89		
	Moderate	20	9,15±0,45	2,01	3,20	>0,05
	Severe	8	7,00±0,57	1,60		
12 мес.	Minimal	10	9,30±0,70	2,214		
	Moderate	15	8,73±0,59	2,282	2,70	>0,05
	Severe	7	7,00±0,38	1,000		

Therefore the lower results shown in all three tests - Esnault, Biering and Ito - are a prognostic factor for a higher degree of disability among participants.

A research of Tekin et al. (2009) confirms our conclusion regarding the comparison of the results obtained in Biering and Oswestry tests. The study included 150 miners. The average retention time of extensional position of the spine in participants with low back pain was 99,9 ± 19,8 sec., while those without pain - 128,6 ± 15,2 sec. The authors found a statistically significant difference between the two groups (P <0.001) and a statistically significant inverse correlation between the results of two tests - Biering and Oswestry - P <0.001 / rhu = -0.824 /

[10]The research of Triano et al. (1987) confirm the correlation we have reviewed as the authors establish a correlation which is directly proportional to the degree of disability and mobility of the back muscles in patients with low back pain

[11]Data from the research of Gillan, et al. (1998) shows that there is little correlation between the degree of disability and physical condition of patients with lumbalgy

[12]The research of Cinar Madeni et al. (2013) found no significant correlations between the main tests of endurance and Oswestry in the study of 21 pilots. A significant positive correlation between Oswestry low back pain disability score and subject's year, employment year and total flight time were found, respectively (r=.55, p=.01; r=.52, p=.018; r=.53, p=.016). There were not any significant correlations between core endurance tests and Oswestry score (p>.05).It shows that low back complaints are work-related in and not related to core muscle endurance

[13]For the first time in Bulgaria there have been studied the correlations in the dynamics of the results of the questionnaire of Oswestry for disability for basic demographic, clinical indicators and the results of functional tests as a result of applied kinesitherapeutic program in patients with chronic lumbalgy.

The kinesitherapeutic program allows for reducing pain, increasing the force of the dorsal muscles, maximizing the performance of abdominal muscles, significantly lowering the degree of disability in patients. The good results obtained in the experimental group (despite implementation of the program for only one year), give us reason to believe that this is the program corresponding to the modern quests in the field of kinesitherapy to achieve fast and stable performance for a more efficient treatment leading to relatively good functional recovery. This in turn is associated with favorable results in social and economic terms. In the control group there was given only medication in the absence of kinesitherapeutic program, resulting in reported significant negative shift consisting in increasing symptoms of pain and degree of disability.

CONCLUSION

Based on the positive results relating to improving the functional abilities of the spine in patients in the experimental group as a result of the application of specific diagnostic algorithm and recommended kinesitherapeutic program and complying with the new requirements of the management system for quality in health care, we suggest preparation of individualized (tailored to existing functional deficits of the patients) programs to be implemented as a mandatory part of the therapeutic algorithm in these conditions.

The lower results in Esnault, Biering and Ito tests constitute a prognostic factor for a higher degree of disability in patients with chronic lumbalgy.

Teaching body mechanics and performing the therapeutic exercises through the multidisciplinary team approach are essential to managing CLBP in a general setting

[14]We consider of utmost importance the implementation of an intensive multidisciplinary rehabilitation involving a GP, physiotherapist, neurologist, occupational therapist and psychologist in order to achieve a good functional recovery by reduction of pain symptoms, improve motor and stabilizing function of the muscles of the spine and a significant reduction in the degree of disability in patients with chronic lumbalgy. This will contribute to optimizing all aspects of the quality of life of patients and reduce direct and indirect costs of state and society.

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