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Using hardware myofascial release, longitudinal traction with thermal influence in patients with dorsal pain, caused by spine degenerative diseases

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Objective. To investigate the effectiveness of the application of hardware myofascial release with thermal influence and longitudinal traction in patients with dorsal pain, caused by spine degenerative diseases. Methods. A prospective study of the results of treatment of 297 patients with dorsal pain, caused by spine degenerative diseases. All patients were divided into 3 groups: D (158) — dorsal pain; DIK (31) — dorsal pain with irradiation in the lower limb; DIS (108) — dorsal pain with irradiation in the buttock. The comparison group consisted of 43 volunteer athletes. With the help of the Nuga Best N5 device, all participants underwent a course of treatment (10 sessions within two weeks, thermal influence — 45–60 °C, depending on the comfort of the patient). Before and after treatment, patients were examined according to the visual analog scale (VAS), the Oswestry questionnaire, volunteers — according to the Oswestry scale. Statistical analysis was performed. The results. In patients of group D, after treatment, the Josw index decreased from 37.1 (24; 51) % to 9.1 (2; 14) % (QV, p < 0.01), VAS — from 29.6 (20; 40) mm to 11.2 (10; 10) mm (KV, p < 0.01). In the DIK group, a decrease in the Josw index was determined from 24.7 (12; 34) % to 7.3 (2; 13) % (QV, p < 0.01), VAS — from 41.9 (20; 60) mm to 14.7 (10; 20) mm (KV, p < 0.01). In the patients of the DIS group, after treatment, the Josw index decreased from 30.5 (18; 41) % to 8.2 (2; 11) % (QV, p < 0.01), VAS — from 24.9 (20; 30) mm to 11.3 (10; 10) mm (KV, p < 0.01). In the group of volunteers, the Josw index decreased from 5.9 (2; 4) % to 3.0 (2; 2) % (QV, p < 0.01), VAS — from 12.6 (10; 10) mm to 2.1 (0; 0) mm (KV, p < 0.01). Conclusions. The hardware myofascial release with thermal influence and longitudinal traction significantly reduces pain caused by tendopathies and muscle structural-functional disorders, improves the quality of life in patients with back pain caused by spine degenerative diseases. In practically healthy people, this method of treatment can be used to restore working capacity, get rid of muscle pain after physical exertion.

Мета. Дослідити ефективність застосування апаратного міофасціального релізу з термальним впливом і поздовжньою тракцією у хворих на дорсалгії, обумовлені дегенеративними захворюваннями хребта. Методи. Проведено проспективне дослідження результатів лікування 297 пацієнтів із дорсалгіями, обумовленими дегенеративними захворюваннями хребта, у 3 групах: Д (158) — дорсалгії; ДІК (31) — дорсалгії й іррадіація в нижню кінцівку; ДІС — дорсалгії й іррадіація в сідницю. Групу порівняння склали 43 волонтери-спортсмени. За допомогою апарата Nuga Best N5 усім учасникам проведений курс лікування (10 сеансів протягом двох тижнів, тепловий вплив — 45–60 °С залежно від комфорту хворого). Пацієнтів до та після лікування обстежено за візуальною аналоговою шкалою (ВАШ), опитувальником Oswestry, волонтерів — за шкалою Oswestry. Виконано статистичний аналіз. Результати. У пацієнтів групи Д після лікування показник Josw знизився від 37,1 (24; 51) % до 9,1 (2; 14) % (КВ, p < 0,01), ВАШ — від 29,6 (20; 40) мм до 11,2 (10; 10) мм (КВ, p < 0,01). У групі ДІК визначено зниження показника Josw від 24,7 (12; 34) % до 7,3 (2; 13) % (КВ, p < 0,01), ВАШ — від 41,9 (20; 60) мм до 14,7 (10; 20) мм (КВ, p < 0,01). У пацієнтів групи ДІС після лікування показник Josw знизився від 30,5 (18; 41) % до 8,2 (2; 11) % (КВ, p < 0,01), ВАШ — від 24,9 (20; 30) мм до 11,3 (10; 10) мм (КВ, p < 0,01). У групі волонтерів показник Josw знизився від 5,9 (2; 4) % до 3,0 (2; 2) % (КВ, p < 0,01), ВАШ — від 12,6 (10; 10) мм до 2,1 (0; 0) мм (КВ, p < 0,01). Висновки. Застосування апаратного міофасціального релізу з теплом і поздовжньою тракцією значно знижує біль, спричинений тендопатіями та структурно-функціональними порушеннями в м'язах, підвищує якість життя хворих на дорсалгії, обумовлені дегенеративними захворюваннями хребта. У практично здорових людей зазначений метод лікування можна застосовувати для відновлення працездатності, позбавлення м'язового болю після фізичних навантажень. Ключові слова. Дорсалгія, міофасціальний реліз, масаж, тракція, фасція.

Key words. Dorsal pain, myofascial release, massage, traction, fascia

Introduction

Dorsalgia caused by degenerative diseases is the most common type of pain. Some statistical data indicate that about 75–85 % of the adult population of the Earth suffered from dorsalgia at various periods of life [1]. Dorsalgia secondary to degenerative diseases of the spine is the ninth most common cause of temporary disability in all age groups, but in people aged 25 to 49 years it is the fourth [2, 3]. This disorder is the most common factor that limits the movement and work activity of the able-bodied population from year to year [4].

According to a number of authors, dorsalgia occurs in the majority of the population of Europe and the USA, with a constant increase in manifestations in young people [3, 5, 6]. This trend has also been observed in Asian countries [7].

Chronic dorsalgia is caused by degenerative changes in the lumbar spine and the muscles stabilizing it. In addition, degenerative changes in these muscles can predict the course of degenerative diseases of the spine [8, 9]. It has been established that many parameters of spine-pelvic balance are inextricably linked with degenerative changes in muscles and ligaments, back stabilizers, and the vertical position of the trunk [10]. Excess weight increases the risk of dorsalgia, as well as degenerative changes in the spine [5].

Development of dorsalgia affects other pathological conditions, such as depression, anxiety and sleep disorders [11, 12].

Dorsalgias are inextricably linked with degenerative changes in such structures of the vertebral column as the intervertebral disc, arcuate joints, fascia and ligaments of the muscles of the stabilizers of the spine and the vertical position of the body, sacroiliac joints, their ligaments, nerve roots and muscles [13–15].

Some authors have concluded that physical exercises and loads are sufficient prevention of back pain. Studies prove that among individuals with regular intense loads, the number of cases with back pain decreases. Moreover, if physically fit people injure their back, they return to normal life much faster [12, 16]. However, the question still arises as to why back pain develops even in people who regularly exercise. One of the possible answers to this question is the so-called «cumulative trauma» theory. It suggests that repeated compressive loads on the spine or caused by certain body positions (such as when driving a car) significantly affect the intervertebral discs and joints. They develop degenerative changes that cause back pain [17].

In the classification developed by the specialists of the State Institution Professor M. I. Sytenko Institute of Spine and Joint Pathology of the National Academy of Medical Sciences of Ukraine [18], pathological changes of the spine are considered in the unity and biomechanical connection of all constituent components. According to this classification, diseases of the spine are divided into degenerative, dysplastic, neoplastic and inflammatory ones. In turn, degenerative diseases of the spine are divided into degenerative diseases of the anterior and posterior support complexes of the spinal motor segment; total degeneration of the spinal motor segment, including the formation of spinal deformities.

Degeneration of intervertebral discs includes structural and functional changes. The first changes (fissures of the fibrous ring, protrusions and hernias of the intervertebral disc) cause a decrease in the height of the intervertebral disc, the development of uncovertebral costo-spinal arthrosis. Functional changes include blockade of the spinal motor segment, instability leading to spondyloarthrosis, degeneration of ligaments and muscles. Structural and functional disorders cause total degeneration and deformation of the spinal motor segment.

Specialists in restorative treatment use various technologies for the treatment of dorsalgia secondary to degenerative diseases of the spine, namely manual therapy, traction treatment, myofascial release, heat exposure, physical therapy, massage, insrumental physical therapy. The optimal combination of different impacts (myofascial release with thermal influence and longitudinal traction) has been successfully implemented in the personal low-frequency combined thermal stimulator Nuga Best N5. Such devices can be used at home.

The purpose of the study: to investigate the effectiveness of the application of instrumental myofascial release with thermal influence and longitudinal traction in patients with dorsalgia caused by degenerative diseases of the spine.

Material and methods

The study materials were discussed and approved at the meeting of the Bioethics Committee at the State Institution Professor M. I. Sytenko Institute of Spine and Joint Pathology of the National Academy of Medical Sciences of Ukraine (Protocol No. 217 of 14.06.2021).

Characteristics of patients

A prospective study of the results of treatment of 297 patients with dorsalgia caused by degenerative diseases of the spine was conducted from August to

December 2021. The comparison group (B) included 43 volunteer athletes. With the help of the Nuga Best N5 device, both groups underwent a course of instrumental treatment (10 sessions over two weeks). Heat exposure was 45–60 °C, depending on the patient's comfort.

Patients were divided into 3 groups:

– with dorsalgia (group D) — 158 patients; the effect of instrumental myofascial release with heat and longitudinal traction was aimed at *m. erector spinae, m. longissimus dorsi, m. ileocostalis* and places of attachment of these muscles;

– with dorsalgia and radiation in the lower limb (DRL) — 31 patients; the impact was directed not only at *m. erector spinae, m. longissimus dorsi, m. ileocostalis, m. quadratus lumborum* and their attachment sites, but also at ligaments and muscles stabilizers of the sacroiliac joints and the vertical position of the trunk (l*ig. sacroiliacus, sacrotuberous, sacrospinous, mm. gluteus medius et maximus, m. piriformis, m. biceps femoris , m. tensor fascia latae and tractus iliacus, m. biceps femoris, m. vastus lateralis*), the area of trochanter major;

– with dorsalgia and radiation in the buttocks (DRB) — 108 patients; the impact was directed not only at *m. erector spinae, m. longissimus dorsi, m. ileocostalis, m. quadratus lumborum* and their attachment sites, but also at ligaments and muscles that stabilize the sacroiliac joints and the vertical position of the trunk (*lig. sacroiliacus, sacrotuberous, sacrospinous, mm. gluteus medius et maximus, m. piriformis, m. biceps femoris*).

Aggravation of dorsalgia was observed in some patient of DRL and DRB groups after the first sessions. They had the intensity of myofascial release reduced or took a break for a day.

In volunteers, the effect of instrumental myofascial release with heat and longitudinal traction was aimed at *m. erector spinae, m. longissimus dorsi, m. ileocostalis m. quadratus lumborum* and places of attachment of these muscles.

Evaluation of results

All patients before and after treatment were examined according to the visual analog scale (VAS), the Oswestry questionnaire (Table 1) [19]. Athlete volunteers were interviewed according to the Oswestry scale. JOSW before and after treatment was calculated according to formula 1 and JREC according to formula 2.

Statistical analysis of the study results was carried out using non-parametric statistics methods in the STATISTICA software environment. For the analysis of related samples, the Wilcoxon test

$$J_{OSW} = \frac{\text{Scores}}{45\ (50)} \times 100\ \%\ , \qquad (1)$$

$$J_{REC} = \frac{J_{OSW\ \text{before treat.}} - J_{OSW\ \text{after treat.}}}{J_{OSW\ \text{before treat.}}} \times 100\ \%\ . \qquad (2)$$

(WT) was used, for unrelated samples, the Mann-Whitney (MWT) test was used. In the text, indicators are given as M (LQ; UQ), where M is the median, LQ is the lower quartile, and UQ is the upper quartile.

Results and their discussion

The characteristics of all indicators of the study groups are given in Table 2. Statistically significant gender differences in the analyzed indicators were not found in any of the groups; therefore, the analysis was not conducted by gender.

In group D there were 80 women (50.6 %) and 78 men (49.4 %) aged 30 to 73 years with a median of 57 years. Before treatment, their presenting symptom was pain in the cervical, thoracic and lumbar regions of the spine, limited rotational movements in the back. After the treatment, patients noted a significant decrease in pain intensity and restoration of the usual range of motion. Statistically significant time course was observed according to Josw and VAS indicators (Fig. 1).

As can be seen, the Josw indicator decreased from the level of 37.1 (24; 51) to 9.1 (2; 14) % (WT, $p < 0.01$), the VAS indicator decreased from 29.6 (20; 40) to 11.2 (10; 10) mm (WT, $p < 0.01$).

There were 26 women (83.9 %) and 5 men (16.1 %) aged 32 to 70 years with a median age of 51 years in the DRL group with statistically significant time course of Josw and VAS indicators (Fig. 2). Before treatment, patients had dorsalgia, lumbar pain that could radiate to the buttock and thigh on one side, limited movements of the lumbar spine in the sagittal and frontal planes. After the treatment, patients noted a significant decrease in the intensity of pain, restoration of normal mobility of the lumbar spine. As the box graphs (Fig. 2) show, a decrease in the Josw index of the DRL group was found from the level of 24.7 (12; 34) to 7.3 (2; 13) % (WT, $p < 0.01$), the VAS index decreased from 41.9 (20; 60) to 14.7 (10; 20) mm (WT, $p < 0.01$).

By gender, there were 71 women (65.7 %) and 37 men (34.3 %) aged 22 to 74 years with a median age of 56 years in the DRB group. Before treatment, patients had dorsalgia, lumbar pain that could radiate to the buttock on one or both sides, limited movements of the lumbar spine in the sagittal and frontal planes. After the treatment, patients noted a significant

Table 1

Oswestry questionnaire

Question	Points
Sector 1. Intensity of pain in the back and (or) legs	
None	0
Very mild	1
Considerable	2
Severe	3
Very severe	4
Unbearable	5
Sector 2. Self-care (e. g. washing, dressing)	
I can take care of myself without making the pain worse	0
I can take care of myself, but it is very painful	1
Because of the pain, self-care is slow and careful	2
I can take care of myself, but in some cases I need help	3
Need daily help with most self-care tasks	4
I can't get dressed, it's difficult to wash myself, I'm lying in bed	5
Sector 3. Weight lifting	
I can lift heavy things without making t he pain worse	0
I can lift heavy things, but it makes the pain worse	1
The pain prevents me from lifting heavy things from the floor, but I can use them if they are conveniently located (for example, on a table)	2
Can't lift heavy things due to pain, but can lift light to moderate things if they are conveniently placed	3
I can only lift very light things	4
I can neither lift nor carry anything	5
Sector 4. Walking	
Unlimited for any distance	0
Limited due to pain: – up to 1.5 km	1
– up to 800 m	2
– up to 100 m	3
Only with a stick or crutches	4
I lie in bed most of the time, even the toilet is difficult to reach	5
Sector 5. Sitting	
I can sit on any chair as long as I want	0
I can sit in my comfortable chair as long as I need	1
Cannot sit due to increased pain: – more than 1 hour	2
– more than 30 min	3
– for 10 minutes	4
– at all	5

Question	Points
Sector 6. Standing	
I can stand as long as I want without making the pain worse	0
I can stand as long as I want, but it makes the pain worse	1
The pain prevents me from standing more than: – 1 hour	2
– 30 min	3
– 10 min	4
I can't stand at all because of the pain	5
Sector 7. Sleeping	
I can sleep without waking up	0
I can sleep, but sometimes I wake up because of pain	1
Because of the pain, I cannot sleep continuously for more than: – 6 hours	2
– 4 hours	3
– 2 hours	4
I can hardly sleep because of the pain	5
Sector 8. Sexual activities (optionally)	
Regular and does not cause pain	0
Regular, but makes the pain worse	1
Almost regular, but very painful	2
Very limited due to pain	3
Almost absent due to pain	4
Completely absent due to pain	5
Sector 9. Social activities (playing sports, attending meetings and other events)	
Normal and does not make the pain worse	0
Regular, but makes the pain worse	1
The pain does not significantly affect my social life except for more active interests (e. g. sports)	2
Because of the pain, I cannot engage in social activities and therefore do not often leave the house	3
Pain limits my social activities outside the apartment (house)	4
Because of the pain, I do not engage in social activities	5
Sector 10. Travel	
I can travel anywhere without making the pain worse	0
I can travel anywhere, but it makes the pain worse	1
Due to pain, I cannot make trips longer than: – 2 hours	2
– 1 hours	3
– 30 min	4
The pain prevents me from going anywhere except for treatment	5
Sector 11. Have you received any treatment for back and/ or leg pain (pills, medication, etc.)?	
Yes	0
No	1

Table 2

Descriptive characteristics of indicators of study groups

Indicator	Statistical characteristic						
	average	median	minimum	maximum	lower quartile	upper quartile	standard deviation
Group D							
Age	52.5	57.0	30.0	73.0	41.0	61.0	10.8
Josw before	37.2	35.0	4.0	95.0	24.0	51.0	19.2
VAS before	29.6	30.0	10.0	70.0	20.0	40.0	14.4
Josw after	9.1	6.0	2.0	42.0	2.0	14.0	8.7
VAS after	11.2	10.0	0.0	30.0	10.0	10.0	5.9
Jrec	73.2	79.0	0.0	96.0	60.0	91.0	21.9
Group DRL							
Age	50.8	53.0	32.0	70.0	43.0	58.0	9.3
Josw before	24.7	22.0	4.0	68.0	12.0	34.0	15.7
VAS before	41.9	40.0	20.0	70.0	20.0	60.0	18.7
Josw after	7.3	4.0	2.0	20.0	2.0	13.0	5.9
VAS after	14.7	10.0	5.0	30.0	10.0	20.0	6.4
Jrec	67.1	70.0	14.0	96.0	55.0	81.0	19.9
Group DRB							
Age	55.8	59.0	22.0	84.0	45.0	65.0	12.4
Josw before	30.5	27.0	4.0	92.0	18.0	41.0	18.3
VAS before	24.9	20.0	10.0	70.0	20.0	30.0	12.0
Josw after	8.2	6.0	2.0	42.0	2.0	11.0	7.8
VAS after	11.3	10.0	0.0	30.0	10.0	10.0	4.4
Jrec	69.7	75.0	10.0	98.0	54.0	87.0	21.4
Group B							
Age	24.5	21.0	19.0	49.0	20.0	23.0	8.6
Josw before	5.9	2.0	0.0	42.0	2.0	4.0	10.2
VAS before	12.6	10.0	0.0	40.0	10.0	10.0	7.6
Josw after	3.0	2.0	0.0	20.0	2.0	2.0	3.6
VAS after	2.1	0.0	0.0	20.0	0.0	0.0	4.7
Jrec	14.6	0.0	0.0	93.0	0.0	33.0	26.7

decrease in pain intensity, restoration of normal mobility of the lumbar spine. The time course of Josw and VAS indicators was also significant: Josw decreased from the level of 30.5 (18; 41) to 8.2 (2; 11) % (WT, $p < 0.01$), VAS decreased from 24.9 (20; 30) to 11.3 (10; 10) mm (WT, $p < 0.01$) (Fig. 3).

A significant improvement in the state of health was also observed in the group of volunteers (13 (30 %) women, 39 (70 %) men, age 24.5 (20; 23) years), who before treatment had periodic back pain, which they did not associate with anything. The Josw indicator decreased from the level of 5.9 (2; 4) to 3.0 (2; 2) % (WT, $p < 0.01$), VAS decreased from 12.6 (10; 10) to 2.1 (0; 0) mm (WT, $p < 0.01$). During treatment, they continued training. After the treatment, the volunteers noted an increase in muscle performance, good health, and quick recovery after physical exertion.

As a result of the comparison of the groups, no significant differences were found in the VAS index in patients of groups D and DRB after treatment from the indicators of the group of volunteers at the beginning of treatment.

Discussion

In all patients with dorsalgia, the effect of myofascial release with heat and longitudinal traction was aimed at treating pain caused by tendopathy of ligaments and muscles. The task of complex action by physical factors for dorsalgia caused by degenerative diseases of the spine includes the gradual unloading of the ligaments and muscles of the stabilizers of the sacroiliac joints and the vertical position

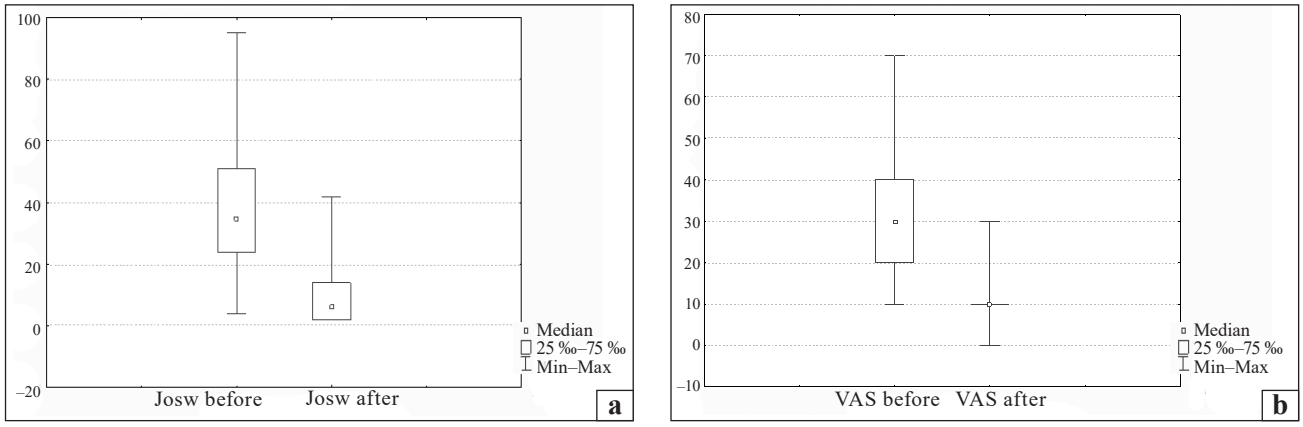

Fig. 1. Time course of Josw (a) and VAS (b) indicators in patients of group D before and after treatment

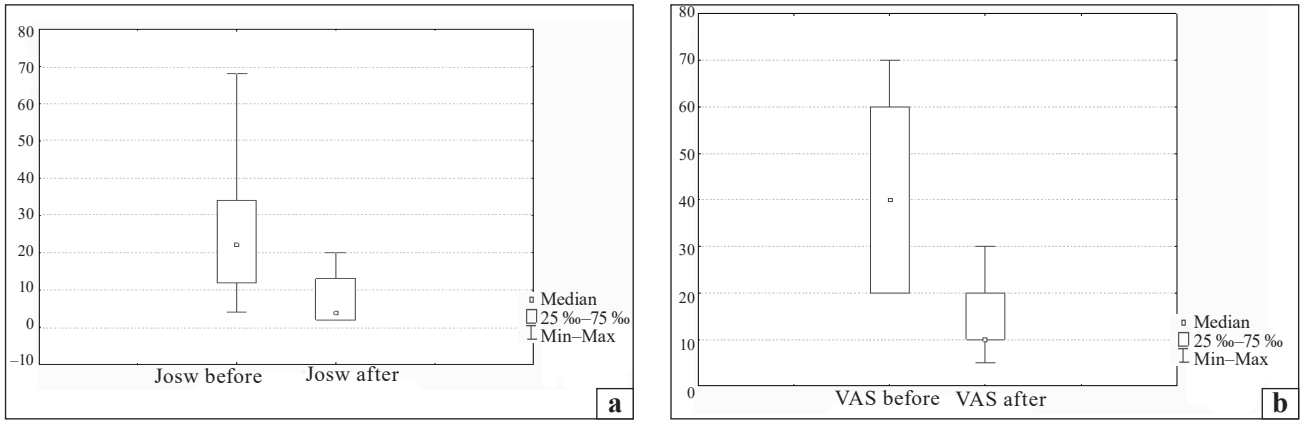

Fig. 2. Time course of Josw (a) and VAS indicators in patients of the DRL group before and after treatment

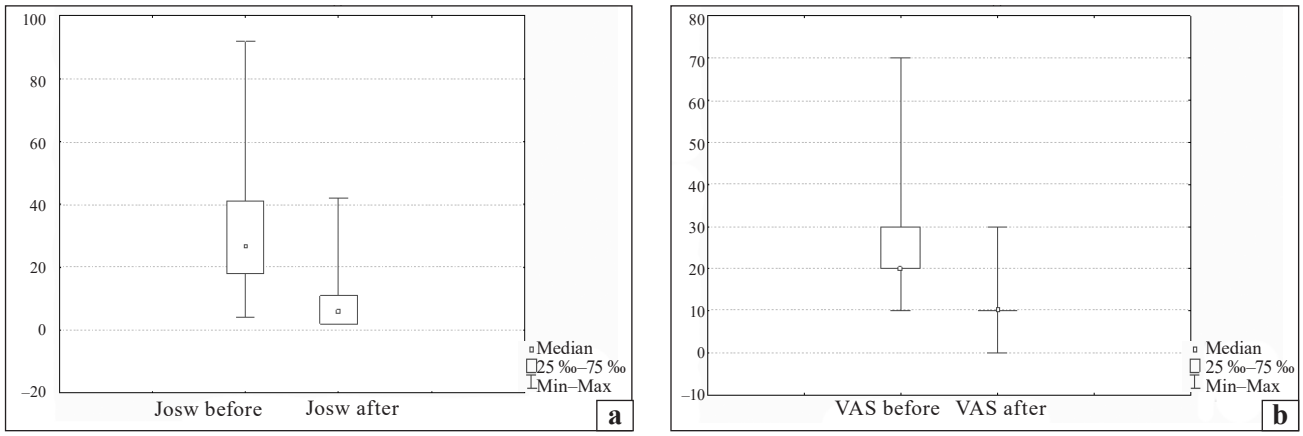

Fig. 3. Time course of Josw and VAS indicators in patients of the DRB group before and after treatment

of the body with the help of myofascial release, heat, longitudinal traction, reducing the tension of the interspinous, supraspinous, posterior sacroiliac, iliolumbar ligaments, iliotibial tract. This leads to the restoration of the bearing capacity of the sacroiliac joints and the spine. As a result of stretching, the inter-articular spaces of the arcuate joints of all parts of the spine expand.

In such a situation, in some cases, it is possible to eliminate the dislocation of the articular surfaces of the intervertebral joints and the functional blocks of the spinal motor segments. As a result, the degree of microtraumatization of the ligaments and capsules of the arcuate joints will decrease, muscle hypertonus and irritation of vascular and neural structures will reflexively decrease, respectively, the pain caused by tendopathy of the ligaments and muscles of the stabilizers

of the sacroiliac joints and the vertical position of the body will significantly decrease.

In an experiment on 51 rats, the effect of deep massage on the injured medial collateral ligaments of the knee joints was investigated. Deep massage was used for one of the injured ligaments during the week after the injury, three times a week, lasting 1 minute. The ligament of the contralateral limb served as a control and healed independently. As a result, it was established that the effect of massage increased the strength limit of the ligament by 43.1 % ($p < 0.05$), rigidity by 39.7 % ($p < 0.01$), energy absorption under rupture conditions by 57.1 % ($p < 0.05$) compared to the control. The treated ligaments, according to the results of histological examination, contained more bundles of collagen fibers, clearly oriented along the lines of application of the load, than in the control [20]. Vascular expansion around the ligaments, as well as an increase in microvascularization in the ligament area of the knee joint, including an increase in the number of blood vessels, were detected in those areas where massage was applied. These changes persisted for one week after the last massage procedure [21].

Mechanical loads have a huge impact on the activity of fibroblasts and the orientation of collagen fibers. After overstrain or injury, the musculo-ligamentous apparatus must form new collagen fibers for recovery. At the same time, if the patient is in a position of immobilization (i.e. at rest), collagen fibers acquire a chaotic orientation. This will cause limited movement and increased recovery time. And only early movements will make it possible to form the correct orientation of collagen fibers along the functional line of force application.

It has been demonstrated that when the temperature of a body part is increased above 40°C, the three-dimensional structure of hyaluronic acid chains is progressively destroyed due to inter- and intramolecular water bridges (van der Waals hydrophobic forces). This reduces its viscosity in the connective tissue that is present in the deep fascia of the muscles. This effect is directly reflected in movements, in particular, morning stiffness can be easily eliminated with the help of a warm shower [22].

Under the influence of gradual stretching of the spine, redressing of muscles, fascia, ligaments and joint capsules, some patients immediately experience muscle relaxant and analgesic effects. In other cases, pain may return 3–4 hours after the procedure, but subsequently regress.

In his report at the Fifth International Fascia Research Congress (5th International Fascia Research Congress, Berlin, 2018), Professor Willard F. H. noted that in 70 % of all cases of dorsalgia, the pain is generated by ligaments, fascia and muscles. Hernias and disc protrusions cause dorsalgia in only 4 %, osteoporosis in 4 %, osteoarthritis in 10 % [23]. On the basis of the given data, it is possible to recommend the treatment of dorsalgia caused by tendopathy of ligaments, fascia and muscle disorders with the help of hardware myofascial release with heat and longitudinal traction in the case of degenerative diseases of the spine and for their prevention.

Conclusions

The use of instrumental myofascial release with heat and longitudinal traction significantly reduces pain caused by tendopathies and structural and functional disorders in muscles, improves the quality of life of patients with dorsalgia caused by degenerative diseases of the spine.

In practically healthy people, instrumental myofascial release with heat and longitudinal traction can be used to restore work capacity, treat muscle pain and muscle balance after physical exertion, including at home.

Conflict of interest. The authors declare no conflict of interest.

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USING HARDWARE MYOFASCIAL RELEASE, LONGITUDINAL TRACTION WITH THERMAL INFLUENCE IN PATIENTS WITH DORSAL PAIN, CAUSED BY SPINE DEGENERATIVE DISEASES

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